Department of Defense
Fiscal Year (FY) 2021 Budget Estimates

February 2020

Navy

Justification Book Volume 2 of 5

Research, Development, Test & Evaluation, Navy

The estimated cost of this report for the Department of the Navy (DON) is $111,385.

The estimated total cost for supporting the DON budget justification material is approximately $2,970,459 for the 2020 fiscal year. This includes $82,977 in supplies and $2,887,482 in labor.

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Department of Defense Appropriations Act, 2021

Research, Development, Test and Evaluation, Navy

For expenses necessary for basic and applied scientific research, development, test and evaluation, including maintenance, rehabilitation, lease, and operation of facilities and equipment, $21,486,610 to remain available for obligation until September 30, 2022.

FY 2021 Overseas Contingency Operations funding can be separated into the following categories:

OCO for Direct War Costs ($42,500): OCO for Direct War costs are those combat or direct combat support costs that will not continue to be expended once combat operations end at major contingency locations.

OCO for Enduring Requirements ($17,062): OCO for Enduring Requirements are enduring in-theater and in-CONUS costs that will likely remain after combat operations cease, and have previously been funded in OCO.

OCO for Base Requirements ($0): OCO for Base Requirements is OCO funding for base budget requirements in support of the National Defense Strategy. The Budget requests these funds in OCO to comply with the base budget defense caps included in the Budget Control Act of 2011.

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Department of Defense
FY 2021President's Budget
Exhibit R-1 FY 2021 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Appropriation	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)
Research, Development, Test & Eval, Navy	18,738,363	20,155,115	130,444	164,410	20,449,969
Total Research, Development, Test & Evaluation	18,738,363	20,155,115	130,444	164,410	20,449,969

Department of Defense
FY 2021President's Budget
Exhibit R-1 FY 2021 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Appropriation	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)
Research, Development, Test & Eval, Navy	21,427,048		59,562	59,562	21,486,610
Total Research, Development, Test & Evaluation	21,427,048		59,562	59,562	21,486,610

Department of Defense
FY 2021President's Budget
Exhibit R-1 FY 2021 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Summary Recap of Budget Activities	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)
Basic Research	662,024	650,800			650,800
Applied Research	1,002,162	1,159,739			1,159,739
Advanced Technology Development	831,351	807,280			807,280
Advanced Component Development & Prototypes	4,033,262	5,329,143		40,006	5,369,149
System Development & Demonstration	5,840,606	6,112,602		1,122	6,113,724
Management Support	1,437,664	999,165	130,444		1,129,609
Operational Systems Development	4,931,294	5,096,386		123,282	5,219,668
Software and Digital Technology Pilot Programs					
Total Research, Development, Test & Evaluation	18,738,363	20,155,115	130,444	164,410	20,449,969

Summary Recap of FYDP Programs					
Strategic Forces	234,760	204,609			204,609
General Purpose Forces	1,866,214	1,770,467		15,000	1,785,467
Intelligence and Communications	707,765	692,955			692,955
Research and Development	14,039,673	15,652,568	130,444	41,128	15,824,140
Central Supply and Maintenance	63,255	74,961			74,961
Administration and Associated Activities	2,376	1,460			1,460
Space	40,735	15,868			15,868
Classified Programs	1,783,585	1,742,227		108,282	1,850,509
Total Research, Development, Test & Evaluation	18,738,363	20,155,115	130,444	164,410	20,449,969

Department of Defense
FY 2021President's Budget
Exhibit R-1 FY 2021 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Summary Recap of Budget Activities	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)
Basic Research	603,087				603,087
Applied Research	953,175				953,175
Advanced Technology Development	760,396				760,396
Advanced Component Development & Prototypes	6,503,074		55,418	55,418	6,558,492
System Development & Demonstration	6,263,883		1,144	1,144	6,265,027
Management Support	991,222				991,222
Operational Systems Development	5,327,043		3,000	3,000	5,330,043
Software and Digital Technology Pilot Programs	25,168				25,168
Total Research, Development, Test & Evaluation	21,427,048		59,562	59,562	21,486,610

Summary Recap of FYDP Programs					
Strategic Forces	330,493				330,493
General Purpose Forces	1,792,408		3,000	3,000	1,795,408
Intelligence and Communications	730,315				730,315
Research and Development	16,655,343		56,562	56,562	16,711,905
Central Supply and Maintenance	51,865				51,865
Administration and Associated Activities	1,536				1,536
Space	70,056				70,056
Classified Programs	1,795,032				1,795,032
Total Research, Development, Test & Evaluation	21,427,048		59,562	59,562	21,486,610

Department of the Navy
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Applied Research	1,002,162	1,159,739			1,159,739
Advanced Technology Development	831,351	807,280			807,280
Advanced Component Development & Prototypes	4,033,262	5,329,143		40,006	5,369,149
System Development & Demonstration	5,840,606	6,112,602		1,122	6,113,724
Management Support	1,437,664	999,165	130,444		1,129,609
Operational Systems Development	4,931,294	5,096,386		123,282	5,219,668
Software and Digital Technology Pilot Programs					
Total Research, Development, Test & Evaluation	18,738,363	20,155,115	130,444	164,410	20,449,969

Summary Recap of FYDP Programs					
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General Purpose Forces	1,866,214	1,770,467		15,000	1,785,467
Intelligence and Communications	707,765	692,955			692,955
Research and Development	14,039,673	15,652,568	130,444	41,128	15,824,140
Central Supply and Maintenance	63,255	74,961			74,961
Administration and Associated Activities	2,376	1,460			1,460
Space	40,735	15,868			15,868
Classified Programs	1,783,585	1,742,227		108,282	1,850,509
Total Research, Development, Test & Evaluation	18,738,363	20,155,115	130,444	164,410	20,449,969

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Applied Research	953,175				953,175
Advanced Technology Development	760,396				760,396
Advanced Component Development & Prototypes	6,503,074		55,418	55,418	6,558,492
System Development & Demonstration	6,263,883		1,144	1,144	6,265,027
Management Support	991,222				991,222
Operational Systems Development	5,327,043		3,000	3,000	5,330,043
Software and Digital Technology Pilot Programs	25,168				25,168
Total Research, Development, Test & Evaluation	21,427,048		59,562	59,562	21,486,610

Summary Recap of FYDP Programs					
Strategic Forces	330,493				330,493
General Purpose Forces	1,792,408		3,000	3,000	1,795,408
Intelligence and Communications	730,315				730,315
Research and Development	16,655,343		56,562	56,562	16,711,905
Central Supply and Maintenance	51,865				51,865
Administration and Associated Activities	1,536				1,536
Space	70,056				70,056
Classified Programs	1,795,032				1,795,032
Total Research, Development, Test & Evaluation	21,427,048		59,562	59,562	21,486,610

Department of the Navy
FY 2021President's Budget
Exhibit R-1 FY 2021 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
1	0601103N	University Research Initiatives	01	155,539	167,850			167,850	U
2	0601152N	In-House Laboratory Independent Research	01	19,123	19,121			19,121	U
3	0601153N	Defense Research Sciences	01	487,362	463,829			463,829	U
	Basic	Research		662,024	650,800			650,800	
4	0602114N	Power Projection Applied Research	02	26,903	28,546			28,546	U
5	0602123N	Force Protection Applied Research	02	175,857	215,517			215,517	U
6	0602131M	Marine Corps Landing Force Technology	02	61,593	69,104			69,104	U
7	0602235N	Common Picture Applied Research	02	40,559	42,846			42,846	U
8	0602236N	Warfighter Sustainment Applied Research	02	64,010	95,825			95,825	U
9	0602271N	Electromagnetic Systems Applied Research	02	74,934	88,497			88,497	U
10	0602435N	Ocean Warfighting Environment Applied Research	02	87,715	82,582			82,582	U
11	0602651M	Joint Non-Lethal Weapons Applied Research	02	6,137	6,346			6,346	U
12	0602747N	Undersea Warfare Applied Research	02	75,998	98,075			98,075	U
13	0602750N	Future Naval Capabilities Applied Research	02	135,523	152,012			152,012	U
14	0602782N	Mine and Expeditionary Warfare Applied Research	02	37,399	54,074			54,074	U
15	0602792N	Innovative Naval Prototypes (INP) Applied Research	02	151,176	152,354			152,354	U

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)	Sec
1	0601103N	University Research Initiatives	01	116,816				116,816	U
2	0601152N	In-House Laboratory Independent Research	01	19,113				19,113	U
3	0601153N	Defense Research Sciences	01	467,158				467,158	U
	Basic	Research		603,087				603,087	
4	0602114N	Power Projection Applied Research	02	17,792				17,792	U
5	0602123N	Force Protection Applied Research	02	122,281				122,281	U
6	0602131M	Marine Corps Landing Force Technology	02	50,623				50,623	U
7	0602235N	Common Picture Applied Research	02	48,001				48,001	U
8	0602236N	Warfighter Sustainment Applied Research	02	67,765				67,765	U
9	0602271N	Electromagnetic Systems Applied Research	02	84,994				84,994	U
10	0602435N	Ocean Warfighting Environment Applied Research	02	63,392				63,392	U
11	0602651M	Joint Non-Lethal Weapons Applied Research	02	6,343				6,343	U
12	0602747N	Undersea Warfare Applied Research	02	56,397				56,397	U
13	0602750N	Future Naval Capabilities Applied Research	02	167,590				167,590	U
14	0602782N	Mine and Expeditionary Warfare Applied Research	02	30,715				30,715	U
15	0602792N	Innovative Naval Prototypes (INP) Applied Research	02	160,537				160,537	U

Department of the Navy
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(Dollars in Thousands)

Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
16	0602861N	Science and Technology Management - ONR Field Acitivities	02	64,358	73,961			73,961	U
		Applied Research		1,002,162	1,159,739			1,159,739	
17	0603123N	Force Protection Advanced Technology	03	32,140	40,286			40,286	U
18	0603271N	Electromagnetic Systems Advanced Technology	03	8,639	9,499			9,499	U
19	0603640M	USMC Advanced Technology Demonstration (ATD)	03	170,659	212,347			212,347	U
20	0603651M	Joint Non-Lethal Weapons Technology Development	03	12,956	13,307			13,307	U
21	0603673N	Future Naval Capabilities Advanced Technology Development	03	210,631	222,477			222,477	U
22	0603680N	Manufacturing Technology Program	03	57,322	65,138			65,138	U
23	0603729N	Warfighter Protection Advanced Technology	03	39,949	34,149			34,149	U
24	0603758N	Navy Warfighting Experiments and Demonstrations	03	64,422	67,739			67,739	U
25	0603782N	Mine and Expeditionary Warfare Advanced Technology	03	38,541	13,335			13,335	U
26	0603801N	Innovative Naval Prototypes (INP) Advanced Technology Development	03	196,092	129,003			129,003	U
		Advanced Technology Development		831,351	807,280			807,280	
27	0603178N	Medium and Large Unmanned Surface Vehicles (USVs)	04						U
28	0603207N	Air/Ocean Tactical Applications	04	29,136	40,643		2,400	43,043	U

Department of the Navy
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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)	Sec
16	0602861N	Science and Technology Management - ONR Field Acitivities	02	76,745				76,745	U
		Applied Research		953,175				953,175	
17	0603123N	Force Protection Advanced Technology	03	24,410				24,410	U
18	0603271N	Electromagnetic Systems Advanced Technology	03	8,008				8,008	U
19	0603640M	USMC Advanced Technology Demonstration (ATD)	03	219,045				219,045	U
20	0603651M	Joint Non-Lethal Weapons Technology Development	03	13,301				13,301	U
21	0603673N	Future Naval Capabilities Advanced Technology Development	03	246,054				246,054	U
22	0603680N	Manufacturing Technology Program	03	60,122				60,122	U
23	0603729N	Warfighter Protection Advanced Technology	03	4,851				4,851	U
24	0603758N	Navy Warfighting Experiments and Demonstrations	03	40,709				40,709	U
25	0603782N	Mine and Expeditionary Warfare Advanced Technology	03	1,948				1,948	U
26	0603801N	Innovative Naval Prototypes (INP) Advanced Technology Development	03	141,948				141,948	U
		Advanced Technology Development		760,396				760,396	
27	0603178N	Medium and Large Unmanned Surface Vehicles (USVs)	04	464,042				464,042	U
28	0603207N	Air/Ocean Tactical Applications	04	35,386				35,386	U

Department of the Navy
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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
29	0603216N	Aviation Survivability	04	7,618	11,919			11,919	U
30	0603239N	ISO Naval Construction Forces	04						U
31	0603251N	Aircraft Systems	04	790	1,473			1,473	U
32	0603254N	ASW Systems Development	04	6,877	7,172			7,172	U
33	0603261N	Tactical Airborne Reconnaissance	04	3,537	3,419			3,419	U
34	0603382N	Advanced Combat Systems Technology	04	38,674	57,947			57,947	U
35	0603502N	Surface and Shallow Water Mine Countermeasures	04	116,113	407,800			407,800	U
36	0603506N	Surface Ship Torpedo Defense	04	6,822	7,242			7,242	U
37	0603512N	Carrier Systems Development	04	5,388	4,997			4,997	U
38	0603525N	PILOT FISH	04	140,354	196,648			196,648	U
39	0603527N	RETRACT LARCH	04	28,653	11,980		22,000	33,980	U
40	0603536N	RETRACT JUNIPER	04	109,958	129,163			129,163	U
41	0603542N	Radiological Control	04	735	689			689	U
42	0603553N	Surface ASW	04	1,078	1,137			1,137	U
43	0603561N	Advanced Submarine System Development	04	103,267	115,717			115,717	U
44	0603562N	Submarine Tactical Warfare Systems	04	12,180	11,192			11,192	U
45	0603563N	Ship Concept Advanced Design	04	73,750	96,846			96,846	U
46	0603564N	Ship Preliminary Design & Feasibility Studies	04	12,839	22,534			22,534	U
47	0603570N	Advanced Nuclear Power Systems	04	256,137	181,652			181,652	U

Department of the Navy
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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)	Sec
29	0603216N	Aviation Survivability	04	13,428				13,428	U
30	0603239N	ISO Naval Construction Forces	04	2,350				2,350	U
31	0603251N	Aircraft Systems	04	418				418	U
32	0603254N	ASW Systems Development	04	15,719				15,719	U
33	0603261N	Tactical Airborne Reconnaissance	04	3,411				3,411	U
34	0603382N	Advanced Combat Systems Technology	04	70,218				70,218	U
35	0603502N	Surface and Shallow Water Mine Countermeasures	04	52,358				52,358	U
36	0603506N	Surface Ship Torpedo Defense	04	12,816				12,816	U
37	0603512N	Carrier Systems Development	04	7,559				7,559	U
38	0603525N	PILOT FISH	04	358,757				358,757	U
39	0603527N	RETRACT LARCH	04	12,562		36,500	36,500	49,062	U
40	0603536N	RETRACT JUNIPER	04	148,000				148,000	U
41	0603542N	Radiological Control	04	778				778	U
42	0603553N	Surface ASW	04	1,161				1,161	U
43	0603561N	Advanced Submarine System Development	04	185,356				185,356	U
44	0603562N	Submarine Tactical Warfare Systems	04	10,528				10,528	U
45	0603563N	Ship Concept Advanced Design	04	126,396				126,396	U
46	0603564N	Ship Preliminary Design & Feasibility Studies	04	70,270				70,270	U
47	0603570N	Advanced Nuclear Power Systems	04	149,188				149,188	U

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
48	0603573N	Advanced Surface Machinery Systems	04	26,272	87,408			87,408	U
49	0603576N	CHALK EAGLE	04	33,943	54,877			54,877	U
50	0603581N	Littoral Combat Ship (LCS)	04	36,864	16,934			16,934	U
51	0603582N	Combat System Integration	04	15,710	17,251			17,251	U
52	0603595N	Ohio Replacement	04	528,146	427,051			427,051	U
53	0603596N	LCS Mission Modules	04	99,728	108,505			108,505	U
54	0603597N	Automated Test and Analysis	04	36,563	42,653			42,653	U
55	0603599N	Frigate Development	04	119,821	59,007			59,007	U
56	0603609N	Conventional Munitions	04	8,942	9,988			9,988	U
57	0603635M	Marine Corps Ground Combat/Support System	04		51,997			51,997	U
58	0603654N	Joint Service Explosive Ordnance Development	04	60,316	33,478		14,178	47,656	U
59	0603713N	Ocean Engineering Technology Development	04	5,697	5,619			5,619	U
60	0603721N	Environmental Protection	04	19,629	20,564			20,564	U
61	0603724N	Navy Energy Program	04	31,726	58,014			58,014	U
62	0603725N	Facilities Improvement	04	5,177	3,440			3,440	U
63	0603734N	CHALK CORAL	04	254,023	307,392			307,392	U
64	0603739N	Navy Logistic Productivity	04	2,803	3,857			3,857	U
65	0603746N	RETRACT MAPLE	04	307,563	242,144			242,144	U
66	0603748N	LINK PLUMERIA	04	347,395	396,509			396,509	U

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Line No	Program Element Number	Item	Act	FY 2021 Base	FY 2021 OCO for Base Requirements	FY 2021 OCO for Direct War and Enduring Costs	FY 2021 Total OCO	FY 2021 Total (Base + OCO)	Sec
48	0603573N	Advanced Surface Machinery Systems	04	38,449				38,449	U
49	0603576N	CHALK EAGLE	04	71,181				71,181	U
50	0603581N	Littoral Combat Ship (LCS)	04	32,178				32,178	U
51	0603582N	Combat System Integration	04	17,843				17,843	U
52	0603595N	Ohio Replacement	04	317,196				317,196	U
53	0603596N	LCS Mission Modules	04	67,875				67,875	U
54	0603597N	Automated Test and Analysis	04	4,797				4,797	U
55	0603599N	Frigate Development	04	82,309				82,309	U
56	0603609N	Conventional Munitions	04	9,922				9,922	U
57	0603635M	Marine Corps Ground Combat/Support System	04	189,603				189,603	U
58	0603654N	Joint Service Explosive Ordnance Development	04	43,084		14,461	14,461	57,545	U
59	0603713N	Ocean Engineering Technology Development	04	6,346				6,346	U
60	0603721N	Environmental Protection	04	20,601				20,601	U
61	0603724N	Navy Energy Program	04	23,422				23,422	U
62	0603725N	Facilities Improvement	04	4,664				4,664	U
63	0603734N	CHALK CORAL	04	545,763		3,000	3,000	548,763	U
64	0603739N	Navy Logistic Productivity	04	3,884				3,884	U
65	0603746N	RETRACT MAPLE	04	353,226				353,226	U
66	0603748N	LINK PLUMERIA	04	544,388				544,388	U

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Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
67	0603751N	RETRACT ELM	04	49,869	63,434			63,434	U
68	0603764M	LINK EVERGREEN	04		30,000			30,000	U
69	0603764N	LINK EVERGREEN	04		167,735			167,735	U
70	0603790N	NATO Research and Development	04	9,280	7,697			7,697	U
71	0603795N	Land Attack Technology	04	6,924	5,900		1,428	7,328	U
72	0603851M	Joint Non-Lethal Weapons Testing	04	26,695	28,466			28,466	U
73	0603860N	Joint Precision Approach and Landing Systems - Dem/Val	04	99,123	51,341			51,341	U
74	0603925N	Directed Energy and Electric Weapon Systems	04	138,988	135,919			135,919	U
75	0604014N	F/A -18 Infrared Search and Track (IRST)	04	104,505	112,416			112,416	U
76	0604027N	Digital Warfare Office	04	19,217	37,000			37,000	U
77	0604028N	Small and Medium Unmanned Undersea Vehicles	04	16,062	47,261			47,261	U
78	0604029N	Unmanned Undersea Vehicle Core Technologies	04	26,406	41,910			41,910	U
79	0604030N	Rapid Prototyping, Experimentation and Demonstration.	04	27,495	31,000			31,000	U
80	0604031N	Large Unmanned Undersea Vehicles	04	57,942	68,310			68,310	U
81	0604112N	Gerald R. Ford Class Nuclear Aircraft Carrier (CVN 78 - 80)	04	81,021	105,756			105,756	U
82	0604126N	Littoral Airborne MCM	04	14,052	20,248			20,248	U
83	0604127N	Surface Mine Countermeasures	04	14,764	18,735			18,735	U

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67	0603751N	RETRACT ELM	04	86,730				86,730	U
68	0603764M	LINK EVERGREEN	04	236,234				236,234	U
69	0603764N	LINK EVERGREEN	04						U
70	0603790N	NATO Research and Development	04	6,880				6,880	U
71	0603795N	Land Attack Technology	04	10,578		1,457	1,457	12,035	U
72	0603851M	Joint Non-Lethal Weapons Testing	04	28,435				28,435	U
73	0603860N	Joint Precision Approach and Landing Systems - Dem/Val	04	33,612				33,612	U
74	0603925N	Directed Energy and Electric Weapon Systems	04	128,845				128,845	U
75	0604014N	F/A -18 Infrared Search and Track (IRST)	04	84,190				84,190	U
76	0604027N	Digital Warfare Office	04	54,699				54,699	U
77	0604028N	Small and Medium Unmanned Undersea Vehicles	04	53,942				53,942	U
78	0604029N	Unmanned Undersea Vehicle Core Technologies	04	40,060				40,060	U
79	0604030N	Rapid Prototyping, Experimentation and Demonstration.	04	12,100				12,100	U
80	0604031N	Large Unmanned Undersea Vehicles	04	78,122				78,122	U
81	0604112N	Gerald R. Ford Class Nuclear Aircraft Carrier (CVN 78 - 80)	04	107,895				107,895	U
82	0604126N	Littoral Airborne MCM	04	17,366				17,366	U
83	0604127N	Surface Mine Countermeasures	04	18,754				18,754	U

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84	0604272N	Tactical Air Directional Infrared Countermeasures (TADIRCM)	04	45,853	58,449			58,449	U
85	0604289M	Next Generation Logistics	04	5,890	19,420			19,420	U
86	0604292N	Future Vertical Lift (Maritime Strike)	04						U
87	0604320M	Rapid Technology Capability Prototype	04	6,986	4,558			4,558	U
88	0604454N	LX (R)	04	5,463	12,500			12,500	U
89	0604536N	Advanced Undersea Prototyping	04	108,482	187,187			187,187	U
90	0604636N	Counter Unmanned Aircraft Systems (C-UAS)	04		3,100			3,100	U
91	0604659N	Precision Strike Weapons Development Program	04	89,477	637,254			637,254	U
92	0604707N	Space and Electronic Warfare (SEW) Architecture/Engineering Support	04	6,952	5,263			5,263	U
93	0604786N	Offensive Anti-Surface Warfare Weapon Development	04	141,383	115,419			115,419	U
94	0303354N	ASW Systems Development - MIP	04	8,889	9,991			9,991	U
95	0304240M	Advanced Tactical Unmanned Aircraft System	04	17,554	45,407			45,407	U
96	0304240N	Advanced Tactical Unmanned Aircraft System	04	9,300					U
97	0304270N	Electronic Warfare Development - MIP	04	466	609			609	U
		Advanced Component Development & Prototypes		4,033,262	5,329,143		40,006	5,369,149	
98	0603208N	Training System Aircraft	05	14,345	15,514			15,514	U

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84	0604272N	Tactical Air Directional Infrared Countermeasures (TADIRCM)	04	59,776				59,776	U
85	0604289M	Next Generation Logistics	04						U
86	0604292N	Future Vertical Lift (Maritime Strike)	04	5,097				5,097	U
87	0604320M	Rapid Technology Capability Prototype	04	3,664				3,664	U
88	0604454N	LX (R)	04	10,203				10,203	U
89	0604536N	Advanced Undersea Prototyping	04	115,858				115,858	U
90	0604636N	Counter Unmanned Aircraft Systems (C-UAS)	04	14,259				14,259	U
91	0604659N	Precision Strike Weapons Development Program	04	1,102,387				1,102,387	U
92	0604707N	Space and Electronic Warfare (SEW) Architecture/Engineering Support	04	7,657				7,657	U
93	0604786N	Offensive Anti-Surface Warfare Weapon Development	04	35,750				35,750	U
94	0303354N	ASW Systems Development - MIP	04	9,151				9,151	U
95	0304240M	Advanced Tactical Unmanned Aircraft System	04	22,589				22,589	U
96	0304240N	Advanced Tactical Unmanned Aircraft System	04						U
97	0304270N	Electronic Warfare Development - MIP	04	809				809	U
		Advanced Component Development & Prototypes		6,503,074		55,418	55,418	6,558,492	
98	0603208N	Training System Aircraft	05	4,332				4,332	U

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99	0604212N	Other Helo Development	05	23,307	38,835			38,835	U
100	0604214M	AV-8B Aircraft - Eng Dev	05	45,639	27,441			27,441	U
101	0604215N	Standards Development	05	3,624	3,642			3,642	U
102	0604216N	Multi-Mission Helicopter Upgrade Development	05	16,178	19,196			19,196	U
103	0604218N	Air/Ocean Equipment Engineering	05	15,212					U
104	0604221N	P-3 Modernization Program	05	2,074					U
105	0604230N	Warfare Support System	05	9,401	8,601			8,601	U
106	0604231N	Tactical Command System	05	53,110	73,920			73,920	U
107	0604234N	Advanced Hawkeye	05	205,612	226,596			226,596	U
108	0604245M	H-1 Upgrades	05	53,083	60,991			60,991	U
109	0604261N	Acoustic Search Sensors	05	41,395	47,013			47,013	U
110	0604262N	V-22A	05	131,363	191,235			191,235	U
111	0604264N	Air Crew Systems Development	05	30,005	19,172			19,172	U
112	0604269N	EA-18	05	235,963	123,637			123,637	U
113	0604270N	Electronic Warfare Development	05	86,719	114,349			114,349	U
114	0604273M	Executive Helo Development	05	237,300	176,211			176,211	U
115	0604274N	Next Generation Jammer (NGJ)	05	426,729	491,884			491,884	U
116	0604280N	Joint Tactical Radio System - Navy (JTRS-Navy)	05	3,178	190,689			190,689	U
117	0604282N	Next Generation Jammer (NGJ) Increment II	05	91,216	90,922			90,922	U

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99	0604212N	Other Helo Development	05	18,133				18,133	U
100	0604214M	AV-8B Aircraft - Eng Dev	05	20,054				20,054	U
101	0604215N	Standards Development	05	4,237				4,237	U
102	0604216N	Multi-Mission Helicopter Upgrade Development	05	27,340				27,340	U
103	0604218N	Air/Ocean Equipment Engineering	05						U
104	0604221N	P-3 Modernization Program	05	606				606	U
105	0604230N	Warfare Support System	05	9,065				9,065	U
106	0604231N	Tactical Command System	05	97,968				97,968	U
107	0604234N	Advanced Hawkeye	05	309,373				309,373	U
108	0604245M	H-1 Upgrades	05	62,310				62,310	U
109	0604261N	Acoustic Search Sensors	05	47,182				47,182	U
110	0604262N	V-22A	05	132,624				132,624	U
111	0604264N	Air Crew Systems Development	05	21,445				21,445	U
112	0604269N	EA-18	05	106,134				106,134	U
113	0604270N	Electronic Warfare Development	05	134,194				134,194	U
114	0604273M	Executive Helo Development	05	99,321				99,321	U
115	0604274N	Next Generation Jammer (NGJ)	05	477,680				477,680	U
116	0604280N	Joint Tactical Radio System - Navy (JTRS-Navy)	05	232,818				232,818	U
117	0604282N	Next Generation Jammer (NGJ) Increment II	05	170,039				170,039	U

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118	0604307N	Surface Combatant Combat System Engineering	05	367,189	375,681			375,681	U
119	0604311N	LPD-17 Class Systems Integration	05	902	640			640	U
120	0604329N	Small Diameter Bomb (SDB)	05	84,029	50,096			50,096	U
121	0604366N	Standard Missile Improvements	05	199,499	195,296			195,296	U
122	0604373N	Airborne MCM	05	8,024	10,916			10,916	U
123	0604378N	Naval Integrated Fire Control - Counter Air Systems Engineering	05	32,512	30,084			30,084	U
124	0604419N	Advanced Sensors Application Program (ASAP)	05						U
125	0604501N	Advanced Above Water Sensors	05	30,551	30,179			30,179	U
126	0604503N	SSN-688 and Trident Modernization	05	119,911	78,625			78,625	U
127	0604504N	Air Control	05	60,323	44,923			44,923	U
128	0604512N	Shipboard Aviation Systems	05	13,530	14,632			14,632	U
129	0604518N	Combat Information Center Conversion	05	18,626	16,094			16,094	U
130	0604522N	Air and Missile Defense Radar (AMDR) System	05	26,079	38,349			38,349	U
131	0604530N	Advanced Arresting Gear (AAG)	05	168,427	122,495			122,495	U
132	0604558N	New Design SSN	05	174,351	321,010			321,010	U
133	0604562N	Submarine Tactical Warfare System	05	77,529	62,426			62,426	U
134	0604567N	Ship Contract Design/ Live Fire T&E	05	69,337	46,809			46,809	U
135	0604574N	Navy Tactical Computer Resources	05	4,460	3,692			3,692	U

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118	0604307N	Surface Combatant Combat System Engineering	05	403,712				403,712	U
119	0604311N	LPD-17 Class Systems Integration	05	945				945	U
120	0604329N	Small Diameter Bomb (SDB)	05	62,488				62,488	U
121	0604366N	Standard Missile Improvements	05	386,225				386,225	U
122	0604373N	Airborne MCM	05	10,909				10,909	U
123	0604378N	Naval Integrated Fire Control - Counter Air Systems Engineering	05	44,548				44,548	U
124	0604419N	Advanced Sensors Application Program (ASAP)	05	13,673				13,673	U
125	0604501N	Advanced Above Water Sensors	05	87,809				87,809	U
126	0604503N	SSN-688 and Trident Modernization	05	93,097				93,097	U
127	0604504N	Air Control	05	38,863				38,863	U
128	0604512N	Shipboard Aviation Systems	05	9,593				9,593	U
129	0604518N	Combat Information Center Conversion	05	12,718				12,718	U
130	0604522N	Air and Missile Defense Radar (AMDR) System	05	78,319				78,319	U
131	0604530N	Advanced Arresting Gear (AAG)	05	65,834				65,834	U
132	0604558N	New Design SSN	05	259,443				259,443	U
133	0604562N	Submarine Tactical Warfare System	05	63,878				63,878	U
134	0604567N	Ship Contract Design/ Live Fire T&E	05	51,853				51,853	U
135	0604574N	Navy Tactical Computer Resources	05	3,853				3,853	U

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136	0604601N	Mine Development	05	22,105	56,464			56,464	U
137	0604610N	Lightweight Torpedo Development	05	62,448	109,349			109,349	U
138	0604654N	Joint Service Explosive Ordnance Development	05	6,829	8,237			8,237	U
139	0604657M	USMC Ground Combat/Supporting Arms Systems - Eng Dev	05		20,085			20,085	U
140	0604703N	Personnel, Training, Simulation, and Human Factors	05	6,287	5,500			5,500	U
141	0604727N	Joint Standoff Weapon Systems	05	424	16,225			16,225	U
142	0604755N	Ship Self Defense (Detect & Control)	05	175,129	178,603		1,122	179,725	U
143	0604756N	Ship Self Defense (Engage: Hard Kill)	05	185,971	115,130			115,130	U
144	0604757N	Ship Self Defense (Engage: Soft Kill/EW)	05	124,769	95,282			95,282	U
145	0604761N	Intelligence Engineering	05	25,965	45,610			45,610	U
146	0604771N	Medical Development	05	36,761	33,181			33,181	U
147	0604777N	Navigation/ID System	05	99,650	45,755			45,755	U
148	0604800M	Joint Strike Fighter (JSF) - EMD	05	64,692	1,710			1,710	U
149	0604800N	Joint Strike Fighter (JSF) - EMD	05	63,535	1,490			1,490	U
150	0604850N	SSN(X)	05						U
151	0605013M	Information Technology Development	05	12,545	1,494			1,494	U
152	0605013N	Information Technology Development	05	233,521	268,547			268,547	U
153	0605024N	Anti-Tamper Technology Support	05	6,049	4,882			4,882	U

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136	0604601N	Mine Development	05	92,607				92,607	U
137	0604610N	Lightweight Torpedo Development	05	146,012				146,012	U
138	0604654N	Joint Service Explosive Ordnance Development	05	8,383				8,383	U
139	0604657M	USMC Ground Combat/Supporting Arms Systems - Eng Dev	05	33,784				33,784	U
140	0604703N	Personnel, Training, Simulation, and Human Factors	05	8,599				8,599	U
141	0604727N	Joint Standoff Weapon Systems	05	73,744				73,744	U
142	0604755N	Ship Self Defense (Detect & Control)	05	157,490		1,144	1,144	158,634	U
143	0604756N	Ship Self Defense (Engage: Hard Kill)	05	121,761				121,761	U
144	0604757N	Ship Self Defense (Engage: Soft Kill/EW)	05	89,373				89,373	U
145	0604761N	Intelligence Engineering	05	15,716				15,716	U
146	0604771N	Medical Development	05	2,120				2,120	U
147	0604777N	Navigation/ID System	05	50,180				50,180	U
148	0604800M	Joint Strike Fighter (JSF) - EMD	05	561				561	U
149	0604800N	Joint Strike Fighter (JSF) - EMD	05	250				250	U
150	0604850N	SSN(X)	05	1,000				1,000	U
151	0605013M	Information Technology Development	05	974				974	U
152	0605013N	Information Technology Development	05	356,173				356,173	U
153	0605024N	Anti-Tamper Technology Support	05	7,810				7,810	U

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154	0605212M	CH-53K RDTE	05	383,558	506,955			506,955	U
155	0605215N	Mission Planning	05	32,032	72,566			72,566	U
156	0605217N	Common Avionics	05	49,316	37,055			37,055	U
157	0605220N	Ship to Shore Connector (SSC)	05	1,425	19,909			19,909	U
158	0605327N	T-AO 205 Class	05	1,253	1,682			1,682	U
159	0605414N	Unmanned Carrier Aviation (UCA)	05	503,989	649,055			649,055	U
160	0605450M	Joint Air-to-Ground Missile (JAGM)	05	16,031	18,393			18,393	U
161	0605500N	Multi-mission Maritime Aircraft (MMA)	05	32,998	21,472			21,472	U
162	0605504N	Multi-Mission Maritime (MMA) Increment III	05	159,572	141,534			141,534	U
163	0605611M	Marine Corps Assault Vehicles System Development & Demonstration	05	64,311	50,137			50,137	U
164	0605813M	Joint Light Tactical Vehicle (JLTV) System Development & Demonstration	05		2,105			2,105	U
165	0204202N	DDG-1000	05	137,004	111,435			111,435	U
166	0303267N	Auctioned Spectrum Relocation Fund*	05	102,762					U
167	0303467N	SENSR Spectrum Pipeline SRF**	05	1,012					U
168	0303567N	Non-SENSR Spectrum Pipeline SRF***	05	2,000					U
169	0304785N	Tactical Cryptologic Systems	05	39,385	91,091			91,091	U
170	0306250M	Cyber Operations Technology Development	05	6,546	19,874			19,874	U
		System Development & Demonstration		5,840,606	6,112,602		1,122	6,113,724	

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154	0605212M	CH-53K RDTE	05	406,406				406,406	U
155	0605215N	Mission Planning	05	86,134				86,134	U
156	0605217N	Common Avionics	05	54,540				54,540	U
157	0605220N	Ship to Shore Connector (SSC)	05	5,155				5,155	U
158	0605327N	T-AO 205 Class	05	5,148				5,148	U
159	0605414N	Unmanned Carrier Aviation (UCA)	05	266,970				266,970	U
160	0605450M	Joint Air-to-Ground Missile (JAGM)	05	12,713				12,713	U
161	0605500N	Multi-mission Maritime Aircraft (MMA)	05	24,424				24,424	U
162	0605504N	Multi-Mission Maritime (MMA) Increment III	05	182,870				182,870	U
163	0605611M	Marine Corps Assault Vehicles System Development & Demonstration	05	41,775				41,775	U
164	0605813M	Joint Light Tactical Vehicle (JLTV) System Development & Demonstration	05	2,541				2,541	U
165	0204202N	DDG-1000	05	208,448				208,448	U
166	0303267N	Auctioned Spectrum Relocation Fund	05						U
167	0303467N	SENSR Spectrum Pipeline SRF	05						U
168	0303567N	Non-SENSR Spectrum Pipeline SRF	05						U
169	0304785N	Tactical Cryptologic Systems	05	111,434				111,434	U
170	0306250M	Cyber Operations Technology Development	05	26,173				26,173	U
		System Development & Demonstration		6,263,883		1,144	1,144	6,265,027	

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171	0604256N	Threat Simulator Development	06	91,921	62,678			62,678	U
172	0604258N	Target Systems Development	06	10,686	12,027			12,027	U
173	0604759N	Major T&E Investment	06	86,967	107,348			107,348	U
174	0605126N	Joint Theater Air and Missile Defense Organization	06	46					U
175	0605152N	Studies and Analysis Support - Navy	06	3,870	3,908			3,908	U
176	0605154N	Center for Naval Analyses	06	42,361	47,669			47,669	U
177	0605285N	Next Generation Fighter	06	4,981	7,100			7,100	U
178	0605502N	Small Business Innovative Research	06	433,656					U
179	0605804N	Technical Information Services	06	1,465	988			988	U
180	0605853N	Management, Technical & International Support	06	84,378	113,844			113,844	U
181	0605856N	Strategic Technical Support	06	4,068	3,742			3,742	U
182	0605861N	RDT&E Science and Technology Management	06	1,041					U
183	0605863N	RDT&E Ship and Aircraft Support	06	100,950	93,872			93,872	U
184	0605864N	Test and Evaluation Support	06	370,229	392,528	130,444		522,972	U
185	0605865N	Operational Test and Evaluation Capability	06	21,218	25,145			25,145	U
186	0605866N	Navy Space and Electronic Warfare (SEW) Support	06	16,032	12,652			12,652	U
187	0605867N	SEW Surveillance/Reconnaissance Support	06		8,402			8,402	U

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171	0604256N	Threat Simulator Development	06	22,075				22,075	U
172	0604258N	Target Systems Development	06	10,224				10,224	U
173	0604759N	Major T&E Investment	06	85,195				85,195	U
174	0605126N	Joint Theater Air and Missile Defense Organization	06						U
175	0605152N	Studies and Analysis Support - Navy	06	3,089				3,089	U
176	0605154N	Center for Naval Analyses	06	43,517				43,517	U
177	0605285N	Next Generation Fighter	06						U
178	0605502N	Small Business Innovative Research	06						U
179	0605804N	Technical Information Services	06	932				932	U
180	0605853N	Management, Technical & International Support	06	94,297				94,297	U
181	0605856N	Strategic Technical Support	06	3,813				3,813	U
182	0605861N	RDT&E Science and Technology Management	06						U
183	0605863N	RDT&E Ship and Aircraft Support	06	104,822				104,822	U
184	0605864N	Test and Evaluation Support	06	446,960				446,960	U
185	0605865N	Operational Test and Evaluation Capability	06	27,241				27,241	U
186	0605866N	Navy Space and Electronic Warfare (SEW) Support	06	15,787				15,787	U
187	0605867N	SEW Surveillance/Reconnaissance Support	06	8,559				8,559	U

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188	0605873M	Marine Corps Program Wide Support	06	21,158	34,734			34,734	U
189	0605898N	Management HQ - R&D	06	40,165	39,673			39,673	U
190	0606355N	Warfare Innovation Management	06	40,722	28,750			28,750	U
191	0606942M	Assessments and Evaluations Cyber Vulnerabilities	06	6,731					U
192	0606942N	Assessments and Evaluations Cyber Vulnerabilities	06	42,285					U
193	0305327N	Insider Threat	06	1,682	2,645			2,645	U
194	0902498N	Management Headquarters (Departmental Support Activities)	06	1,568	1,460			1,460	U
195	0909980N	Judgment Fund Reimbursement	06	49					U
196	0909999N	Financing for Cancelled Account Adjustments	06	759					U
197	1206867N	SEW Surveillance/Reconnaissance Support	06	8,676					U
		Management Support		1,437,664	999,165	130,444		1,129,609	
199	0604227N	HARPOON Modifications	07	5,016	2,302			2,302	U
200	0604840M	F-35 C2D2	07	222,644	391,165			391,165	U
201	0604840N	F-35 C2D2	07	215,366	354,960			354,960	U
202	0607658N	Cooperative Engagement Capability (CEC)	07	124,413	127,924			127,924	U
203	0607700N	Deployable Joint Command and Control	07	2,817					U
204	0101221N	Strategic Sub & Weapons System Support	07	145,670	125,766			125,766	U

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188	0605873M	Marine Corps Program Wide Support	06	42,749				42,749	U
189	0605898N	Management HQ - R&D	06	41,094				41,094	U
190	0606355N	Warfare Innovation Management	06	37,022				37,022	U
191	0606942M	Assessments and Evaluations Cyber Vulnerabilities	06						U
192	0606942N	Assessments and Evaluations Cyber Vulnerabilities	06						U
193	0305327N	Insider Threat	06	2,310				2,310	U
194	0902498N	Management Headquarters (Departmental Support Activities)	06	1,536				1,536	U
195	0909980N	Judgment Fund Reimbursement	06						U
196	0909999N	Financing for Cancelled Account Adjustments	06						U
197	1206867N	SEW Surveillance/Reconnaissance Support	06						U
		Management Support		991,222				991,222	
199	0604227N	HARPOON Modifications	07	697				697	U
200	0604840M	F-35 C2D2	07	379,549				379,549	U
201	0604840N	F-35 C2D2	07	413,875				413,875	U
202	0607658N	Cooperative Engagement Capability (CEC)	07	143,667				143,667	U
203	0607700N	Deployable Joint Command and Control	07						U
204	0101221N	Strategic Sub & Weapons System Support	07	173,056				173,056	U

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Line No	Program Element Number	Item	Act	FY 2019 (Base + OCO)	FY 2020 Base Enacted	FY 2020 Emergency	FY 2020 OCO Enacted	FY 2020 Total Enacted (Base+Emerg+ OCO)	Sec
205	0101224N	SSBN Security Technology Program	07	40,804	43,354			43,354	U
206	0101226N	Submarine Acoustic Warfare Development	07	11,102	6,815			6,815	U
207	0101402N	Navy Strategic Communications	07	37,184	28,674			28,674	U
208	0204136N	F/A-18 Squadrons	07	199,881	187,911			187,911	U
209	0204163N	Fleet Telecommunications (Tactical)	07	1,613					U
210	0204228N	Surface Support	07	9,328	34,602			34,602	U
211	0204229N	Tomahawk and Tomahawk Mission Planning Center (TMPC)	07	233,913	273,036			273,036	U
212	0204311N	Integrated Surveillance System	07	68,326	103,382			103,382	U
213	0204313N	Ship-Towed Array Surveillance Systems	07	15,250	14,449			14,449	U
214	0204413N	Amphibious Tactical Support Units (Displacement Craft)	07	4,840	6,931			6,931	U
215	0204460M	Ground/Air Task Oriented Radar (G/ATOR)	07	43,184	28,891			28,891	U
216	0204571N	Consolidated Training Systems Development	07	101,451	128,673			128,673	U
217	0204574N	Cryptologic Direct Support	07	4,244					U
218	0204575N	Electronic Warfare (EW) Readiness Support	07	64,264	71,143			71,143	U
219	0205601N	HARM Improvement	07	116,881	132,371			132,371	U
220	0205604N	Tactical Data Links	07	96,542					U

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205	0101224N	SSBN Security Technology Program	07	45,970				45,970	U
206	0101226N	Submarine Acoustic Warfare Development	07	69,190				69,190	U
207	0101402N	Navy Strategic Communications	07	42,277				42,277	U
208	0204136N	F/A-18 Squadrons	07	171,030				171,030	U
209	0204163N	Fleet Telecommunications (Tactical)	07						U
210	0204228N	Surface Support	07	33,482				33,482	U
211	0204229N	Tomahawk and Tomahawk Mission Planning Center (TMPC)	07	200,308				200,308	U
212	0204311N	Integrated Surveillance System	07	102,975				102,975	U
213	0204313N	Ship-Towed Array Surveillance Systems	07	10,873				10,873	U
214	0204413N	Amphibious Tactical Support Units (Displacement Craft)	07	1,713				1,713	U
215	0204460M	Ground/Air Task Oriented Radar (G/ATOR)	07	22,205				22,205	U
216	0204571N	Consolidated Training Systems Development	07	83,956				83,956	U
217	0204574N	Cryptologic Direct Support	07						U
218	0204575N	Electronic Warfare (EW) Readiness Support	07	56,791				56,791	U
219	0205601N	HARM Improvement	07	146,166				146,166	U
220	0205604N	Tactical Data Links	07						U

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221	0205620N	Surface ASW Combat System Integration	07	25,478	29,572			29,572	U
222	0205632N	MK-48 ADCAP	07	66,934	72,265			72,265	U
223	0205633N	Aviation Improvements	07	130,986	125,461			125,461	U
224	0205675N	Operational Nuclear Power Systems	07	117,028	106,192			106,192	U
225	0206313M	Marine Corps Communications Systems	07	180,758	156,307		15,000	171,307	U
226	0206335M	Common Aviation Command and Control System (CAC2S)	07	4,628	4,489			4,489	U
227	0206623M	Marine Corps Ground Combat/ Supporting Arms Systems	07	95,319	51,788			51,788	U
228	0206624M	Marine Corps Combat Services Support	07	27,642	44,528			44,528	U
229	0206625M	USMC Intelligence/Electronic Warfare Systems (MIP)	07	37,821	27,886			27,886	U
230	0206629M	Amphibious Assault Vehicle	07	18,757	5,476			5,476	U
231	0207161N	Tactical AIM Missiles	07	36,444	19,488			19,488	U
232	0207163N	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	27,698	34,191			34,191	U
236	0303109N	Satellite Communications (SPACE)	07		34,344			34,344	U
237	0303138N	Consolidated Afloat Network Enterprise Services (CANES)	07	23,322	22,873			22,873	U
238	0303140N	Information Systems Security Program	07	43,348	44,853			44,853	U
239	0305192N	Military Intelligence Program (MIP) Activities	07	6,081	8,913			8,913	U
240	0305204N	Tactical Unmanned Aerial Vehicles	07	8,529	9,451			9,451	U

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221	0205620N	Surface ASW Combat System Integration	07	29,348				29,348	U
222	0205632N	MK-48 ADCAP	07	110,349				110,349	U
223	0205633N	Aviation Improvements	07	133,953				133,953	U
224	0205675N	Operational Nuclear Power Systems	07	110,313				110,313	U
225	0206313M	Marine Corps Communications Systems	07	207,662				207,662	U
226	0206335M	Common Aviation Command and Control System (CAC2S)	07	4,406				4,406	U
227	0206623M	Marine Corps Ground Combat/ Supporting Arms Systems	07	61,381				61,381	U
228	0206624M	Marine Corps Combat Services Support	07	10,421				10,421	U
229	0206625M	USMC Intelligence/Electronic Warfare Systems (MIP)	07	29,977		3,000	3,000	32,977	U
230	0206629M	Amphibious Assault Vehicle	07	6,469				6,469	U
231	0207161N	Tactical AIM Missiles	07	5,859				5,859	U
232	0207163N	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	44,323				44,323	U
236	0303109N	Satellite Communications (SPACE)	07	41,978				41,978	U
237	0303138N	Consolidated Afloat Network Enterprise Services (CANES)	07	29,684				29,684	U
238	0303140N	Information Systems Security Program	07	39,094				39,094	U
239	0305192N	Military Intelligence Program (MIP) Activities	07	6,154				6,154	U
240	0305204N	Tactical Unmanned Aerial Vehicles	07	7,108				7,108	U

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241	0305205N	UAS Integration and Interoperability	07	24,235	40,446			40,446	U
242	0305208M	Distributed Common Ground/Surface Systems	07	7,610	22,042			22,042	U
243	0305208N	Distributed Common Ground/Surface Systems	07	45,338					U
244	0305220N	MQ-4C Triton	07	13,395	11,784			11,784	U
245	0305231N	MQ-8 UAV	07	23,144	29,618			29,618	U
246	0305232M	RQ-11 UAV	07	524	509			509	U
247	0305234N	Small (Level 0) Tactical UAS (STUASL0)	07	5,265	9,410			9,410	U
248	0305239M	RQ-21A	07	6,000	10,914			10,914	U
249	0305241N	Multi-Intelligence Sensor Development	07	80,232	70,612			70,612	U
250	0305242M	Unmanned Aerial Systems (UAS) Payloads (MIP)	07	5,956	10,004			10,004	U
251	0305251N	Cyberspace Operations Forces and Force Support	07						U
252	0305421N	RQ-4 Modernization	07	218,366	185,446			185,446	U
253	0307577N	Intelligence Mission Data (IMD)	07						U
254	0308601N	Modeling and Simulation Support	07	6,824	12,119			12,119	U
255	0702207N	Depot Maintenance (Non-IF)	07	36,961	48,182			48,182	U
256	0708730N	Maritime Technology (MARITECH)	07	26,294	26,779			26,779	U

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241	0305205N	UAS Integration and Interoperability	07	62,098				62,098	U
242	0305208M	Distributed Common Ground/Surface Systems	07	21,500				21,500	U
243	0305208N	Distributed Common Ground/Surface Systems	07						U
244	0305220N	MQ-4C Triton	07	11,120				11,120	U
245	0305231N	MQ-8 UAV	07	28,968				28,968	U
246	0305232M	RQ-11 UAV	07	537				537	U
247	0305234N	Small (Level 0) Tactical UAS (STUASL0)	07	8,773				8,773	U
248	0305239M	RQ-21A	07	10,853				10,853	U
249	0305241N	Multi-Intelligence Sensor Development	07	60,413				60,413	U
250	0305242M	Unmanned Aerial Systems (UAS) Payloads (MIP)	07	5,000				5,000	U
251	0305251N	Cyberspace Operations Forces and Force Support	07	34,967				34,967	U
252	0305421N	RQ-4 Modernization	07	178,799				178,799	U
253	0307577N	Intelligence Mission Data (IMD)	07	2,120				2,120	U
254	0308601N	Modeling and Simulation Support	07	8,683				8,683	U
255	0702207N	Depot Maintenance (Non-IF)	07	45,168				45,168	U
256	0708730N	Maritime Technology (MARITECH)	07	6,697				6,697	U

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257	1203109N	Satellite Communications (SPACE)	07	32,059	15,868			15,868	U
9999	9999999999	Classified Programs		1,783,585	1,742,227		108,282	1,850,509	U
		Operational Systems Development		4,931,294	5,096,386		123,282	5,219,668	
258	0608013N	Risk management Information - Software Pilot Program	08						U
259	0608231N	Maritime Tactical Command and Control (MTC2) - Software Pilot Program	08						U
		Software and Digital Technology Pilot Program							
Total Research, Development, Test & Eval, Navy				18,738,363	20,155,115	130,444	164,410	20,449,969	

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257	1203109N	Satellite Communications (SPACE)	07	70,056				70,056	U
9999	9999999999	Classified Programs		1,795,032				1,795,032	U
		Operational Systems Development		5,327,043		3,000	3,000	5,330,043	
258	0608013N	Risk management Information - Software Pilot Program	08	14,300				14,300	U
259	0608231N	Maritime Tactical Command and Control (MTC2) - Software Pilot Program	08	10,868				10,868	U
		Software and Digital Technology Pilot Program		25,168				25,168	
Total Research, Development, Test & Eval, Navy				21,427,048		59,562	59,562	21,486,610	

*Funding in this Program Element was transferred during the year of execution from the Spectrum Relocation Fund (SRF) in support of the Advanced Wireless Services 3 (AWS-3) auction and is associated with the reallocation or sharing of the 1755-1780 MHz and 1695-1710 MHz bands. The SRF is administered by the Office of Management and Budget (OMB), which approves SRF transfers to federal agencies on an annual basis in consultation with the National Telecommunications and Information Administration (NTIA).

**Funding in this Program Element was transferred during the year of execution from the Spectrum Relocation Fund (SRF) in support of the Joint Spectrum Efficient National Surveillance Radar (SENSR) Pipeline Plan to determine the feasibility and impacts of the proposed spectrum reallocation of the 1300-1350 MHz band. The SRF is administered by the Office of Management and Budget (OMB), which approves SRF transfers to federal agencies on an annual basis in consultation with the National Telecommunications and Information Administration (NTIA).

***Funding in this Program Element was transferred during the year of execution from the Spectrum Relocation Fund (SRF) in support of the proposed reallocation of the 1300-1350 MHz band and adjacent bands. Funds in this Program Element are to be used for activities and costs associated with the study of systems or operations not included in the Joint Spectrum Efficient National Surveillance Radar (SENSR) Pipeline Plan. The SRF is administered by the Office of Management and Budget (OMB), which approves SRF transfers to federal agencies on an annual basis in consultation with the National Telecommunications and Information Administration (NTIA).

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Intelligence Mission Data (IMD)	0307577N	253	07	Volume 5 - 1317
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JNT Service EOD	0604654N	138	05	Volume 3 - 1071
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JNT Standoff Weapon Systems	0604727N	141	05	Volume 3 - 1103

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LINK EVERGREEN	0603764N	69	04	Volume 2 - 953
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Submarine Tactical Warfare System	0604562N	133	05	Volume 3 - 939
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Combat System Integration	0603582N	51	04	Volume 2 - 593
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Counter Unmanned Aircraft System (C-UAS)	0604636N	90	04	Volume 2 - 1323
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GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80	0604112N	81	04	Volume 2 - 1177
JNT Precision Approach & Ldg Sys	0603860N	73	04	Volume 2 - 995
JNT Service EOD Development	0603654N	58	04	Volume 2 - 759
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Navy Logistic Productivity	0603739N	64	04	Volume 2 - 923
Ocean Engineering Tech Dev	0603713N	59	04	Volume 2 - 801
Offensive Anti-Surface Warfare Weapon Dev	0604786N	93	04	Volume 2 - 1385
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RETRACT ELM	0603751N	67	04	Volume 2 - 949
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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	0.000	464.042	-	464.042	530.035	380.379	320.427	260.535	Continuing	Continuing
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	0.000	238.617	-	238.617	377.200	144.549	198.720	134.948	Continuing	Continuing
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	0.000	199.123	-	199.123	122.837	192.836	77.854	80.857	Continuing	Continuing
3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	0.000	0.000	26.302	-	26.302	29.998	42.994	43.853	44.730	Continuing	Continuing

Note

FY 2020 and prior funding in Program Element (PE) 0603502N. Large Unmanned Surface Vessel (LUSV) (Project 3066), Unmanned Surface Vehicle (USV) Enabling Capabilities (Project 3067), and Medium Unmanned Surface Vehicle (MUSV) (Project 3428) projects realigned from PE 0603502N in FY 2021.

A. Mission Description and Budget Item Justification

Projects under this Program Element provide resources for the unmanned platforms in the Navy's Future Surface Combatant Force (FSCF), the Large Unmanned Surface Vessel (LUSV) and Medium Unmanned Surface Vehicle (MUSV), along with relevant supporting enabling technologies.

Medium Unmanned Surface Vehicle (MUSV) is defined as having a reconfigurable mission capability which is accomplished via modular payloads with an initial capability to support Battlespace Awareness through supporting Intelligence, Surveillance and Reconnaissance (ISR) and Information Operations (IO) mission areas. The Large Unmanned Surface Vessel (LUSV) will be delivered and fielded initially as research and development prototype vessels (Overlord prototypes and one prototype LUSV) intended to demonstrate successful integration of government furnished Command, Control, Communications, Computers and Intelligence (C4I) and combat systems and the reliability of automated hull, mechanical, and electrical (HM&E) systems. The prototype LUSVs will incorporate reservations in the design for future combat capabilities with the desired goal of transitioning to procuring and delivering a LUSV with an integrated combat system and organic payloads supporting Anti-Surface Warfare (ASuW) and Strike mission areas.

MUSVs and LUSVs provide affordable, high endurance, reconfigurable ships able to accommodate various payloads for unmanned missions and augment the Navy's manned surface force. MUSVs and LUSVs will be capable of semi-autonomous operation, with operators in-the-loop or on-the-loop. USV Command and Control (C2) will be maintained via an afloat
element (i.e., embarked on a United States Navy (USN) combatant/other assigned afloat asset) or via an ashore element (C2 station ashore). While MUSV and LUSV will logically share common Government Furnished Equipment (GFE) C2 systems to support fleet integration and operations and may share other autonomy and mechanical technologies (depending on acquisition approaches), they will be primarily differentiated by size and cost as driven by payload capabilities, and capacities.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*

Other potential future LUSV capabilities are being informed by the Navy's FSCF Analysis of Alternatives (AoA) and will be refined as future payloads and Concepts of Operation (CONOPS) are developed. MUSV and LUSV are key enablers of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to forward deploy and team with individual manned combatants or augment battle groups. Fielding of MUSV and LUSV will provide the Navy increased capability and necessary capacity at lower procurement and sustainment costs, reduced risk to sailors and increased readiness by offloading missions from manned combatants.

While unmanned surface vehicles are new additions to fleet units, MUSV and LUSV are intended to combine robust and proven commercial vessel specifications with existing military payloads to rapidly and affordably expand the capacity and capability of the surface fleet. Both programs benefit from years of investment and full scale demonstration efforts in autonomy, endurance, command and control, payloads and testing from the Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/ Sea Hunter (FY 2017 to FY 2021) and Office of the Secretary of Defense Strategic Capabilities Office (OSD SCO) Ghost Fleet Overlord Large USV experimentation effort (FY 2018 to FY 2021). The combination of fleet-ready C2 solutions developed by the Ghost Fleet Overlord program and initial man-in-the-loop or man-on-the-loop control will reduce the risk of fleet integration of unmanned surface vehicles and allow autonomy and payload technologies to develop in parallel with fielding vehicles with standardized interfaces.

These efforts are broken out into three (3) Project Units (PUs): Medium Unmanned Surface Vehicle (MUSV) (Project 3428), Large Unmanned Surface Vessel (LUSV) (Project 3066) and Unmanned Surface Vehicle Enabling Capabilities (Project 3067).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	464.042	-	464.042
Total Adjustments	0.000	0.000	464.042	-	464.042
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	464.417	-	464.417
• Rate/Misc Adjustments	0.000	0.000	-0.375	-	-0.375

Change Summary Explanation

Program Changes: +$464,042K transfer from PE 0603502N
Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*				**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	0.000	238.617	-	238.617	377.200	144.549	198.720	134.948	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2020 and prior funding in Program Element (PE) 0603502N. Project 3066 realigned from PE 0603502N starting in FY 2021.

A. Mission Description and Budget Item Justification

The Large Unmanned Surface Vessel (LUSV) project was a new start effort in FY 2020 that leveraged efforts under PE 0604250D8Z through the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) Ghost Fleet Overlord project.

LUSVs will provide affordable, high endurance, ships able to accommodate various payloads augmenting the Navy's manned surface force in supporting the Future Surface Combatant Force (FSCF) program and Distributed Maritime Operations (DMO) concept. The platforms will be capable of weeks-long deployments and trans-oceanic transits and operate aggregated with Carrier Strike Groups (CSGs), Amphibious Ready Groups (ARGs), Surface Action Groups (SAGs), and individual manned combatants.

Major changes from FY 2020 President's Budget request to FY 2021 President's Budget request:

(1) The program will award Conceptual Design (CD) contracts to multiple vendors in FY20. The CD effort will support refinement of a LUSV Performance Specification that does not include the Vertical Launch System (VLS). The final Performance Specification will define a LUSV with reservations in the design to support integration of a variety of capabilities and payloads. This effort, which was originally planned to award in Q2 FY 2020 will be delayed until early Q4 FY 2020 in order to support amendment of the CD Request for Proposals (RFP), Performance Specification, and associated artifacts.

(2) The delay in award of the LUSV CD effort will delay follow-on activities (RFP, source selection) leading up to the award of the LUSV Detail Design and Construction (DD&C) contract. DD&C award will be delayed one year, from FY 2021 to FY 2022. The DD&C award will deliver a non-VLS LUSV prototype based on the Performance Specification developed during the CD effort.

(3) In lieu of the FY 2020 President's Budget request plan of awarding the LUSV DD&C contract in FY21, the Navy is planning to procure up to two additional Overlord prototypes, building on the lessons learned through the Ghost Fleet program and advances in C4I and combat system prototyping efforts.

(4) The Navy plans to transition LUSV to a program of record in FY 2023 and align procurement funding to the Shipbuilding and Conversion, Navy (SCN) account.

Program prototyping and development strategy by year:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

The LUSV program has developed a vessel prototyping strategy to develop and deliver incremental capability increases and demonstrate key autonomy and automation enablers. The strategy supports research and development prototype vessels intended to demonstrate successful integration of government furnished Command, Control, Communications, Computers and Intelligence (C4I) and combat systems and the reliability of automated hull, mechanical, and electrical (HM&E) systems, eventually leading to a LUSV with the Integrated Combat System (ICS) and organic payloads. Early prototype vessels will enable the Navy to accrue operational hours to gather data on autonomy, automation, and systems reliability; increase confidence in the man-machine team; and develop and refine unmanned concepts of operation (CONOPs) and tactics, techniques, and procedures (TTPs).

(1) FY 2019: Ghost Fleet Overlord prototypes - quantity 2, (RDTE under PE 0604250D8Z). OSD SCO-funded vessels currently executing a two-phase experimentation plan that will conclude end of FY 2021 after which they will be turned over to the Navy. These vessels are designed to employ modular payloads and combat systems.

(2) FY 2020: Overlord prototypes - quantity 2 (RDTEN). These vessels will be executed as options on the Washington Headquarters Services (WHS) contract on which the Ghost Fleet Overlord prototypes were procured. These vessels will advance the lessons learned through the Overlord project and will integrate Navy C4I systems in addition to having the capability to employ modular payloads.

(3) FY 2021: Overlord prototypes - quantity up to 2 (RDTEN). Up to two additional prototype vessels are included in the FY 2021 President's Budget request which will deliver updated HM&E and integrated C4I systems and will be the first vessels to integrate a developmental version of the ICS. These vessels will also provide the Navy the opportunity to explore other potential missions (e.g. logistics support, USMC warfighting requirements) for unmanned platforms.

(4) FY 2022: Prototype LUSV - quantity 1 (RDTEN). The prototype LUSV will serve as the DD&C step towards delivering a LUSV with the Integrated Combat System and VLS. The prototype will be designed and delivered based on the Performance Specification developed during the FY 2020 CD effort to include reservations in the design to incorporate a variety of capabilities and payloads. The LUSV prototype will remain at the Surface Developmental Squadron as an R&D and test asset for continued technology development and payload integration efforts.

(5) FY 2023+: LUSV- quantity 7 planned in the FY 2021 President's Budget request Future Years Defense Plan (SCN). The LUSV will be delivered with fully integrated ICS and VLS and will be Fleet assets supporting Anti-Surface Warfare (ASuW) and Strike mission areas. The first LUSVs will be delivered in FY 2026.

The ICS that will be incorporated into the LUSV will be developed under the Unmanned Surface Vehicle Enabling Capabilities (Project 3067). Non-organic payloads may be developed separately by other programs or prototyping efforts and will be further developed and/or integrated into LUSV under the Enabling Capabilities project. Key combat systems and payload technologies and enablers will continue to be developed and matured, leading to an at-sea capstone demonstration, remotely commanded from a surface combatant, in FY 2022.

Overlord prototypes and LUSVs will be capable of autonomous navigation, transit planning, and COLREGS-compliant maneuvering and will be designed with automated propulsion, electrical generation, and support systems. LUSV missions will be conducted with operators in-the-loop (with continuous or near-continuous observation or control) or on-the-loop (autonomous operation that prompts operator action/intervention from sensory input or autonomous behaviors).

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

LUSVs with integrated payload capability and prototypes employing non-organic payloads will not be capable of autonomous payload engagement or execution of a complete detect- to-engage sequence. The vessel will be incapable of payload activation, deactivation, or engagement without the deliberate action of a remote, off-hull human operator in the command and control loop. The program will integrate current Navy combat systems programs of record that have been adapted to enable remote monitoring and operational control from an off-hull command and control point, and will not be equipped with components that would enable payload engagement from onboard the vessel. USV Command and Control (C2) will be maintained via an afloat element (i.e., embarked on a United States Navy (USN) combatant/support ship), or via the ashore element (C2 station ashore).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	0.000	216.235	0.000	216.235
Articles:	-	-	-	-	-

FY 2020 Plans:
FY 2020 Plans under PE 0603502N.

FY 2021 Base Plans:
In FY 2021, the Conceptual Design effort will be completed, delivering a Performance Specification supporting release of a Request for Proposal solicitation for a full and open competition leading up to the award of the Detail Design and Construction (DD&C) for a prototype LUSV designed to be capable of integrating future combat systems and payloads in FY 2022. The Conceptual Design effort along with lessons learned and technologies developed for the Overlord project will inform the LUSV design. The Navy will also execute efforts to integrate modular payloads on the two Ghost Fleet Overlord vessels procured by OSD in FY 2019 that will be transferring to the Navy in FY 2021. Technology development and maturation efforts in FY 2021 will build upon activities executed throughout FY 2020, with the goal to execute an at-sea capstone demonstration of the integrated combat system remotely from a surface combatant. Also in FY21, the Navy will purchase Overlord prototype(s) that advance lessons learned from the Ghost Fleet Overlord project, and will serve as HM&E and combat systems/C4I test vessels, and used to further refine TTPs and CONOPs.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:
Decrease from FY 2020 to FY 2021 accounts for the shift in acquisition strategy, which originally planned for the award of two LUSVs with an integrated combat system and organic payloads in FY 2021. The Navy's FY 2021 President's Budget request plan continues the Conceptual Design effort which will produce a Performance Specification that will be released as part of a RFP solicitation leading to a DD&C award in FY 2022. Additionally, the FY 2021 President's Budget request plan to purchase Overlord prototypes based on

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
commercial vessels capable of employing modular payloads in lieu of executing DD&C contract(s) per the original FY 2020 President's Budget plan accounts for the decrease between FY 2020 and FY 2021.					
Title: Support	0.000	0.000	20.246	0.000	20.246
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** Complete the Conceptual Design effort started in FY 2020. Support development of the RFP and associated artifacts for the prototype LUSV DD&C contract. Execute source selection activities following the RFP leading to a planned award in FY 2022. Continue support to technology development and maturation efforts and the development of requirements and acquisition documentation including a Capability Development Document, System Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan, Navy Training Systems Plan (NTSP) and Program Protection Plan (PPP). Support efforts leading to purchase of Overlord prototypes that advance lessons learned from the Ghost Fleet Overlord project, and will serve as HM&E and combat systems/C4I test vessels, and used to further refine TTPs and CONOPs. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 supports efforts to execute the LUSV program incremental capability acquisition strategy and transition development technologies into future LUSV designs. Supports program ramp up to support ongoing Conceptual Design, RFP release and source selection for the planned prototype LUSV DD&C award in FY 2022, and management support to the planned purchase of the FY 2021 Overlord prototypes.					
Title: Management Services	0.000	0.000	2.136	0.000	2.136
Articles:	-	-	-	-	-
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** Continue efforts started in FY 2020, developing governing LUSV program acquisition and requirements documentation. Provide management support and oversight for the construction of the two Overlord prototypes that will be procured in FY 2020 and FY 2021. Support development of prototype LUSV RFP and source selection activities leading up to the planned FY 2022 DD&C award. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 supports ongoing management of the construction of the two FY 2020 Overlord prototypes and LUSV Conceptual Design, the program ramp up to the prototype LUSV RFP release, and source selection for the planned prototype LUSV DD&C award in FY 2022, and management support to the planned purchase of the FY 2021 Overlord prototype(s).					
Accomplishments/Planned Programs Subtotals	0.000	0.000	238.617	0.000	238.617

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603502N/3066: *Large Unmanned Surface Vehicle (LUSV)*	0.000	273.327	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	273.327
• SCN/5119: *Large Unmanned Surface Vessel*	0.000	0.000	0.000	-	0.000	0.000	455.000	373.605	536.598	0.000	1,365.203

Remarks

D. Acquisition Strategy

In FY 2020, the Navy will purchase two Overlord prototypes as a means to mitigate technical risk and continue to generate lessons learned through testing and experimentation, which will be delivered in FY 2021. In FY 2020, the Navy will award multiple Conceptual Design contracts for a LUSV with reservations in the design to integrate future payloads, which will inform the final Performance Specification. In FY 2021, the Navy intends to purchase up to two additional Overlord prototypes to build on the lessons learned through the Overlord project. Designed to employ modular payloads, they will serve as additional combat systems, C4I, and HM&E test and evaluation platforms as well as be used to further refine CONOPs and TTPs to include manned/unmanned teaming. Also in FY 2021, the Navy will release a RFP in support of a full and open competition for a DD&C contract for LUSV. The FY22 award will be for a single prototype LUSV with reservations to integrate future payloads

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

as a step towards delivering a LUSV with the ICS and VLS. In FY 2023 and following years, the Navy plans to execute contract options for production of LUSVs with ICS and VLS using SCN appropriations. The FY 2021 President's Budget request plan procures ten vessels throughout the FYDP, two Overlord prototypes and one prototype LUSV using RDTEN funding in Project 3066, then two LUSVs with ICS and VLS yearly in FY 2023 and FY 2024, and three in FY 2025 using SCN. All planned vessels are fully funded in the year of procurement, regardless of appropriation.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LUSV Combat Systems/ C4I/HM&E Automation Design and Testing	Various	TBD : TBD	0.000	0.000		0.000		97.478	Nov 2020	-		97.478	Continuing	Continuing	Continuing
LUSV Prototype Fabrication & System/ Payload Integration	C/CPIF	TBD : TBD	0.000	0.000		0.000		54.000	Jun 2021	-		54.000	Continuing	Continuing	Continuing
Government Furnished Equipment	C/CPIF	TBD : TBD	0.000	0.000		0.000		26.000	Jun 2021	-		26.000	Continuing	Continuing	Continuing
LUSV Specification/ Hardware Contract Support	WR	Various : Various	0.000	0.000		0.000		6.120	Nov 2020	-		6.120	Continuing	Continuing	Continuing
Overlord Experimentation	Various	Not Specified : Not Specified	0.000	0.000		0.000		32.637	Nov 2020	-		32.637	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		216.235		-		216.235	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SUPSHIP, WF Center Support	WR	Various : Various	0.000	0.000		0.000		18.129	Nov 2020	-		18.129	Continuing	Continuing	Continuing
LUSV Source Selection	WR	Various : Various	0.000	0.000		0.000		2.117	Nov 2020	-		2.117	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		20.246		-		20.246	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	WR	NAVSEA : Washington, DC	0.000	0.000		0.000		0.300	Nov 2020	-		0.300	Continuing	Continuing	Continuing
Management Services	WR	Various : Various	0.000	0.000		0.000		1.836	Nov 2020	-		1.836	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	0.000		0.000		2.136		-		2.136	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		238.617		-		238.617	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3066				
Project Moved from Program Element 0603502N: New PE	1	2021	1	2021
Overlord Prototypes: Overlord Prototype Construction (options on WHS contract)	1	2021	4	2021
Overlord Prototypes: Overlord Prototype Construction	2	2021	3	2022
Overlord Prototypes: Overlord Prototype Experimentation	1	2021	4	2025
Phase 1: Conceptual Design Contract(s): Conceptual Design	1	2021	2	2021
Phase 2: LUSV Prototype Detail Design & Construction (DD&C) Contract Base Award: RFP	3	2021	3	2021
Phase 2: LUSV Prototype Detail Design & Construction (DD&C) Contract Base Award: Source Selection	3	2021	3	2022
Phase 2: LUSV Prototype Detail Design & Construction (DD&C) Contract Base Award: Award	3	2022	3	2022
Phase 2: LUSV Prototype Detail Design & Construction (DD&C) Contract Base Award: Detail Design and Construction (DD&C)	3	2022	1	2025
Phase 2: LUSV Prototype Detail Design & Construction (DD&C) Contract Base Award: Test/OPDEMO	2	2025	3	2025
LUSV HM&E, C4I, and Combat System Autonomy and Automation: LUSV Prototype Development	1	2021	2	2022
LUSV HM&E, C4I, and Combat System Autonomy and Automation: Development from Experimentation & Lessons Learned	1	2021	4	2025
LUSV HM&E, C4I, and Combat System Autonomy and Automation: Demonstration	2	2022	2	2022

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	0.000	199.123	-	199.123	122.837	192.836	77.854	80.857	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2020 and prior funding in Program Element (PE) 0603502N. Project 3067 realigned from PE 0603502N starting in FY 2021.

A. Mission Description and Budget Item Justification

In order to accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS), the Unmanned Surface Vessel Enabling Capabilities project includes development, test, and integration of USV technologies; the advancement of Defense Advanced Research Projects Agency (DARPA), Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO), Office of Naval Research (ONR) and Industry USV efforts for associated technologies and the development and fabrication of payloads for Large Unmanned Surface Vessels (LUSVs) and Medium Unmanned Surface Vehicles (MUSVs). USV technology efforts in this project unit support demonstration of mission level autonomy, communications, command and control, navigation compliance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGS), endurance, at sea replenishment, payload feasibility, mission planning and execution for the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) Overlord efforts, and enabling technologies for other USVs in the USV FoS, as applicable.

Modular payloads employed by LUSVs and MUSVs will be developed under this project unit. Payloads will be customized to meet Navy needs and demonstrate useful capability for the Fleet. MUSVs will achieve their mission capability through their employment of modular payloads. LUSVs will augment organic warfare capabilities with additional modular payloads. Efforts to develop LUSV organic warfare capability will also be executed under this project. In order to support LUSV future missions, investment in LUSV payload development, payload integration, and Integrated Combat System (ICS) development is required. Investment is also needed to support LUSV payload testing and follow-on operations.

The Autonomy portion of this project funds efforts (in conjunction with Program Element 0604029N, Project 3393 UxS Payloads, C2) to develop common standards, interfaces, and systems to support cross-domain (surface, sub-surface, aviation, and ground) applications. These efforts include advanced development, prototyping and demonstrations to accelerate the design and development of system commonality and interoperability for the cross-domain requirements of the Navy. Autonomy development efforts will demonstrate scalable, adaptable and interoperable warfighting capabilities across various unmanned systems. The advanced development emphasis will encourage innovation and enable rapid integration of UxS capabilities across domains while common standards, interfaces, and systems development occurs in parallel. Autonomy and Command and Control (C2) architectures and interface definitions will be incorporated into near-term and future USV requests for proposals (RFP) and associated artifacts. Coordinated autonomy and C2 efforts, will define, develop and demonstrate capability that advances new technology, and the hardware and software of control systems that will be used to operate multiple and dissimilar Naval UxSs.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Under this project, the Navy is pursuing prototyping efforts to develop modular payloads to enable USVs to deploy persistent airborne systems, extending the C2 reach of host platforms and providing USVs and human operators with more time and space to identify potential threats and make critical decisions. In FY 2020, the Navy is conducting market research and technology feasibility studies that will provide options on mature technologies that can be quickly adapted into developmental systems. Following up in FY 2021, the Navy will consider promising options and will release a technical data package for bids for vendors on the Unmanned Surface Vehicle (USV) Family of Systems (FoS) Indefinite Delivery Indefinite Quantity (IDIQ) Multiple Award Contract (MAC) and plans to award a design and developmental contract in Q4FY 2021 which will deliver in FY 2025.

In FY 2021, Integrated Combat System development efforts will continue under both this project and under the Large Unmanned Surface Vehicle (LUSV) project (Project 3066). Technology development and maturation efforts will build upon activities executed throughout FY 2020, with the goal of delivering a Land Based Test Site (LBTS) software build in early FY 2022 and executing an at-sea capstone demonstration of the ICS remotely from a surface combatant. Also in FY 2021, the Navy will transition the prototype modular payloads developed by OSD SCO into production.

Due to the nature of this project, specific applications and detailed plans are available at a higher classification.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	0.000	182.732	0.000	182.732
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N.					
FY 2021 Base Plans: Continue efforts started in FY 2020 under the Future Surface Combatant Force (FSCF) strategy. Following up on FY 2020 market research and technical studies, develop the technical data package, release for bids on the USV FoS IDIQ MAC, and award the development contract for and commence production of the chosen Elevated Sensor solution following source selection efforts. Continue developmental efforts for the LUSV ICS, which will lead to the delivery of the Land Based Test Site initial build and a demonstration of ICS capabilities (details can be sent at a higher classification level) in FY 2022. Award the production contract (following source selection activities in FY 2020) for the initial prototype modular payloads, with production activities to continue throughout FY 2021. Continue to support efforts to develop the Unmanned Maritime Autonomy Architecture (UMAA) effort led in Project 3393, starting spiral development efforts and implementation of the UMAA Interface Control Document (ICD) and start efforts to establish an autonomy laboratory.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase from FY 2020 to FY 2021 accounts for the start of production for prototype payloads that will be integrated into the OSD SCO-configured experimentation vessels.					
Title: Support	0.000	0.000	13.591	0.000	13.591
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** Continue efforts started in FY 2020 concerning development and refinement of common autonomy standards, interfaces, modeling and simulation efforts, test and evaluation, and prototype development. Continue development of interface control specifications and architecture documentation and update Common Control System documentation and support testing and design efforts. Complete any necessary plans, documents, and other artifacts to support installation and integration of the initial prototype modular payloads. Provide for the operation and maintenance of experimental platforms. Commence development of the Request for Proposals and associated artifacts and initial source selection activities for the production contract for Payload 1 that will award in FY 2021. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 accounts for support to payload production source selection efforts, increase in funding needed for operation of Sea Hunter and the OSD SCO-configured experimental vessels, and for development of the Request for Proposals for the production contracts for Payload 1.					
Title: Management Services	0.000	0.000	2.800	0.000	2.800
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** Continue to provide oversight and management of product development and support efforts. Commence program					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
management activities and management for the production of the prototype modular payloads planned for award in FY 2021. Continue coordination with and across supporting activities (e.g., Program Executive Office (PEO) Integrated Warfare Systems (IWS), PEO Command, Control, Communications, Computers and Intelligence (C4I)), warfare centers, labs, and industry partners to address requirements, manage funding and execute plans for the integration of LUSV payloads with ICS. Continue to develop and refine required acquisition documents and artifacts that support required capabilities managed under this project. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 accounts for production management for prototype payloads and preparations for integration into the OSD SCO-configured experimentation vessels.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	199.123	0.000	199.123

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603502N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	50.413	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.413

Remarks

D. Acquisition Strategy

USV Enabling Capabilities efforts will accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS). By leveraging efforts from the Naval Research and Development Enterprise and industry for associated technologies and payloads and integrating them into USVs at the appropriate level of technical maturity, USV capabilities for the Fleet will be increasingly enhanced. Coordination with UxS platforms will eliminate redundant efforts, encourage innovation and improve coordination of unmanned systems across multiple domains. Leveraging SCO-developed standalone capabilities, the plan is to develop these capabilities for the initial LUSVs and then transition those capabilities into the LUSV through incremental development and integration across the funding portfolio. The project will deliver an ICS that will be ready for combined and integrated capabilities with the infrastructure ready to support any future systems, payloads,

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

and capabilities. The Navy will accomplish efforts under USV Enabling Capabilities through existing contract vehicles prepared for SCO and ONR efforts, the USV FoS Indefinite Delivery Indefinite Quantity (IDIQ) Multiple Award Contract (MAC) which will be awarded in FY 2020, the prime contract awarded for MUSV design and fabrication, the prime contract(s) awarded for LUSV Conceptual Design and, later, Detail Design, and existing contracts for payload fabrication.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Combat System (ICS) Integration Development	Various	TBD : TBD	0.000	0.000		0.000		37.097	Apr 2021	-		37.097	Continuing	Continuing	Continuing
Technical Services	WR	Various : Various	0.000	0.000		0.000		1.658	Oct 2020	-		1.658	Continuing	Continuing	Continuing
Elevated Sensors	C/CPIF	TBD : TBD	0.000	0.000		0.000		2.295	Apr 2021	-		2.295	Continuing	Continuing	Continuing
Experimentation	WR	Various : Various	0.000	0.000		0.000		5.355	Oct 2020	-		5.355	Continuing	Continuing	Continuing
Payload Production	C/CPIF	TBD : TBD	0.000	0.000		0.000		136.327	Dec 2020	-		136.327	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		182.732		-		182.732	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomy	Various	Various : Various	0.000	0.000		0.000		1.530	Oct 2020	-		1.530	Continuing	Continuing	Continuing
Command and Control (C2) Integration	Various	Various : Various	0.000	0.000		0.000		3.060	Oct 2020	-		3.060	Continuing	Continuing	Continuing
USV Squadron Operations	WR	Various : Various	0.000	0.000		0.000		3.901	Oct 2020	-		3.901	Continuing	Continuing	Continuing
Delta Req, RFP Dev, Evaluation	WR	Various : Various	0.000	0.000		0.000		2.200	Oct 2020	-		2.200	Continuing	Continuing	Continuing
RFP Development	WR	Various : Various	0.000	0.000		0.000		2.900	Jul 2021	-		2.900	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		13.591		-		13.591	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	WR	NAVSEA : Washington, DC	0.000	0.000		0.000		2.800	Oct 2020	-		2.800	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		2.800		-		2.800	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		199.123		-		199.123	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3067				
Project Moved from Program Element 0603502N: New PE	1	2021	1	2021
Autonomy: UMAA ICD Development: ICD Development and Delivery	1	2021	2	2022
Autonomy: UMAA ICD Spiral Development & Reference Implementation: Spiral Development and Reference Implementation	3	2021	4	2025
Autonomy: ATR Warfighting Lab (Autonomy) Lab Stand Up: Autonomy Lab Stand Up	1	2021	4	2025
Command and Control (C2): Command and Control (C2)	1	2021	4	2024
Elevated Sensors: RFP Release	1	2021	1	2021
Elevated Sensors: Source Selection	1	2021	3	2021
Elevated Sensors: Award	4	2021	4	2021
Elevated Sensors: Development/Design	1	2022	3	2023
Elevated Sensors: Installation	4	2023	1	2025
Elevated Sensors: Test	1	2025	2	2025
USV Squadron: Maintenance Support	1	2021	4	2024
Experimentation: Planning/Workup: 2	1	2021	2	2021
Experimentation: Planning/Workup: 3	1	2022	2	2022
Experimentation: Planning/Workup: 4	1	2023	2	2023
Experimentation: Planning/Workup: 5	1	2024	2	2024
Experimentation: Planning/Workup: 6	1	2025	2	2025
Experimentation: Experiment: 2	3	2021	3	2021
Experimentation: Experiment: 3	3	2022	3	2022
Experimentation: Experiment: 4	3	2023	3	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Experimentation: Experiment: 5	3	2024	3	2024
Experimentation: Experiment: 6	3	2025	3	2025
Experimentation: Data Analysis: 2	4	2021	4	2021
Experimentation: Data Analysis: 3	4	2022	4	2022
Experimentation: Data Analysis: 4	4	2023	4	2023
Experimentation: Data Analysis: 5	4	2024	4	2024
Experimentation: Data Analysis: 6	4	2025	4	2025
Payload Procurement: Award	1	2021	1	2021
Payload Procurement: Design and Build: 1	2	2021	3	2022
Payload Procurement: Design and Build: 2	1	2022	2	2023
Payload Procurement: Design and Build: 3	1	2023	2	2024
Payload Procurement: Design and Build: 4	1	2024	2	2025
Payload Procurement: Design and Build: 5	1	2025	4	2025
Payload Procurement: Integration and Installation: 1	4	2022	4	2022
Payload Procurement: Integration and Installation: 2	3	2023	3	2023
Payload Procurement: Integration and Installation: 3	3	2024	3	2024
Payload Procurement: Integration and Installation: 4	3	2025	3	2025
Integrated Combat Systems (ICS): Hardware Development: Hardware Design and Development	1	2021	3	2021
Integrated Combat Systems (ICS): Hardware Development: Hardware Virtual Environment Available at Land Based Test Site	4	2021	4	2021
Integrated Combat Systems (ICS): Hardware Development: Hardware Refresh and Update	1	2022	4	2022
Integrated Combat Systems (ICS): Hardware Development: Hardware Update Build and Test	1	2023	3	2023
Integrated Combat Systems (ICS): Hardware Development: Hardware - Updated ICS HW Shipyard Delivery	4	2023	4	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Integrated Combat Systems (ICS): Software Development: Software Build	1	2021	4	2021
Integrated Combat Systems (ICS): Software Development: Virtual Combat Management System (VCMS) Software Delivery to Land Based Test Site (LBTS) Initial Build	2	2022	2	2022
Integrated Combat Systems (ICS): Software Development: Demonstration	2	2022	2	2022
Integrated Combat Systems (ICS): Software Development: VCMS LBTS Integration and Test	3	2022	2	2024
Integrated Combat Systems (ICS): Software Development: LUSV Combat System Light Off 1	2	2024	2	2024
Integrated Combat Systems (ICS): Software Development: VCMS Fixes and CS Certification Window	2	2024	3	2025
Integrated Combat Systems (ICS): Software Development: LUSV Combat System Light Off 2	2	2025	2	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	0.000	0.000	26.302	-	26.302	29.998	42.994	43.853	44.730	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2020 and prior funding in Program Element (PE) 0603502N. Project 3428 realigned from PE 0603502N starting in FY 2021.

The MUSV project builds on efforts executed in FY 2019 under PE 0603502N, Project 3428 as well as through the Congressional Add of $42.000 million in Project 9999. Additionally, the project continues to leverage lessons learned through experimentation efforts external to this program element under Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and the Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter projects.

A. Mission Description and Budget Item Justification

As part of the Unmanned Surface Vehicle (USV) Family of Systems (FoS), the Medium Unmanned Surface Vehicle (MUSV) project provides resources for the detail design, fabrication, testing, experimentation and support of the MUSV. The MUSV is defined as having a reconfigurable mission capability which is accomplished via modular payloads with an initial capability to support Battlespace Awareness through supporting Intelligence, Surveillance and Reconnaissance (ISR) and Information Operations (IO) mission areas. Modular payloads may be developed separately by other programs or prototyping efforts and will be further developed and/or integrated into MUSV under the Unmanned Surface Vehicle Enabling Capabilities project unit that supports MUSV and LUSV. MUSVs will provide affordable, high endurance, reconfigurable vehicles able to accommodate various payloads for unmanned missions to augment the Navy's manned surface force.

MUSVs will support the Navy's ability to produce, deploy and disburse ISR/EW capabilities in sufficient quantities and provide/improve distributed situational awareness in maritime Areas of Responsibility (AORs). MUSVs will be designed to be attritable assets if used in a peer or near-peer conflict. MUSVs will initially be capable of semi-autonomous operation, with operators in-the-loop (continuous or near-continuous observation and/or control of operations by remote operators) or on-the-loop (semi-autonomous operations where autonomy is controlling the vessel, but it may prompt the remote human operator for input based on sensory input and autonomy behaviors, or an operator may choose to intervene based on data sent from the MUSV or other sources to the remote operating station). USV Command and Control (C2) will be maintained via the afloat element (i.e., embarked on a United States Navy (USN) combatant/support ship), or via the ashore element (C2 station ashore). MUSV C2, combat and/or weapon system integration will employ tamper proofing and
security controls to prevent disclosure of data and electronic warfare defenses during autonomous operation. MUSVs will employ a Risk Management Framework (RMF) approach with physical, technical and administrative security controls. MUSVs will have hardware and software components to protect classified/sensitive functions. MUSVs will be capable of
weeks-long deployments and trans-oceanic transits, and operate aggregated with Carrier Strike Groups (CSGs) and Surface Action Groups (SAGs), as well as have the ability to deploy independently.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

MUSV leverages efforts external to this project unit accomplished through Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter investments in autonomy, reliability, endurance, command and control, payloads and testing that started in FY 2017 and will continue through FY 2021. In addition, the MUSV C2 concept directly leverages the fleet-ready C2 solution developed for unmanned surface vessels in the OSD SCO Ghost Fleet Overlord LUSV experimentation program. In FY 2020, the Navy is transitioning MDUSV Sea Hunter I to the Surface Development Squadron (SURFDEVRON) under the MUSV project, and will be used for continued experimentation and Fleet learning.

The MUSV will be a key enabler of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to deploy independently or with other MUSVs as well as operate with individual manned combatants or as part of a larger battle group. Potential future missions for MUSV will continue to be explored as the Navy continues to learn through
experimentation with Sea Hunter I and the Ghost Fleet Overlord projects and as MUSV concepts of operation (CONOPs) are developed and refined. Following up on the outcome of the FSCF Analysis of Alternatives (AOA) completed in FY 2019, the Navy will have opportunities in the future to increase the MUSV capability set as technology matures. Fielding of MUSV starting in FY 2022 will provide the Navy increased capability and necessary capacity at lower procurement and sustainment costs, reduced risk to sailors and increased readiness by assuming missions from manned combatants.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Product Development	0.000	0.000	14.062	0.000	14.062
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N.					
FY 2021 Base Plans: - Execute Detail Design and Fabrication (DD&F) contract for MUSV prototype (contract award described under Congressional Add of $42.000M in Project Unit 9999/C442). Procure materials in support of fabrication. Begin construction of hull and assembly of subcomponents. Begin software modifications to existing autonomy systems to comply with Navy requirements. - Evaluate and approve industry's preliminary and detailed designs for MUSV through Preliminary Design Review (PDR) and Critical Design Review (CDR) for the MUSV prototype. Develop and review Engineering Change Proposals. The Navy will provide systems engineering, design analysis, hull and assembly oversight, and integration support related to the execution of the DD&F contract. - Develop logistics products to enable the operations, training, and sustainment of the MUSV prototype. - Perform required engineering and development to support the integration and verification of the modularized payloads for the prototype MUSV.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease from FY 2020 to FY 2021 accounts for test and evaluation efforts being broken out into a new category.					
Title: Support	0.000	0.000	7.490	0.000	7.490
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** - Having transitioned Sea Hunter I to Commander, Naval Surface Forces / Surface Development Squadron in Q1FY20, the Navy will award support contracts to enable the sustainment of MUSVs delivered to CNSF. Develop of training and maintenance documentation in preparation of fleet-based operations and sustainment. Support the operations and sustainment for the operational tempo required by CNSF for MUSVs. Provide engineering and operational support for experimental payload integration and demonstration. Transition Sea Hunter II to CNSF Q3FY21. - Provide Systems Engineering Support of any Engineering Change Proposals or Ship Alternations required to support continued availability of the MUSV by CNSF. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 accounts for additional funding to support transition of Sea Hunter II to SURFDEVRON and for funding for experimentation efforts, maintenance, and sustainment of both Sea Hunter I and Sea Hunter II.					
Title: Test and Evaluation	0.000	0.000	3.200	0.000	3.200
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct test and trial event planning. Coordinate with required Navy and OSD testing organizations to reserve testing resources. Conduct initial Cybersecurity Testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase from FY 2020 to FY 2021 account for test and evaluation efforts being broken out from the product development category.					
Title: Management Services	0.000	0.000	1.550	0.000	1.550
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Plans under PE 0603502N. ***FY 2021 Base Plans:*** - Develop all governing MUSV documentation as required to support advancement of the prototype program as required by DoDI 5000.80. This includes the creation of the following artifacts or equivalents: System Engineering Plan (SEP), Test and Evaluation Strategy (TES), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, and Program Protection Plan (PPP). The Navy will provide program management support related to the execution of the MUSV Prototype Contract as well as contracts to support MUSVs delivered to CNSF. - Develop Draft Capabilities Development Document to capture warfighting requirements of future increment of MUSV. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease from FY 2020 to FY 2021 accounts for completion of the governing MUSV documentation that is required for the prototype program.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	26.302	0.000	26.302

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603502N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	2.690	23.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.590
• RDTEN/0603502N/9999: *Congressional Add*	57.981	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	70.527

Remarks

RDT&E/0603502N/9999 - The above funding line accounts for several programs, of which the Medium Unmanned Surface Vehicle program is only a portion.

D. Acquisition Strategy

MUSV has been designated as a Rapid Prototyping Program designation and follows a Middle Tier Acquisition approach per Section 804 of the Fiscal Year (FY) 2016 National Defense Authorization Act (NDAA), as amended in FY 2017 NDAA (codified at 10 U.S.C. sub sec 2302 note). Required capabilities were codified in a Top Level Requirements (TLR) document approved by the OPNAV Director of Surface Warfare in FY 2019. While the project only has two MUSVs funded in the FYDP (one MUSV in FY 2019 and one in FY 2023), the contract structure allows for options to be added should funding become available. Delivery of the initial prototype is planned FY 2022 following completion of initial testing and a Military Utility Assessment (MUA). The prototyping efforts with the FY 2019 MUSV will inform procurement of additional MUSV units and eventual transition to an ACAT program with formalized requirements through a Capability Development Document and procurement funding.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Engineering	WR	Various : Various	0.000	0.000		0.000		2.100	Nov 2020	-		2.100	Continuing	Continuing	Continuing
Vessel Construction and Integration	C/FPIF	TBD : TBD	0.000	0.000		0.000		7.000	Oct 2020	-		7.000	Continuing	Continuing	Continuing
Logistics Package Development	C/FPIF	TBD : TBD	0.000	0.000		0.000		2.977	Oct 2020	-		2.977	Continuing	Continuing	Continuing
Payload Integration	Various	Various : Various	0.000	0.000		0.000		1.985	Oct 2020	-		1.985	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		14.062		-		14.062	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MUSV Experimentation	Various	Various : Various	0.000	0.000		0.000		5.750	Jan 2021	-		5.750	Continuing	Continuing	Continuing
In-Service Engineering Support	WR	Various : Various	0.000	0.000		0.000		1.740	Oct 2020	-		1.740	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		7.490		-		7.490	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test Execution	Various	Not Specified : Not Specified	0.000	0.000		0.000		3.200	Oct 2020	-		3.200	0.000	3.200	-
		Subtotal	0.000	0.000		0.000		3.200		-		3.200	0.000	3.200	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Requirements Development	WR	Various : Washington, DC	0.000	0.000		0.000		0.800	Oct 2020	-		0.800	Continuing	Continuing	Continuing
Acquisition Management	Various	Various : Various	0.000	0.000		0.000		0.750	Oct 2020	-		0.750	0.000	0.750	-
		Subtotal	0.000	0.000		0.000		1.550		-		1.550	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		26.302		-		26.302	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603178N / *Medium and Large Unmanned Surface Vehicles (USVs)*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3428				
Project Moved from Program Element 0603502N: New PE	1	2021	1	2021
Knowledge Points (KP): Knowledge Point 2	1	2023	1	2023
MUSV #1: Detail Design	1	2021	1	2021
MUSV #1: Critical Design Review (CDR)	1	2021	1	2021
MUSV #1: Construction	1	2021	4	2021
MUSV #1: Government Furnished Equipment (GFE) Procurement	1	2021	4	2021
MUSV #1: GFE Integration	2	2021	3	2021
MUSV #1: Test	4	2021	4	2022
MUSV #1: Delivery	4	2022	4	2022
MUSV #1: Logistics Package Development	1	2021	4	2022
MUSV #2: Option Award	1	2023	1	2023
MUSV #2: Design	2	2023	2	2023
MUSV #2: Construction	3	2023	3	2024
MUSV #2: Test	3	2024	1	2025
MUSV #2: Delivery	1	2025	1	2025
MUSV #2: GFE Procurement	1	2023	4	2023
In-Service Engineering: Engineering Change Proposal (ECP) Development	2	2021	4	2025
Fleet Experimentation: Sea Hunter I Experimentation	1	2021	4	2025
Fleet Experimentation: Sea Hunter II Experimentation	3	2021	4	2025
Fleet Experimentation: MUSV Support Award	2	2021	2	2021

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	475.167	29.136	43.043	35.386	-	35.386	36.716	37.445	37.885	38.650	Continuing	Continuing
2341: *METOC Data Acquisition*	177.319	3.338	7.062	6.131	-	6.131	6.192	7.874	8.034	8.197	Continuing	Continuing
2342: *METOC Data Assimilation and Mod*	272.165	17.301	21.168	22.371	-	22.371	22.400	22.025	22.463	22.913	Continuing	Continuing
2344: *Precise Time and Astrometry*	20.525	4.381	2.467	2.466	-	2.466	3.628	3.345	3.102	3.168	Continuing	Continuing
2363: *Remote Sensing Capability Development*	1.886	0.312	0.327	0.328	-	0.328	0.328	0.000	0.000	0.000	0.000	3.181
3207: *Fleet Synthetic Training*	2.642	0.256	0.283	0.305	-	0.305	0.326	0.332	0.339	0.346	Continuing	Continuing
3404: *Tactical Environmental Support*	0.315	2.496	2.619	2.641	-	2.641	2.671	2.683	2.737	2.792	Continuing	Continuing
3405: *Decision Support Products & Dissemination*	0.315	1.052	1.117	1.144	-	1.144	1.171	1.186	1.210	1.234	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

A. Mission Description and Budget Item Justification

Understanding and accurately predicting the maritime environment is a naval warfighting advantage. Effective meteorological and oceanographic modeling depends upon a network of advanced, reliable sensors below, on and above the world's oceans. Combined with state-of-the-art computational infrastructure, the Navy-Marine Corps Meteorological and Oceanographic (METOC) team delivers 24/7 observations, precise forecasts and operational recommendation to commanders. The Air Tactical Applications (AOTA) Program Element (PE) is aligned with the Navy's maritime strategy to enhance future METOC mission capabilities supporting naval warfighters worldwide. New state-of-the art government and commercial technologies are identified, transitioned, demonstrated and then integrated into Combat Systems and programs of record to provide capabilities that provide real-time and near-real-time operational effects of the physical environment on the performance of combat forces and their new and emerging platforms, sensors, systems and munitions. The AOTA program element focuses on sensing and characterizing and predicting the littoral and deep-strike battlespace in the context of regional conflicts and crisis response scenarios.

Projects in this PE transition state-of-the art sensing, assimilation, modeling and decision aid technologies from government and commercial sources. Unique project development efforts include atmospheric and oceanographic data assimilation techniques, forecast models, data base management systems and associated software for use in mainframe, desktop and laptop computers. Model data, products and services can be used by forward-deployed personnel or in a reach-back mode to optimize sensor placement and force allocation decisions. Global Geospatial Information and Services efforts within this program address the bathymetric needs of the Navy. Also developed are algorithms to process new satellite sensor data for integration into Navy and Marine Corps decision support systems and for display as part of the common operational and tactical pictures. In addition, the projects provide for demonstration and validation of specialized atmospheric and oceanographic

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*

instrumentation and measurement techniques, new sensors, communications and interfaces. Included are new capabilities to assess, predict and enhance the performance of current and emerging undersea warfare and mine warfare weapons systems. AOTA capabilities are designed to support the latest versions of the Global Command and Control System and specific unit-level combat systems. This PE develops technological upgrades for the U.S. Naval Observatory's Master Clock system to meet requirements of Department of Defense communications, cryptographic, intelligence, geolocation, and targeting systems; develops near-real-time earth orientation predictions; develops very precise determination of positions of both faint and bright stars; and supports satellite tracking and space debris studies.

Major emphasis areas include the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) and the METOC Data Acquisition, the METOC Data Assimilation & Modeling, the Precise Timing and Astrometry, the Fleet Synthetic Training, the Tactical Environmental Support, Decision Support Products & Dissemination, the Earth System Prediction Capability projects, and the Remote Sensing Capability Development.

Advanced Component Development and Prototypes (ACD&P) efforts necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment are funded in this PE. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 6 (system/subsystem model or prototype demonstration in a relevant environment) and TRL 7 (system prototype demonstration in an operational environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	29.747	32.643	36.157	-	36.157
Current President's Budget	29.136	43.043	35.386	-	35.386
Total Adjustments	-0.611	10.400	-0.771	-	-0.771
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	8.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.611	0.000			
• Program Adjustments	0.000	2.400	-0.777	-	-0.777
• Rate/Misc Adjustments	0.000	0.000	0.006	-	0.006

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2019**	**FY 2020**
Project: 9999: *Congressional Adds*		
Congressional Add: *Long duration autonomous hydrographic survey*	0.000	8.000
Congressional Add Subtotals for Project: 9999	0.000	8.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2019**	**FY 2020**
Congressional Add Totals for all Projects	0.000	8.000

Change Summary Explanation

The FY 2021 funding request was reduced by $0.777 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2341: *METOC Data Acquisition*	177.319	3.338	7.062	6.131	-	6.131	6.192	7.874	8.034	8.197	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The major work of the Meteorology and Oceanography (METOC) Data Acquisition Project is to provide future mission capabilities to warfighters allowing them to detect and monitor the conditions of the physical environment throughout the entire battlespace. The most promising new sensor technologies (including unmanned vehicles, tactical sensor exploitation, in-situ sensors) are transitioned from the government's and commercial industry's technology base. These new sensor technologies are demonstrated, validated and integrated into operational programs for warfighters. These new sensor capabilities provide timely and accurate METOC data to operational and tactical commanders. METOC data requirements have evolved with emphasis on naval warfare shifting to littoral and deep strike battlespace. The need to accurately characterize dynamic conditions are crucial in planning and executing warfare operations and effectively allocating force weapon and sensor systems. Routinely available data sources, such as climatology, oceanographic and meteorological numerical models are necessary but not sufficient to support the littoral and deep strike regions. Operational sensors are deployed great distances from the target area of interest. The challenge is to collect and disseminate METOC data in variable and dynamic littoral environmental conditions or in denied, remote or inaccessible areas over extended periods of time.

This project: 1) provides the means to rapidly and automatically acquire a broad array of METOC data using off-board and on-board sensors; 2) provides an on-scene assessment capability for the tactical commander; 3) provides the tactical commander with real-time METOC data and products for operational use; 4) demonstrates and validates the use of tactical workstations and desktop computers for processing and display of METOC data and products; 5) demonstrates and validates techniques which employ data compression, connectivity and interface technologies to obtain, store, process, distribute and display these METOC data and products; 6) develops new charting and bathymetric survey techniques necessary to reduce hazards to navigation and improve forecast skill.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Meteorological and Oceanographic (METOC) Data Acquisition	3.338	7.062	6.131	0.000	6.131
Articles:	-	-	-	-	-
Description: Efforts falling within the Meteorology and Oceanography (METOC) Collections Project provide future scientific and technological warfighting capabilities that detect and continuously monitor environmental (atmospheric, sea surface, oceanographic and seabed) conditions throughout the battlespace. The Navy's mission continues to require focus on blue-water operations, littoral and deep-strike (inland) battlespaces. Each of these operating areas (and the transitions between them) has its own dynamic and complex environmental characteristics and behaviors that require modifying METOC Collections and associated sensing strategies and methodologies. Without reliable characterization of ocean and atmosphere in these operating areas, the Navy risks ineffective allocation and employment of warfighters and weapon systems, and the sensors that					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
fully enable them. Fleet Naval METOC has updated the definition and structure of the METOC program along the lines of operational mission needs. This update focuses on the operational characteristics of Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) of METOC data and information. Identified efforts supporting METOC are realigned to projects and activities that align to the TCPED updated program structure.					
FY 2020 Plans: Continue with implementing a "rapid innovation" weather-ocean capability that emphasizes observing systems.					
Continue assimilating satellite optical data streams into the Coupled Ocean-Atmosphere Mesoscale Prediction System ocean model component.					
The effort will also focus on each category as described below:					
Forward-based Navy coupled ocean data assimilation (NCODA). Emphasize Compression Integration, Integration of NCODA-Forward processing and algorithms, Modifications to bathythermograph (BT) Manager, integration of the BT-SSP (sound speed profile) and BT Manager modules, New Data Visualization.					
Develop automated mission planning and route selection aids in support of TRITON MQ-4C hazardous weather avoidance (Priority T-1a). Weather variables will include probability of icing, turbulence, thunderstorms, and cross-winds at air base for both takeoff and landing. Increases automation of Aerographers Mate (AG) mission planning, route selection, and weather briefing materials that will improve C2 and vehicle autonomy with greater platform-to-operator (AG) ratio, and automated planning (Priority T-1b). Improves platform-to-operator ratio supports guidance that many METOC billets supporting TRITON will not be renewed in FY 2019.					
Towed Array Ballasting System Construct prototype and integrate onto operational platform. Acoustic Towed Array Miniaturization Construct "build 2, 45mm footprint" into three prototype arrays with 3-different node spacings. Signal Processing Fully implement R-Theta algorithm. Remote Sea-Test Demonstrate technology in ONR-sponsored West Pacific sea-test.					
The capability delivered will be to provide operational high-resolution satellite visible/infrared (Vis/IR) and passive microwave (PMW) sea ice concentration retrievals for improved sea ice forecasts and safe navigation					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
in the Arctic. Users will be sea ice forecasters and personnel operating in the ice environment either surface or subsurface. The utility of SPIRE ionospheric data for modeling the ionosphere was evaluated in two parts split across fiscal year FY18 and FY19. In part 2 (FY19), a representative sample of SPIRE data (which includes at a minimum two contiguous days of data) acquired and ingested into an ionospheric data assimilative model. The performance of the model runs with SPIRE data will be compared to the performance of model runs without SPIRE data to demonstrate the overall impact of the data. Since it is anticipated that the volume of SPIRE data will grow substantially, the impact of the SPIRE data will be measured as a function of the density of SPIRE data samples in the vicinity of the independent ionospheric observations. This will provide for an estimation of the utility of larger constellations of SPIRE satellites with higher sample densities than the representative SPIRE data used in this study. Conclude the effort to Collect in-situ transmission loss (TL) from tactical platforms in support of Naval Oceanographic Office's (NAVOCEANO's) Low Frequency Bottom Loss (LFBL) database that developed efficient algorithm to perform inversion of TL data to produce geo-acoustic parameters of the local environment. ***FY 2021 Base Plans:*** On going Implementation of a "rapid innovation" weather-ocean capability that emphasizes observing systems. Further Assimilation of satellite optical data streams into the Coupled Ocean-Atmosphere Mesoscale Prediction System ocean model component. Maintain Forward-based Navy coupled ocean data assimilation (NCODA). Emphasize Compression Integration, Integration of NCODA-Forward processing and algorithms, Modifications to bathythermograph (BT) Manager, integration of the BT-SSP (sound speed profile) and BT Manager modules, New Data Visualization. Further Updates and expands applications of refractivity from radios (RFRs) projects Concluded Development of automated mission planning and route selection aids in support of TRITON MQ-4C hazardous weather avoidance (Priority T-1a).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Concluded the Delivery and environmental data collected by the P-8 to NAVOCEANO to be incorporated into prediction tools. Conduct METOC data acquisition methods for UxV platforms into the processing stream. Develop Expand satellite-based environmental monitoring (SBEM) data acquisition from domestic, commercial, and international partners as capabilities mature. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The FY 2021 funding decreases in PRJ 2341 METOC Data Acquisition by $0.931 million due to the conclusion and delivery of environmental data collected by the P-8 to NAVOCEANO to be incorporated into prediction tools.					
Accomplishments/Planned Programs Subtotals	3.338	7.062	6.131	0.000	6.131

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0604218N/2345: *FLEET METOC EQUIPMENT*	0.672	0.217	0.620	-	0.620	0.577	0.487	0.497	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Meteorological and Oceanographic (METOC) Data Acquisition Project to develop, demonstrate, and validate METOC data collection methods and sensors, and to evolve the ability to provide timely and accurate METOC data and products to the Tactical Commander, all with management oversight by the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC (DATA) Collections	WR	NRL : Washington, DC	81.363	0.430	Nov 2018	2.510	Dec 2019	0.575	Nov 2020	-		0.575	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	WR	SSC PAC : California	23.063	0.000		0.050	Oct 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	Various	Various : Various	45.516	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	Various	Various : Various	5.764	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	Various	Various : Various	8.422	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	NSWC : Bethesda, MD	1.193	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	APPLIED SCIENCE ASSOCIATED : RHODE ISLAND	0.226	0.000		0.200	Oct 2019	0.040	Dec 2020	-		0.040	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	University of Washington : Seattle, WA	0.050	0.470	Nov 2018	0.102	Oct 2019	0.321	Oct 2020	-		0.321	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	METRON : Reston, VA	0.314	0.110	Dec 2018	0.300	Dec 2019	0.400	Oct 2020	-		0.400	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC : Virginia	1.781	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	CSC : Virginia	0.731	0.000		0.700	Dec 2019	0.400	Oct 2020	-		0.400	Continuing	Continuing	Continuing
METOC (DATA) Collections	WR	NRL : Monterry,CA Stennis Space Center, MS	1.689	0.915	Dec 2018	0.300	Dec 2019	1.435	Dec 2020	-		1.435	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/CPFF	GDIT : Virginia	0.138	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2341 / *METOC Data Acquisition*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC (DATA) Collections	C/FP	Penn State University : PA	2.791	1.413	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	173.041	3.338		4.162		3.421		-		3.421	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	C/CPIF	Various : Various	2.672	0.000		2.400	Nov 2019	1.900	Nov 2020	-		1.900	0.000	6.972	-
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.600	0.000		0.000		0.000		-		0.000	0.000	0.600	-
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	SSC PAC : California	0.247	0.000		0.000		0.000		-		0.000	0.000	0.247	-
METOC Future Mission Capabilities	C/CPFF	PSS/BAH : California	0.066	0.000		0.000		0.000		-		0.000	0.000	0.066	-
		Subtotal	3.585	0.000		2.400		1.900		-		1.900	0.000	7.885	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	Various	Various : Various	0.200	0.000		0.200	Nov 2019	0.460	Nov 2020	-		0.460	0.000	0.860	-
		Subtotal	0.200	0.000		0.200		0.460		-		0.460	0.000	0.860	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Acquisition Workforce	Various	Not Specified : Not Specified	0.093	0.000		0.050	Oct 2019	0.100	Oct 2020	-		0.100	0.000	0.243	-
METOC Future Mission Capabilities Management Support	C/FP	BAH : Virginia	0.400	0.000		0.250	Oct 2019	0.250	Oct 2020	-		0.250	0.000	0.900	-
		Subtotal	0.493	0.000		0.300		0.350		-		0.350	0.000	1.143	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	177.319	3.338		7.062		6.131		-		6.131	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

2021PB - 0603207N - 2341

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

2021PB - 0603207N - 2341

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Collections - global and theater scales				
Oceanographic and Ocean Acoustics Database Development: Deep Ocean Bottom Backscattering Database -- ARL-PSU	1	2020	4	2021
Oceanographic and Ocean Acoustics Database Development: Deep Ocean Bottom Backscattering Database -- NPS	1	2020	4	2023
Oceanographic and Ocean Acoustics Database Development: "Use of Mobile Acoustic Source for In-situ Transmission	1	2020	4	2021
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Atmospheric Data Assimilation -- NRL-MRY	1	2020	4	2024
Satellite-based environmental monitoring for, analysis, assimilation and modeling: "DoD MW Sensors Special Sensor Microwave Imager Sounder (SSMIS),	1	2020	4	2021
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Operational Satellite Sea Ice Products -- NRL-DC	1	2020	4	2022
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Satellite Optical Data for Coupled Ocean-Atmosphere Models -- NRL-SSC	1	2020	4	2024
Satellite-based environmental monitoring for, analysis, assimilation and modeling: RTP: Flux Correction for Coupled System Extended Forecasts using Satellite Observations -- NRL-MRY	1	2020	4	2021
Satellite-based environmental monitoring for, analysis, assimilation and modeling: RTP: Flux Correction for Coupled System Extended Forecasts using Satellite Observations -- NRL-SSC	1	2020	4	2021
METOC Collections - targeted and tactical scales				
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - LBS-G AN (Ambient Noise) -- SSC-PAC	1	2020	4	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - SHARC RFR -- Various	1	2020	4	2020
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- METRON Scientific Solutions, Inc.	1	2020	4	2020
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NRL-DC	1	2020	4	2022
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NSWCCD / METRON	1	2020	4	2022
Forward-based ocean and ocean acoustics modeling and data assimilation: RTP: An NCODA-based Capability for Forward Ocean Data Assimilation -- NRL-SSC	1	2020	4	2021
Through-the-sensor environmental data collections: P-8 Environmental Data Sensing -- SSC-LANT	1	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2342: *METOC Data Assimilation and Mod*	272.165	17.301	21.168	22.371	-	22.371	22.400	22.025	22.463	22.913	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Battlespace Data Assimilation and Prediction Project (2342) enables the future warfighter to leverage observed environmental data gathered under Project 2341 (METOC Data Acquisition) by assimilating data into and fusing them with sophisticated high-resolution (spatial and temporal) assessment and prediction models made possible by high-performance computing. These models gain increasing importance as weapons and sensors grow in sophistication and complexity, making them all the more sensitive to the effects of the natural environment. Meteorology and Oceanography (METOC) Processing enables full understanding of the limitations and constraints imposed by ocean and atmosphere, in space and time, thus quantifying and minimizing their impact on weapons, sensors, and mission. However, METOC Processing itself is limited by the temporal and spatial resolutions at which data are collected and numerically analyzed and predicted. Thus Projects 2341 and 2342 must remain aggressive in delivering higher and higher resolutions, demanding greater and greater computational and database capacities. METOC Processing efforts must also rise to the challenge of assimilating smaller-scale phenomena, particularly in the littorals, and predicting their spatial and temporal effects, as stated by Fleet and Force Commanders who require remote autonomous, clandestine, littoral battlespace sensing in near-shore areas to enable Sea Shield & Sea Basing. This next step in the Information Warfare (IW) Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) continuum, METOC Processing, is critical to fully characterize the physical battlespace environment in real-time and in predictive/forecasting modes, and gives the warfighter a decisive advantage in the complex blue-water, littoral and deep-strike battlespaces.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Battlespace Data Assimilation and Prediction	8.373	21.168	22.371	0.000	22.371
Articles:	-	-	-	-	-
Description: The Battlespace Data Assimilation and Prediction Project (2342) enables the future warfighter to leverage observed environmental data gathered under Project 2341 (METOC Collections) by assimilating data into and fusing them with sophisticated high-resolution (spatial and temporal) assessment and prediction models made possible by high-performance computing. These models gain increasing importance as weapons and sensors grow in sophistication and complexity, making them all the more sensitive to the effects of the natural environment. METOC Processing enables full understanding of the limitations and constraints imposed by ocean and atmosphere, in space and time, thus quantifying and minimizing their impact on weapons, sensors and mission. However, METOC Processing itself is limited by the temporal and spatial resolutions at which data are collected and numerically analyzed and predicted. Thus Projects 2341 and 2342 must remain aggressive in delivering higher and higher resolutions, demanding greater and greater computational and database capacities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
METOC Processing efforts must also rise to the challenge of assimilating smaller-scale phenomena, particularly in the littorals, and predicting their spatial and temporal effects, as stated by Fleet and Force Commanders who require remote autonomous, clandestine, littoral battlespace sensing in near-shore areas to enable Sea Shield & Sea Basing. This next step in the TCPED continuum, METOC Processing, is critical to fully characterize the physical battlespace environment in real-time and in predictive/ forecasting modes, and gives the warfighter a decisive advantage in the complex blue-water, littoral and deep-strike battlespaces. ***FY 2020 Plans:*** The effort plans to focus on each category as described below : Complete: Reduce Navy Global Environmental Model's (NAVGEM) error in the calculations of the Effective Atmospheric Angular Momentum Functions (EAAMF), which are provided to the Naval Observatory for calculation of the changes in the length of day (LOD). Complete: Naval Research Laboratory (NRL) will transition the 3-grid WaveWatch3 real-time system to replace two existing operational global WaveWatch3 systems (one used now by Fleet Numerical Meteorology and Oceanography Center (FNMOC)-Monterey (MRY) and the other used now by FNMOC-John C. Stennis Space Center (SSC)). Transition will include a Validation Test Report. The majority of the required labor is associated with preparation of this report. NRL will also assist FNMOC with Operational Test (OPTEST). Complete: Leverage a coupled ocean and atmospheric modeling and assimilation system based on Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS), Navy Coastal Ocean Model (NCOM) and a range-dependent acoustic model (RAM). Operationalize the forward coupled ocean-acoustic system at Naval Oceanographic Office (NAVO)/FNMOC which will provide a number of advantages over current capabilities. Reduce runtime for acoustic simulations, reduce error due to the coupling of the models, reduce manpower due to the automation, and provide uncertainty estimates via uband. Complete: Develop and transition to the Fleet Numerical Meteorology and Oceanography Center (FNMOC) the Navy Ionosphere Model for Operations (NIMO), which consists of a physics-based model of the ionosphere and a data assimilation capability that will provide a real-time electron density specification on a global grid with the ability to specify high-resolution configurable regional grids. NIMO will also provide a 24-hour forecast of electron density climatology. The Ionospheric Data Assimilation 4-D (IDA4D) will be coupled with the Navy's Highly Integrated Thermosphere/Ionosphere Demonstration System (Navy-HITIDES) to form NIMO. NIMO and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
associated data preprocessors will be optimized to run efficiently on the Navy DoD Supercomputing Resource Centers (DSRC). NIMO will form the basis of a future Navy operational ionospheric forecasting system, running at multiple resolutions and fully coupled to operational atmospheric forecast models. Complete: Develop, test, and transition for operational implementation a strongly coupled ocean-atmosphere 4D-Var assimilation system for COAMPS. The new system will provide a unique capability that enables the observations from the atmosphere (ocean) to directly improve the analysis/forecast in the ocean (atmosphere). The US Navy will own the superior capability of accurately and efficiently characterizing the battlespace environment at the ocean-atmosphere interface once the proposed system becomes operational. The coupled DA system will be demonstrated in COAMPS-OS (on-scene) and verified with propagation products as well as traditional metrics. Complete: Substantially increase the skill of the COAMPS-TC (tropical cyclone) model in the prediction of rapid intensification (RI) events and inner-core structure (6.4), and to elucidate the nature of the relationship between inner-core structure and TC intensification prediction and predictability (6.2). Our approach includes (1) Model development Resolution increases and physics improvements for COAMPS-TC, (2) Data assimilation New capabilities for initializing COAMPS-TC, (3) TC structure guidance development structure assessment and prediction, (4) TC forecast post-processing exploiting statistically-corrected RI forecasts for increased skill. Through a synergistic combination of advancements to the COAMPS-TC model, the data assimilation system used to initialize the model, and the aids utilized by the operational warning centers to estimate TC inner-core structure characteristics (subsequently fed into the COAMPS-TC initial state), we aim to address the #1 research priority of both Joint Typhoon Warning Center (JTWC) and National Hurricane Center (NHC) Rapid intensification prediction. Complete: Develop and transition a global ensemble aerosol prediction system, including data assimilation, to FNMOC. This system will provide a new probabilistic aerosol prediction and product capability for enhanced aerosol data assimilation and downstream Electro-Optical (EO) attenuation modeling. This work leverages BA2 (budget activity 2) efforts that helped optimize the use of ensemble data assimilation methods for aerosol prediction. The Navy Aerosol Analysis Prediction System (ENAAPS) system and Data Assimilation Research Testbed (DART) were ported and tested on Navy DSRC machines as a near-real-time (NRT) system and implemented using Cylc (Cylc [pronounced silk] is a workflow engine for cycling systems - it orchestrates distributed suites of interdependent cycling tasks that may continue to run indefinitely). Under the Rapid Transition Project (RTP), the system will be thoroughly tested for NRT applications with a focus on how the					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
ensemble performs in the forecast, including the ensemble mean and spread. Means for improving system performance will also be tested and implemented as part of NRT ENAAPS, including bias correction, new observations for assimilation, and evaluation of the NAVGEM ensemble impact on ENAAPS forecasts. Complete: Develop and test a Navy Coupled Ocean Data Assimilation (NCODA) -based capability for forward platforms (NCODA-forward) to assimilate collected oceanographic data (e.g. eXpendable BathyThermographs (XBTs), glider, etc./temperature, salinity, etc.) into an oceanographic model field (NCOM or Hybrid Coordinate Ocean Model (HYCOM)) in an acoustically consistent way for operational and tactical analysis and predictions. The proposed capability will provide an estimate of the uncertainty associated with the assimilation process that allows the user to know when the process is reliable and flag cases where the model data cannot be appropriately reconciled with respect to the observations. Production of such uncertainty fields will be used to derive sampling plans to confirm or exclude suspected outliers and reduce excessive uncertainty. Supporting capabilities must also be developed as part of the system to improve compression algorithms to allow more data (temperature, salinity, wind, model error estimates) to be sent to forward platforms and to provide capabilities to assess acoustic integrity of the assimilation process for frequencies of interest. Complete: Implement middle atmosphere processes into a fully coupled global atmosphere/wave/ocean/ land/ice prediction system providing daily predictions out to 16 days, weekly predictions out to 32 days and weekly ensemble predictions to 90 days. Predictions will provide environmental information to meet Navy and Department of Defense (DoD) operations and planning needs throughout the globe from undersea to the upper atmosphere and from the tropics to the poles. The system will be implemented on Navy operational computer systems, and the necessary processing infrastructure will be put in place to provide products for Navy fleet user consumption. Develop an improved algorithm for estimating near-shore bathymetry from Synthetic Aperture Radar (SAR) imagery that would be incorporated into NAVO's operational implementation (using future Commander Naval Meteorology and Oceanography Command (CNMOC) funding). Algorithm improvements have been identified under previous work funded by NRL and CNMOC, and shown to perform significantly better than the existing operational capability on a small test set. The goal of this program is to incorporate those improvements into a single system suitable for transition and test it on a larger range of operational data. Specific tasks of this program, based on previously developed improvements, would be (1) incorporate a dynamic box capability based on instantaneous wave parameters; (2) incorporate an automated wave group amplitude metric to determine when to use bathymetry estimates within small spatial extents; (3) determine source and mitigation of					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
wave noise in new "Undispersion" algorithm; (4) perform validation studies using existing test sets; and (5) write report for NAVO implementation. Test assimilation of updated Naval Oceanographic Office (NAVOCEANO) derived swath ice concentration from NOAA-20 VIIRS and AMSR2 into the GOFS 3.1 system. Investigate ability to assimilate sea ice thickness observations and transition into NCODA system. Test sea ice thickness assimilation in GOFS 3.1 and GOFS 3.5 systems. Establish a geologically consistent physics-based seafloor prediction capability coupled with existing operational oceanic and atmospheric prediction systems. This seafloor prediction capability, based on the NRLs Global Predictive Seafloor Model (GPSM) foundation, will produce a geologically and geo-acoustically consistent replacement for the current high-frequency bottom loss (HFBL) values at any point on the seafloor for transition to NAVO. Characterize forecast dropouts, based on 500mb Anomaly Correlation (AC) methods, in the Navy Global Environmental Model (NAVGEM), including forecast statistics, common properties and causes. Develop and implement a fully coupled global atmosphere/wave/ocean/land/ice prediction system providing daily high- resolution deterministic 16-day and lower-resolution ensemble predictions at longer lead times. Optimize scripting for the deterministic and ensemble systems to better manage cycling tasks for model components and data assimilation, resulting in increased modularity, better parallelism, easier debugging through error trapping, and greater reuse. Develop an ensemble prediction system for a fully coupled global atmosphere/wave/ ocean/land/sea ice coupled model for predictions out to 90 days. Develop a fully- coupled data assimilation capability to optimize the use of the observations across fluid interfaces, eliminating the transient inconsistences, increasing forecast skill and representing coupled uncertainties. Evaluate and demonstrate the capabilities of a new generation of atmospheric dynamical systems that allow for variable resolution on the sphere, are highly scalable, and eliminate or mitigate spurious problems near the poles of the globe. Further develop, validate, and evaluate the capability of a fully coupled regional Arctic prediction system. Develop, integrate, and test improvements to the computational performance of models within the Navy global coupled forecast system as well as the coupling infrastructure to ensure that operational partners will meet their production schedules using available computational resources. Improve capabilities for supporting long range Navy planning (lead times of one week and longer). Develop and transition for operational implementation a high resolution global weather prediction system NAVGEM with resolution of approximately T1023L100 (13 km horizontal resolution and 100 vertical layers) that is highly competitive in predictive skill with other operational global numerical weather prediction (NWP) systems. Define, develop, and implement consistent quantitative skill metrics to assess the advancements in the Earth System Prediction Capability (ESPC), taking into account the applications and lead-times for which the ESPC environmental information will be used. Evaluate and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
validate multi-model extended-range forecasts produced from interagency projects such as the North American Multi-model Ensemble (NMME). Develop the NAVGEM global model to include inline aerosols to simulate aerosol life cycle and perform aerosol direct radiative heating of the atmosphere. Participate in the NMME by re-forecasting the global coupled (NAVGEM-HYCOM- Los Alamos sea ice model (CICE)) Navy ESPC model for years 1999 to 2015. Accelerate the rate of improvement in the US National ESPC and National Unified Operational Prediction Capability (NUOPC), focusing primarily on the current and future generation global modeling enterprise. Develop the NAVGEM global model to address middle atmosphere processes associated with sudden stratospheric warming and extended range prediction.					
FY 2021 Base Plans: Maintain Development of Navy Earth System Prediction Capability (ESPC) systems towards final operating capability (FOC) estimated for FY22, including integration of improved aerosol, atmosphere, and land modeling systems, implementation of wave modeling, fully coupled data assimilation, improved spatial and temporal time scales, and ensemble prediction. Further Transition of merged atmospheric modeling capabilities towards transition from the current model (NAVGEM) into the next generation architecture (NEPTUNE). On-going Improvements to mesoscale modeling of hurricane forecasts, specifically targeting intensity and structure representations that inhibit prediction of realistic rates of rapid intensification. Maintain Leverage machine learning to better represent physical processes in specialty modeling systems, including ice, acoustics, and physics parameterizations. Further Improvements for ambient noise database usage, modeling, and integration into ocean modeling. Maintain Mature and integrate geologically consistent, physics-based seafloor prediction capability coupled with existing operational oceanic and atmospheric prediction systems. Further Expansion, validation, and verification of aerosol modeling to include greater chemistry capabilities, ensemble approaches, and in-line and offline capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Concluded Development of NAVGEM will be frozen pending demonstrated improved capability from next generation system (NEPTUNE). Concluded Acoustic propagation and uncertainty modeling upgrades, including new surface algorithms, variable depth-griddings, and range uncertainties. Development of Expanded middle and upper atmosphere analysis and modeling capabilities, including Ionospheric forecasting for assessment of environmental effects and variability on Over-the-Horizon Radar and HF radio propagation. Conduct the Development of enhanced probabilistic forecasting and analysis capabilities that leverage ensembles and increased capabilities to understand and communicate predictability and uncertainty. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The FY 2021 increase in PRJ 2342 METOC Data Assimilation and Modeling of $1.203 million is in support of transition to operations of improved Ionospheric analysis for assessment of environmental effects and variability on over-the-horizon radar and HF radio propagation.					
Title: Earth System Prediction Capability (ESPC)	8.928	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The Navy Earth System Prediction Capability (ESPC) program will provide a more accurate, longer range, global ocean and atmospheric forecast system for decision support to DoD Maritime Operations through the development of an integrated, coupled atmosphere, ocean, sea ice, land and near-space prediction system with improved deterministic and probabilistic skill over the current operational modeling suite. It will result in increased accuracy for lead times of 1-30 days as well as a new capability for accurate forecasts in the Arctic at all lead times. Additionally it will seek to develop more computationally efficient environmental prediction for emerging architectures and provide Navy Research and Development (R&D) support to the National ESPC. ***FY 2020 Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Starting in FY 2020, the Earth System Prediction Capability System is migrated into the Battlespace Data Assimilation and Prediction activity to more align with the modeling efforts for Air/Ocean Tactical Applications. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	17.301	21.168	22.371	0.000	22.371

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0604218N/2345: *FLEET METOC EQUIPMENT*	0.672	0.217	0.620	-	0.620	0.577	0.487	0.497	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Meteorological and Oceanographic (METOC) Data Assimilation and Modeling Project to develop, demonstrate, and validate METOC data assimilation and environmental prediction capabilities, enabling timely and accurate delivery of METOC prediction data and products to the Tactical Commander, all with management oversight by the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	WR	NRL : Washington DC	128.802	0.852	Nov 2018	3.450	Nov 2019	2.877	Nov 2020	-		2.877	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	Various	Various : Various	46.068	0.000		0.000		0.000		-		0.000	0.000	46.068	-
METOC Space-Based Sensing Capabilities	WR	NRL : Washington, DC	17.092	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NRL : Washington, DC	9.480	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Texas : TX	1.263	0.000		0.150	Nov 2019	0.250	Oct 2020	-		0.250	0.000	1.663	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	NSWC Carderock : West Bethesda, MD	2.090	0.000		0.150	Dec 2019	0.350	Oct 2020	-		0.350	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NAVOCEANO : Mississippi	0.549	0.000		0.500	Mar 2020	0.000		-		0.000	0.000	1.049	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Washington : Seattle, WA	0.850	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Johns Hopkins University : MD	0.431	0.000		0.030	Mar 2020	0.133	Oct 2020	-		0.133	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC/QNA : Various	1.876	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC/QNA : Various	3.096	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Penn Sate University : Pennsylvania	0.125	0.000		0.000		0.000		-		0.000	0.000	0.125	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Tactical Oceanography Capabilities / Undersea Warfare	WR	SSC LANT : North Charleston	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SPA : Virginia	0.375	0.000		0.000		0.000		-		0.000	0.000	0.375	-
METOC SUPPORT SPACE-SOFTWARE DEVELOPMENT	WR	NRL : WASHINGTON DC	0.515	0.000		0.000		0.125	Dec 2020	-		0.125	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	METRON : Virginia	0.385	0.000		0.150	Oct 2019	0.150	Oct 2020	-		0.150	0.000	0.685	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Vencore : Virginia	0.239	0.000		0.000		0.000		-		0.000	0.000	0.239	-
METOC Battlespace Data Assimilation and Prediction	WR	NRL : Monterey, CAl Stennis Space Center,MS	7.695	7.054	Dec 2018	4.500	Nov 2019	6.234	Oct 2020	-		6.234	0.000	25.483	-
Earth Systems Prediction Capability (ONR)	WR	NRL : Washington DC	31.999	6.611	Dec 2018	8.569	Dec 2019	8.792	Oct 2020	-		8.792	Continuing	Continuing	Continuing
ESPC	Various	Various : Various	8.348	0.981	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
CHIEF OF NAVAL OPERATIONS SPEED TO FLEET INITIATIVE	WR	NRL : WASHINGTON DC	0.850	0.000		0.000		0.000		-		0.000	1.130	1.980	-
		Subtotal	262.178	15.498		17.499		18.911		-		18.911	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	Various	Various : Various	0.795	0.000		0.000		0.000		-		0.000	0.000	0.795	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.473	0.000		0.000		0.000		-		0.000	0.000	0.473	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC : Virginia	0.634	0.000		0.000		0.000		-		0.000	0.000	0.634	-
METOC Future Mission Capabilities	C/FP	SAIC : VIRGINIA	0.215	0.100	Dec 2018	0.300	Feb 2020	0.300	Oct 2020	-		0.300	Continuing	Continuing	Continuing
METOC SUPPORT SPACE-PROGRAM SUPPORT	WR	SSC PACIFIC : SAN DIEGO, CA	0.190	0.100	Dec 2018	0.641	Feb 2020	0.425	Nov 2020	-		0.425	Continuing	Continuing	Continuing
Earth System Modeling Framework - Common Software Architecture	Various	Various : Boulder, CO; Various	0.660	0.660	Nov 2018	0.641	Nov 2019	0.731	Dec 2020	-		0.731	0.000	2.692	-
Program Support and Subject Matter Expertise	Various	UW-APL : Seattle, WA	1.921	0.358	Dec 2018	0.425	Dec 2019	0.380	Oct 2020	-		0.380	Continuing	Continuing	Continuing
		Subtotal	4.888	1.218		2.007		1.836		-		1.836	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Data Analytics and Machine Learning	TBD	Charles River : Boston, MA	0.234	0.323	Dec 2018	0.500	Feb 2020	0.500	Nov 2020	-		0.500	0.000	1.557	-
		Subtotal	0.234	0.323		0.500		0.500		-		0.500	0.000	1.557	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Acquisition Workforce	Various	Various : Various	0.090	0.000		0.000		0.000		-		0.000	0.000	0.090	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Space-Based Sensing Capabilities	Various	Various : Various	1.350	0.000		0.000		0.150	Oct 2020	-		0.150	0.000	1.500	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	SSC PAC : San Diego, CA	1.316	0.000		0.000		0.252	Oct 2020	-		0.252	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	PSS/BAH : San Diego, CA	0.216	0.000		0.000		0.000		-		0.000	0.000	0.216	-
METOC Space-Based Sensing Capabilities	C/FP	BAH : VIRGINIA	0.242	0.100	Nov 2018	0.400	Mar 2020	0.250	Dec 2020	-		0.250	Continuing	Continuing	Continuing
METOC Space-Based Sensing Capabilities	WR	SSC PAC : SAN DIEGO, CA	1.552	0.100	Nov 2018	0.400	Mar 2020	0.250	Dec 2020	-		0.250	Continuing	Continuing	Continuing
METOC Acquisition Management	C/CPFF	PSS/BAH : SAN DIEGO, CA	0.099	0.062	Nov 2018	0.362	Nov 2019	0.222	Dec 2020	-		0.222	Continuing	Continuing	Continuing
		Subtotal	4.865	0.262		1.162		1.124		-		1.124	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	272.165	17.301		21.168		22.371		-		22.371	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

2021PB - 0603207N - 2342 Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 2342				
METOC Processing - global and theater scales: Numerical prediction in support of Precise Time and Astrometry: NAVGEM Upgrade for Improved Earth Orientation Parameters -- NRL-MRY	1	2020	4	2023
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Biological scattering and attenuation at tactical frequencies -- APL-JHU	1	2020	4	2021
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Boundary Interactions - TOTLOS Improvements -- APL-UW	1	2020	4	2022
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Cloud Enablement of Ocean and Atmospheric Master Library -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: "OAML Models and Database Verification, Validation and Enhancement	1	2020	4	2024
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: The Improved Synthetic Ocean Profiles (ISOP), Version 2 -- NRL-SSC	1	2020	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Advanced Satellite Data Assimilation -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Aerosol observations for NAAPS validation -- NRL-MRY	1	2020	4	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Mean sea surface height for Sentinel -3A/B x -- NRL-SSC	1	2020	4	2021
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Modeling, Sensing and Forecasting Ocean Optical Products	1	2020	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: NFLUX: Ocean Surface Bias Detection and Correction Using Satellites	1	2020	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Operationally implementing sat-derived ice products	1	2020	4	2024
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Radio occultations from commercial data providers -- NRL-MRY	1	2020	4	2021
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Satellite Aerosol Data Assimilation -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Space METOC: Sea Surface Temp (SST) -- NRL-SSC	1	2020	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Validating and assimilating SAR	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: Large Scale Prediction -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: National Unified Operational Prediction Capability	1	2020	4	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NAVGEM NRL-MRY	1	2020	4	2023
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NCOM-4DVAR NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 B: High Resolution NAVGEM RTP NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-DC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-MRY	1	2020	4	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 3: Coupled Global Ensemble Prediction System	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4 :Next Generation Model NEPTUNE -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4A - NexGen Ocean Model -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 6 Climate Analysis LR Forecasting (ACAF) Navy	1	2020	4	2022
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 9 National ESPC Committee Support -- NRL-MRY	1	2020	4	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 9 National ESPC Committee Support -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-7 Regional Arctic (Prediction) System -- NRL-MRY	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-7 Regional Arctic (Prediction) System -- NRL-SSC	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-99 Naval Capabilities Development and R2O	1	2020	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: RTP Hi-res NAVGEM -- NRL-MRY	1	2020	4	2021
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 5: Computational Efficiency of Earth System Models - NRL-MRY	1	2020	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 5: Computational Efficiency of Earth System Models - NRL-SSC	1	2020	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-MRY	1	2020	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-SSC	1	2020	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC-11A: Characterization and Assessment of Forecast Dropouts in NAVGEM - NRL-MRY	1	2020	4	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - targeted and tactical scales: Forward-based ocean and ocean acoustics modeling and data assimilation: Acoustic Propagation and Uncertainty Model Upgrades: NSPE v6	1	2020	4	2024
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: Global Ensemble Aerosol Prediction (ENAAPS) -- NRL-DC	1	2020	4	2024
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: Navy Aerosol Analysis and Prediction System (NAAPS) -- NRL-MRY	1	2020	4	2024
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: ESPC 1 C NAVGEM Aerosol Model Development / NAVGEM In-Line NAAPS -- NRL-MRY	1	2020	4	2024
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: ASDEMRI RTP -- NRL-MRY	1	2020	4	2021
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: ASDEMRI RTP -- NSWCDD	1	2020	4	2021
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: RTP: Physics-based Ionosphere Model - NRL-DC / APL-JHU / ARL-UT	1	2020	4	2024
METOC Processing - targeted and tactical scales: Numerical prediction in support of Tropical Cyclone characterization: Environmental and Tropical NRL-MRY	1	2020	4	2024
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- METRON Scientific Solutions, Inc.	1	2020	4	2023
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- NRL-DC	1	2020	4	2023
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: COAMPS-OS -- NRL-MRY	1	2020	4	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small Scale Atmospheric Models -- NRL-MRY	1	2020	4	2024
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small scale oceanography -- NRL-SSC	1	2020	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2344: *Precise Time and Astrometry*	20.525	4.381	2.467	2.466	-	2.466	3.628	3.345	3.102	3.168	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Precise Timing and Astrometry (PTA) project funds research and development of improvements for the Master Clock (MC) System, the DoD Time Transfer capability, the Earth Orientation System, and the Astrometric Observation System. The MC System and Time Transfer provides precise time for use in modern military and National Technical Means (NTM) navigation, guidance, positioning, and tracking systems. The Earth Orientation System provides precise Earth Orientation Parameters (EOP) for use by the DoD and national civilian infrastructure to establish the specific orientation of the Earth and to provide input to the terrestrial reference frame. The Astrometric Observation System provides the basic data needed to generate the Celestial Reference Frame (CRF) which is the standard for calibrating all inertial navigation systems, satellite orbits, and earth rotation determinations. Improvement to the MC System, Time Transfer, Earth Orientation, and Astrometric Observation Systems are needed to ensure that new and upgraded DoD and NTM capabilities meet their performance requirements. The U.S. Naval Observatory (USNO), is responsible for coordinating Precise Time and Time Interval (PTTI) requirements and for maintaining a PTTI reference standard (astronomical and atomic) for use by all DoD, federal agencies, and related scientific laboratories. The Navy is also responsible for providing CRF data for military and NTM navigation, positioning, and guidance capabilities to all DoD.

The PTA research and development efforts are focused on several areas relating to timing and time transfer: (1) Fielding of Rubidium Fountain Atomic Clocks and development of improved Global Positioning System (GPS) Timing Receivers in order to meet the precise timing requirements for the GPS III system; (2) Research & development of the capability of distributing timing signals via Optical fiber lines, as an alternative and backup to GPS time distribution; and (3) Research & development into Optical Clock technology, which is expected to be required for future DoD systems. The PTA research and development effort is also focused on the following areas related to EOP determination: (1) Upgrade of the Very Long Baseline Interferometry (VBLI) data acquisition system / radio telescope at Kokee Park HI; (2) Development of a Software (SW) Correlator for processing of VLBI data, necessary for the generation of EOP data; (3) Development of the capability for electronic transmission of the VLBI data from remote VLBI sites to the USNO correlator. The new SW Correlator and VLBI infrastructure upgrades are necessary in order to support daily updates of EOP data required by GPS III; (4) Development of an automated end-to-end EOP processing system, which combines input from multiple data sets (e.g. VLBI data, GPS orbit data, and laser ranging data, etc.). Automation is necessary to meet future DoD and GPS requirements; (5) Modifications to the EOP system for compatibility with the new international standard. PTA research and development for astrometry focuses on 1) 1.8 meter telescope deployment 2) research into the development of a GPS-denied reference frame as a navigation solution 3) visible and infrared (IR) instrumentation development. These activities are necessary for producing CRF products in an era of new surveillance, targeting, intelligence, and reconnaissance technologies and instrumentation.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Precise Timing and Astronomy	4.381	2.467	2.466	0.000	2.466
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Research and development of improvements for the Master Clock (MC) System, the DoD Time Transfer capability, the Earth Orientation System, and the Astrometric Observation System. ***FY 2020 Plans:*** *Next Generation transceiver (modem) transition to operations *Further develop Two Way Satellite time transfer (TWSTT) enhancements *Further develop Optical time transfer: Fiber and Free Space Optical time transfer capability development *Initiate study for 1.8m robotic adaptive optics system *Optical Clock development: Assess calcium thermal-beam Clock stability, develop spectroscopy on laser-cooled beam *Transition Earth Orientation Parameters (EOP) automation products to operations (Final Operating Capability - FOC) *Transition GPS-denied reference frame data pipeline to operations*Further develop Solar Lunar Almanac Core (SLAC) Shapiro illuminance model study/upgrade ***FY 2021 Base Plans:*** *Critical Design Review (CDR) for transceiver for next generation time transfer *Two Way Satellite Time Transfer (TWSTT) enhancements *Optical Time Transfer: Fiber and Free Space optical time transfer capability development *Optical Clock Development: Assess calcium thermal-beam clock stability, develop spectroscopy on laser-cooled beam *Transition Earth Orientation Parameters(EOP)automation products to operations (Final Operating Capability - FOC) *Transition GPS-denied reference frame data pipeline to operations (Final Operating Capability - FOC) *Continue Solar Lunar Almanac Core (SLAC) Shapiro illuminance model study/upgrade *Begin development of the 1.8m robotic adaptive optics system ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 decrease of $0.001 million is due to planned transition to Full Operating Capability (FOC) and equipment for both the Two Way Satellite Time Transfer (TWSTT) enhancements and the development of Fiber and Free Space optical time transfer capability.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The FY 2021 funding request was reduced by $0.777 million to account for the availability of prior year execution balances.					
Accomplishments/Planned Programs Subtotals	4.381	2.467	2.466	0.000	2.466

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The included technology developments are primarily in-house with selected contractor participation.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development (NPOI) 1.8m Telescope Project (1)	SS/FFP	Lowell Observatory : Flagstaff, AZ	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Primary Hardware Development (NPOI) 1.8m Telescope (2)	SS/FFP	AZ Embeded System : Not Specified	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
Ancillary Hardware Development 1	Various	U.S. Naval Observatory : Washington, DC	0.173	0.060	Dec 2018	0.058	Dec 2019	0.017	Dec 2020	-		0.017	0.000	0.308	-
Ancillary Hardware Development 2	Various	U.S. Naval Observatory : Washington, DC	0.172	0.060	Jan 2019	0.058	Jan 2020	0.058	Jan 2021	-		0.058	0.000	0.348	-
Ancillary Hardware Development 3	Various	U.S. Naval Observatory : Washington, DC	0.210	0.060	Apr 2019	0.058	Apr 2020	0.058	Apr 2021	-		0.058	0.000	0.386	-
Ancillary Hardware Development 4	Various	U.S. Naval Observatory : Washington, DC	0.115	0.060	Jul 2019	0.058	Jul 2020	0.098	Apr 2021	-		0.098	0.000	0.331	-
Primary Hardware Development for CTD (System Integration)	C/FP	Classified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Primary Hardware Development for CTD (RF Interface)	MIPR	Classified : Not Specified	5.640	0.000		0.000		0.000		-		0.000	0.000	5.640	-
Primary Hardware Development for CTD (Line Interface)	MIPR	Classified : Not Specified	3.049	0.000		0.000		0.000		-		0.000	0.000	3.049	-
Primary Hardware Development for CTD (Reference Upgrade)	C/FFP	Symmetricom : San Jose, CA	0.550	0.000		0.000		0.000		-		0.000	0.000	0.550	-
Next Generation Secure Time Transfer	C/FFP	Classified : Not Specified	1.207	0.500	Mar 2019	0.157	Mar 2020	0.155	Mar 2021	-		0.155	0.565	2.584	-
1.8 meter infrared camera development	C/FFP	Classified : Not Specified	0.000	0.931	Jan 2019	0.288	Jan 2020	0.540	Jan 2021	-		0.540	4.249	6.008	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development (Site Prep)	SS/FFP	NASA/GSFC : HI	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	-
Primary Hardware Development (Antenna Receiver Electronics)	C/FFP	NASA : GSFC	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	-
1.8 meter Telescope Enclosure	C/FFP	NAVFAC SW : Not Specified	2.153	0.000		0.000		0.000		-		0.000	0.000	2.153	-
Advanced Time and Frequency Tranfer Upgrade	C/FFP	Classified : Not Specified	0.000	0.500	Jul 2019	0.150	Jul 2020	0.150	Mar 2021	-		0.150	0.600	1.400	-
Optical Lattice Clocks	C/FFP	Classified : Not Specified	0.000	0.500	Jul 2019	0.150	Jul 2020	0.150	Mar 2021	-		0.150	0.600	1.400	-
		Subtotal	15.069	2.671		0.977		1.226		-		1.226	6.014	25.957	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support (All PTA - Labor) 1	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.528	0.115	Dec 2018	0.100	Dec 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 2	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.528	0.115	Mar 2019	0.100	Mar 2020	0.100	Mar 2021	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 3	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.528	0.115	Jun 2019	0.100	Jun 2020	0.100	Mar 2021	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 4	Allot	U.S. Naval Observatory (Civilian	0.528	0.115	Jul 2019	0.100	Jul 2020	0.100	Mar 2021	-		0.100	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Labor) : Washington, DC													
Software Development (EOP Automation)	C/FFP	U.S. Naval Observatory (Civilian Labor) : Washington, DC	1.436	0.362	Jun 2019	0.250	Jun 2020	0.000		-		0.000	0.000	2.048	-
Travel 1	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.043	0.000		0.000		0.000		-		0.000	0.000	0.043	-
Travel 2	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.043	0.000		0.000		0.000		-		0.000	0.000	0.043	-
Travel 3	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.044	0.000		0.000		0.000		-		0.000	0.000	0.044	-
Travel 4	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.044	0.000		0.000		0.000		-		0.000	0.000	0.044	-
VLBI2010 Testing and Integration	MIPR	NASA : GSFC	0.905	0.000		0.000		0.000		-		0.000	0.000	0.905	-
Software Development (SW Correlator GUI)	C/FFP	U.S. Naval Observatory : Washington, DC	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Astrometric Development	C/FFP	U.S. Naval Observatory : Washington, DC	0.487	0.261	Mar 2019	0.280	Mar 2020	0.280	Jan 2021	-		0.280	0.000	1.308	-
EOP Optimal Estimation	C/FFP	NASA : GSFC	0.000	0.125	Feb 2019	0.165	Feb 2020	0.125	Feb 2021	-		0.125	0.500	0.915	-
Foreign GNSS	C/FFP	Classified : Not Specified	0.000	0.125	Feb 2019	0.165	Feb 2020	0.125	Feb 2021	-		0.125	0.500	0.915	-
SLAC Software Upgrade	C/FFP	Classified : Not Specified	0.000	0.377	Mar 2019	0.230	Mar 2020	0.230	Jan 2021	-		0.230	0.690	1.527	-
Primary Hardware Development (NPOI) 1.8m Telescope Project (2)	SS/FFP	NASA : Varies	0.342	0.000		0.000		0.080	Mar 2021	-		0.080	0.000	0.422	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2344 / *Precise Time and Astrometry*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	5.456	1.710		1.490		1.240		-		1.240	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	20.525	4.381		2.467		2.466		-		2.466	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Precise Timing and Astronomy (PTA)				
Master Clock System: Rb Full Operational Capability (FOC) - AMC	3	2019	1	2020
Master Clock System: Optical Fiber Time (OFT) Transmission	3	2019	4	2025
Master Clock System: Fiber Time Transmission (FTT) in Baltimore/DC Area	2	2019	4	2025
Master Clock System: Fiber Time Transmission - Urban Demo	4	2019	4	2025
Master Clock System: Master Clock System; Optical Clock Development	1	2019	4	2024
GPS M-Code Receiver: GPS Denied Navigation Pipeline	1	2019	2	2021
GPS M-Code Receiver: M-Code IOC at USNO	2	2019	4	2022
GPS M-Code Receiver: M-Code FOC at USNO	1	2023	4	2024
GPS M-Code Receiver: Schedule Detail	1	2019	1	2025
USNO: Transition Earth Orientation Parameters (EOP) Automation software to operations (FOC)	2	2019	2	2020
USNO: Next Generation Time Transfer Transceiver (modem) CDR, transition to operations	1	2019	3	2020
USNO: Solar Lunar Almanac Core (SLAC); Illuminance Model study/upgrade	1	2019	4	2025
1.8m Telescope Deployment: FAC-D Development for Telescope Enclosure	3	2019	4	2022
1.8m Telescope Deployment: Development of 1.8m Robotic Adaptive Optics System	1	2019	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2363: *Remote Sensing Capability Development*	1.886	0.312	0.327	0.328	-	0.328	0.328	0.000	0.000	0.000	0.000	3.181
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Remote Sensing Capability Development characterizes ocean environment using a variety of remote sensing techniques that provide that capability to discriminate atypical oceanographic phenomena from the natural environment that will greatly improve undersea dominance capabilities. The Naval Oceanographic Office will employ oceanographic data to refine and extend environmental characterization of the phenomena and disseminate data to the Fleet.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Remote Sensing Capability Dev.	0.312	0.327	0.328	0.000	0.328
Articles:	-	-	-	-	-
Description: Collect remote sensing and ground truth data in various weather and sea states to broaden the range of environmental conditions and reduce uncertainty in environmental prediction. Develop and enhance software algorithms to automatically detect oceanographic phenomena. Integrate algorithms for access over the network. Enhance existing toolsets to provide users robust applications to assist in their daily tasks. Develop training to provide the user community education on using the different tools and applications. (Details held at a higher classification) ***FY 2020 Plans:*** Invest in new technology that allows for an accelerated pace to detect oceanographic phenomena of ocean science transitions in the interest of national security for Task Force Ocean. ***FY 2021 Base Plans:*** Pursue technologies that continue an accelerated pace to detect oceanographic phenomena of ocean science transitions in the interest of national security for Task Force Ocean. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** There is no significant change between FY2020 and FY 2021					
Accomplishments/Planned Programs Subtotals	0.312	0.327	0.328	0.000	0.328

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Remote Sensing Capability Development is being managed as a PEO Project leveraging the Rapid Development and Deployment (RDD) construct for rigor and discipline.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
REMOTE SENSING CAPABILITY DEVELOPMENT DATA COLLECTION	Various	VARIOUS : VARIOUS	0.268	0.312	Jan 2019	0.327	Nov 2019	0.328	Nov 2020	-		0.328	5.176	6.411	-
		Subtotal	0.268	0.312		0.327		0.328		-		0.328	5.176	6.411	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Remote Sensing Capability Development Data Collection	WR	SSC Pacific : SAN DIEGO, CA	1.081	0.000		0.000		0.000		-		0.000	0.375	1.456	-
		Subtotal	1.081	0.000		0.000		0.000		-		0.000	0.375	1.456	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Remote Sensing Capability Development Data Collection	C/FP	BAH : VA	0.537	0.000		0.000		0.000		-		0.000	0.374	0.911	-
		Subtotal	0.537	0.000		0.000		0.000		-		0.000	0.374	0.911	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1.886	0.312		0.327		0.328		-		0.328	5.925	8.778	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Remote Sensing Capability Dev.				
Data Collection:: Schedule Detail	1	2019	2	2020
Algorithm Development:: Schedule Detail	1	2019	1	2021
System Integration:: Schedule Detail	3	2019	4	2019
Testing:: Schedule Detail	1	2020	4	2021
System Engineering:: Schedule Detail	1	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3207: *Fleet Synthetic Training*	2.642	0.256	0.283	0.305	-	0.305	0.326	0.332	0.339	0.346	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Fleet Synthetic Training (FST) provides Naval Forces with an enhanced in-port training capability. Integrating embedded shipboard training devices, aircraft, and submarine simulators into an interoperable network with joint, coalition, and interagency partners will provide more effective training for our deploying naval forces.

A key factor in achieving this new way of training our Naval Forces is to ensure that the required training is based on realistic characterizations of the physical environment. This project develops and delivers software that characterizes the ocean and atmospheric environments; adjusts to meet fleet-required training scenarios; allows synthetic training to be conducted in areas of planned and contingency operations and provides sufficient detail to simulate the real-world conditions of the physical environment in those areas of interest.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Fleet Synthetic Training	0.256	0.283	0.305	0.000	0.305
Articles:	-	-	-	-	-

Description: Ballistic Missile Defense (BMD) Fleet Synthetic Training (FST) at sea effort will provide the capability to conduct integrated Live, Virtual, and Constructive (LVC) single or multi-ship exercises with ships at sea using the Navy Continuous Training Environment (NCTE). This capability will support BMD mission area Fleet training and mission rehearsal in theater, allow ships to participate in Combatant Command (CCMD) mandated BMD exercises while pier-side or underway, as well as enhance BMD training objective accomplishment in current Optimized Fleet Response Plan (O-FRP) underway training events such as Composite Training Unit Exercises (COMPTUEX) and Joint Task Force Exercises (JTFEX). The NCTE and FST directly support Fleet training readiness, strike group and BMD platform deployment certifications.

FY 2020 Plans:
*Complete on-demand cloud hosting to dynamically scale to workloads, thus making it more efficient, able to scale up for large jobs, and ultimately saving future operating costs
*Further develop SensorSim to provide increased simulated sensor effects as an external service to provide standard and consistent sensor effect modeling across the Navy Continuous Training Environment (NCTE) and offer ease of extension and modification

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
*Research a Search and Rescue (SAR) capability to provide the necessary environmental data in an executable format with existing capabilities or as an interactive tool to allow an end-user to provide inputs such as the location of the incident and entity in the water, then model the drift path of the object or person *Implement and execute a service around Advanced Propagation Model utilized by any simulation in the NCTE *Develop Fleet Synthetic Training (FST)/Live, Virtual, and Constructive (LVC) providing integrated LVC single or multi-ship exercises in support of Ballistic Missile Defense (BMD) ***FY 2021 Base Plans:*** *Further develop SensorSim to provide increased simulated sensor effects as an external service to provide standard and consistent sensor effect modeling across the NCTE and offer ease of extension and modification *Implement a SAR capability to provide the necessary environmental data in an executable format with existing capabilities or as an interactive tool to allow an end-user to provide inputs such as the location of the incident and entity in the water, then model the drift path of the object or person *Advance the capabilities of a service around Advanced Propagation Model utilized by any simulation in the NCTE *Implement FST/LVC capabilities providing integrated LVC single or multi-ship exercises in support of BMD. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase between FY20 and FY21 of $0.022 million due to requirements for advanced technology development to support SensorSim and Advanced Propagation Modeling providing environmental data for integrated single or multi-platform exercises.					
Accomplishments/Planned Programs Subtotals	0.256	0.283	0.305	0.000	0.305

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The included technology developments are primarily in-house with contractor participation through existing vehicles.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	C/FFP	AER : VA	0.641	0.000		0.106	Jan 2020	0.115	Jan 2021	-		0.115	Continuing	Continuing	Continuing
Software Development	C/FFP	AER : VA	0.243	0.000		0.053	Jan 2020	0.061	Jan 2021	-		0.061	Continuing	Continuing	Continuing
Configuration Management	C/FFP	AER : VA	0.408	0.000		0.043	Apr 2020	0.045	Jan 2021	-		0.045	0.000	0.496	-
Studies and Analysis	C/FFP	AER : VA	0.508	0.000		0.043	Jan 2020	0.045	Jan 2021	-		0.045	0.000	0.596	-
Award Fees	C/FFP	NAWC TSD (Orlando, FL) : FL	0.105	0.000		0.017	Jan 2020	0.018	Jan 2021	-		0.018	0.000	0.140	-
Technical Data	C/FFP	N/A : N/A	0.119	0.000		0.000		0.000		-		0.000	0.000	0.119	-
		Subtotal	2.024	0.000		0.262		0.284		-		0.284	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Operational Test & Evaluation	C/FFP	AER : VA	0.321	0.000		0.000		0.000		-		0.000	0.000	0.321	-
Development Test and Evaluation	C/FFP	AER : VA	0.297	0.256	Jan 2019	0.021	Jan 2020	0.021	Jan 2021	-		0.021	0.000	0.595	-
		Subtotal	0.618	0.256		0.021		0.021		-		0.021	0.000	0.916	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	2.642	0.256		0.283		0.305		-		0.305	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 3207																												
Fleet Synthetic Training: Database Development:																												
Fleet Synthetic Training: Architecture:																												
Fleet Synthetic Training: Performance Surface Improvements:																												
Fleet Synthetic Training: Development Work:																												
Fleet Synthetic Training: Studies:																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3207				
Fleet Synthetic Training: Database Development:	1	2020	4	2025
Fleet Synthetic Training: Architecture:	1	2020	4	2025
Fleet Synthetic Training: Performance Surface Improvements:	1	2020	4	2025
Fleet Synthetic Training: Development Work:	1	2020	4	2025
Fleet Synthetic Training: Studies:	1	2020	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3404: *Tactical Environmental Support*	0.315	2.496	2.619	2.641	-	2.641	2.671	2.683	2.737	2.792	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Tactical Environmental Support Project (3404) enables the future warfighter to leverage environmental data gathered, assimilated and predicted under Projects 2341 (METOC Collections) and 2342 (METOC processing) by incorporating them into warfighting technological, net-centric applications that shape the way in which commanders engage the enemy, take full advantage of environmental conditions (and their impacts on systems and sensors) and complete the mission in the most efficient manner feasible. These software decision support tools complement the capabilities found in the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) Program of Record, and provide platform, sensor, communications, and weapon systems performance assessments for littoral and deep-strike warfighters. The following warfighting disciplines benefit directly from these METOC Exploitation capabilities: (1) Undersea Warfare(USW), Anti-Submarine Warfare(ASW), Mine Warfare(MIW), Amphibious Warfare(AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare, (AAW), Strike Warfare(STW), Expeditionary Warfare(EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations(INT), Non-Combat Operations (NCO), Command, Control, Communication (CCC), and Naval Special Warfare(NSW).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Tactical Environmental Support	2.496	2.619	2.641	0.000	2.641
Articles:	-	-	-	-	-
Description: The Tactical Environmental Support Project (3404) enables the future warfighter to leverage environmental data gathered, assimilated and predicted under Projects 2341 (METOC Collections) and 2342 (METOC processing) by incorporating them into warfighting technological, net-centric applications that shape the way in which commanders engage the enemy, take full advantage of environmental conditions (and their impacts on systems and sensors) and complete the mission in the most efficient manner feasible. These software decision support tools complement the capabilities found in the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) POR, and provide platform, sensor, communications, and weapon systems performance assessments for littoral and deep-strike warfighters. The following warfighting disciplines benefit directly from these METOC Exploitation capabilities (1) Undersea Warfare (USW), Anti-Submarine Warfare (ASW), Mine Warfare (MIW), Amphibious Warfare (AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare, (AAW), Strike Warfare (STW), Expeditionary Warfare (EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations (INT), Non-Combat Operations				

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(NCO), Command, Control, Communication (CCC), and Naval Special Warfare (NSW). Accomplishments and plans described below are examples for each effort category. ***FY 2020 Plans:*** In FY 2020 Tactical Environment Support will focus on the Improving the Builder software to include Bragg Line analysis, upgrades to the Ionospheric model and upgrades to output metadata. Leverage lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary layer turbulence observation, data-basing and modeling, as they pertain to Navy tactical problems. Enhancements to newly fielded RF and EO capability that incorporates Fleet user feedback and tactical lessons learned. Explore synergies with other DoD ocean observation system initiatives in order to rapidly advance and scale-up Navy ocean observation systems, data exfiltration, data assimilation and forward modeling capabilities. Fully explore artificial intelligence (AI) and machine learning aspects of EPMA, to include optimization within private cloud and "big data analytics" architectures. Incorporate "mirrored" test and evaluation computational environments when fielding new EPMA capabilities. Develop technologies that will improve NAVAIR's ability to quickly integrate newly developed NRLAAP capabilities. Explore options in terms of long-term, state-of-the-art maintenance of and improvements to PE and ASW modeling. Explore means of integrating STAPLE with newly developed cloud-based OAML software distribution capability. Make additional modifications to TrueView/Builder in order to meet new Fleet operational and Cyber requirements in an agile manner. Leverage lessons learned from remote sensing data algorithms for use in SmallSats and other newly emerging remote sensing technologies. Develop and transition 4D performance surfaces and optimized suite of analyses and forecasts to identify hazardous weather and EM propagation forecasts along Triton UAS flight paths. Sensible weather variables that affect Triton and will be developed include cloud-free line-of-sight, improved turbulence probability, convection and lightning hazard probability, improved flight level winds, and cross-winds at the air base for both takeoff					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and landing. Algorithms for more physically-based turbulence diagnosis will be developed, along with improve cloud microphysics capable of representing convection and lightning hazards. EM propagation routines will be developed to forecast probability of red detection areas (Priority T-1a, E-1c, and RTP Topic 5). Routines to forecast cloud-free line-of-sight will be developed to forecast EO/IR sensor effectiveness. Integrate Oceanographic and Atmospheric Model Library (OAML) model and database updates into the Scalable Tactical Acoustic Propagation Loss Engine (STAPLE) baseline. Work with the Sensor Optimization Working Group (SOWG) on suitability of OAML updates for Fleet implementation. Provide STAPLE update coordination. Maintain STAPLE configuration management and documentation Incorporate the latest in 6.1/6.2 research into the Navy's operational low-frequency passive acoustic models, Navy Standard Parabolic Equation (NSPE) and Uncertainty Band (uBand). Upgrades to NSPE include ice-covered sea surface elastic effects and a new variable depth grid finite-difference algorithm. Upgrades to uBand include cumulative uncertainty effects, a new input front-end, and several new surface duct treatment algorithms. Modifications to ray path calculations of GRAB-3D for vertical wall scenarios; convert the existing mathematical model to the proposed numerical model accounting for source bearing launch versus target bearing receiving angles; compute the acoustic pressure on a wave at the current source bearing launch angles with Caustic correction; refine/validate CASS-3D with MODSS SDSNE dataset (obtained in Phase I Base); convert validated FORTRAN model to C++ and multi-thread. 6) Develop and document an OAML Submission Plan (OSP), file an ECP, and submit CASS-3D to OAML to begin the approval process Develop techniques to conduct near real-time RF channel estimation using distributed EW/IO receivers in combination with Blue Force emitters of opportunity, and an efficient operator interface and display for interpreting the complex and rapidly changing urface EW environment. PCAP will develop a system that combines previously-developed elements, namely Refractivty Data Fusion (RDF) and Refractivity from Radio (RFR), and makes the information available to an operator in real-time. Implement Variable Resolution (VR) BAGs into its survey and production workflow, which will require the development of tools for the exploitation of this new structure. The goal of this effort will be to provide this capability and toolset to NAVOCEANO. The Naval Research Laboratory's (NRL) effort will include					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
the determination of the best approach for design/development of the tools, develop the tools, coordinate appropriate demonstrations to all required parties, and to provide software documentation to the customer. Improve the accuracy of Tactical Decision Aide (TDA) acoustic performance calculations in support of surface ship operations by reconciling Fleet sonar data with the OAML models and databases. Conversely, the Fleet data will be used to validate and upgrade the OAML models and databases. The objective of the effort is to improve the predicted performance of tactical weapon systems by measuring key environmental parameters in the battle space with tactical sensors. This is to be accomplished through the development, demonstration, and transition of new Through-the-Sensor data collection, extraction, processing, and dissemination techniques. System specifications to extract environmental data from tactical warfare sensors for use in on-scene decision aids will be developed. Sensors will include acoustic, oceanographic, and atmospheric environmental sensors. Data transformation goals include environmental data acquisition using advanced data processing techniques and rapid information dissemination capabilities. Data dissemination goals include integrating and exposing sensor data across Navy enclaves. Improve accuracy and efficacy of clutter extraction algorithms and processes utilized in the creation of Clutter databases for NAVO. Process currently utilizes AN/SQQ-89(A) recorded data. This task would also explore feasibility of future real time clutter extraction. Geospatially derived acoustic ground analysis has been shown to yield high correlation with acoustic signal excess range predictions generated from physics-based Transmission-Loss (TL) models. We propose to provide a high-performance tool implementing a promising method by which the integration of empirical geospatial acoustic high/low ground analysis may be used to optimized traditional physics-based sensor performance predictions. These optimizations range from narrowing choices on frequency performance, sensor performance, and range within which TL is computed. The goal of this proposed effort is to improve the accuracy and expand the capabilities of models, algorithms and databases that characterize atmospheric impacts on electromagnetic and electro-optical (EM/EO) sensors, weapons, EW/ES and communications systems. Ultimately, this effort will directly help in providing U.S. warfighters with enhanced battlespace awareness to optimize Electromagnetic Maneuver Warfare (EMW) decision making and planning for the current or predicted environmental conditions. These NPS-developed models, algorithms and databases (including NAVSLaM, EDC, UADC, VRPBA, RSMA-ED, Upper-Air Cn2					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
models, Cn2 climatology and others) will be submitted to the CNMOC Oceanic and Atmospheric Master Library (OAML) in order to make fully tested, validated, documented and accredited products available "off the shelf" to U.S. DoD researchers and developers of EM/EO prediction TDAs and systems when and as needed. These NPS products are also disseminated to a multitude of U.S. DoD agencies and researchers prior to submission to OAML for research, development, testing and evaluation purposes. Optimize placement of unmanned oceanographic sensors for assimilation into numerical forecasts using technologies such as Guidence for Heterogeneous Observing SysTems (GHOST) developed and maintained by NRL 7300. Optimally integrate the sensor/vehicle allocation, model performance optimization, situational awareness and overall mission planning tasks into capabilities that can be transitioned to the Glider Operations center at NAVOCEANO for use with GHOST guidance. In addition, couple functionality with TOPSIDE software such that the tactical analyst can receive authoritative environmental information to inform operational decisions and to visualize mission definition input as well as platform instruction output from GHOST. Work towards transitioning a new probabilistic aerosol forecasting system, ensemble Navy Aerosol Analysis Prediction System (ENAAPS), to operations. ENAAPS was previously ported to the Navy DoD Supercomputing Resource Center (DSRC) computers and developed as a near-real-time (NRT) system run using Cylc with evaluation of the ensemble mean forecast. In the proposed work, new metrics will be developed for evaluating ensemble spread and used to evaluate the NRT 5 day forecasts, bias correction code for post-processing of the ensemble mean forecast will be added to the NRT system, and new probabilistic aerosol products will be developed. ***FY 2021 Base Plans:*** Tactical Environment Support will focus on the Improving the Builder software to include Bragg Line analysis, upgrades to the Ionospheric model and upgrades to output metadata. Leverage lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary layer turbulence observation, data-basing and modeling, as they pertain to Navy tactical problems. Enhancements to newly fielded RF and EO capability that incorporates Fleet user feedback and tactical lessons learned. Explore synergies with other DoD ocean observation system initiatives in order to rapidly advance and scale-up Navy ocean observation systems, data exfiltration, data assimilation and forward modeling capabilities. Fully explore artificial intelligence (AI) and machine learning aspects of EPMA, to include optimization within private cloud and "big data analytics" architectures. Incorporate "mirrored" test and evaluation computational environments when fielding new EPMA capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Develop technologies that will improve NAVAIR's ability to quickly integrate newly developed NRLAAP capabilities. Explore options in terms of long-term, state-of-the-art maintenance of and improvements to PE and ASW modeling. Explore means of integrating STAPLE with newly developed cloud-based OAML software distribution capability. Make additional modifications to TrueView/Builder in order to meet new Fleet operational and Cyber requirements in an agile manner. Leverage lessons learned from remote sensing data algorithms for use in SmallSats and other newly emerging remote sensing technologies. Develop and transition 4D performance surfaces and optimized suite of analyses and forecasts to identify hazardous weather and EM propagation forecasts along Triton UAS flight paths. Sensible weather variables that affect Triton and will be developed include cloud-free line-of-sight, improved turbulence probability, convection and lightning hazard probability, improved flight level winds, and cross-winds at the air base for both takeoff and landing Initiate: Improve oceanographic predictions by developing a system that automates the control of cooperative teams of unmanned maritime vehicles (UxVs). Continue: Explore options in terms of long-term, state-of-the-art maintenance of and improvements to PE and ASW modeling. Continue: Leverage lessons learned from remote sensing data algorithms for use in SmallSats and other newly emerging remote sensing technologies. Continue: Leverage lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary laryer turbulence observation, data-basing and modeling, as they pertains to Navy tactical problems. Continue: Explore synergies with other DoD ocean observation system initiatives in order to rapidly advance and scale-up Navy ocean observation systems, data exfiltration, data assimilation and forward modeling capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Complete: Fully explore artificial intelligence (AI) and machine learning aspects of EPMA, to include optimization within private cloud and "big data analytics" architectures. Incorporate "mirrored" test and evaluation computational environments when fielding new EPMA capabilities. Complete: Enhancements to newly fielded RF and EO capability that incorporates Fleet user feedback and tactical lessons learned. Complete: Develop technologies that will improve NAVAIR's ability to quickly integrate newly developed NRLAAP capabilities. Complete: Make additional modifications to TrueView/Builder in order to meet new Fleet operational and Cyber requirements in an agile manner. Complete: Explore means of integrating STAPLE with newly developed cloud-based OAML software distribution capability. Complete: Provide a new ashore (reach back) radar/radio frequency (RF) and electro-optical (EO) performance products system that is modular, extensible, and high fidelity environmental model-driven that can serve as a replacement for the current tactical decision aids (TDAs) for RF: AREPS (Advanced Refractive Effects Prediction System), and EO: TAWS ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** There is no significant change between FY 2020 and FY 2021					
Accomplishments/Planned Programs Subtotals	2.496	2.619	2.641	0.000	2.641

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Tactical Environmental Support Project to develop, demonstrate and validate products and decision aids to understand and predict the impact of the environment on military operations.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Tactical Environmental Support	WR	NRL : Washington, DC	0.133	2.184	Nov 2018	1.319	Nov 2019	0.800	Nov 2020	-		0.800	0.000	4.436	-
METOC Tactical Environmental Support	WR	NRL : Monterey, CD Stennis Space Center,MS	0.182	0.312	Nov 2018	1.300	Nov 2019	1.300	Nov 2020	-		1.300	Continuing	Continuing	Continuing
METOC Tactical Environmental Support-Staple Transitions	WR	NSWC Carderock : West Bethesda, MD	0.000	0.000		0.000		0.541	Nov 2020	-		0.541	2.500	3.041	-
METOC Tactical Environmental Support	C/FFP	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.075	0.075	-
		Subtotal	0.315	2.496		2.619		2.641		-		2.641	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.315	2.496		2.619		2.641		-		2.641	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3404				
Forward-based ocean and ocean acoustics modeling and data assimilation: STAPLE Transitions -- NSWCCD	1	2020	4	2024
Forward-based ocean and ocean acoustics modeling and data assimilation: TOPSIDE Acoustics Support / Sonar Performance Engine (SPE)/ RAM-Seahawk Upgrade 1.1 (was FY17-TES-09-N) -- OASIS, Inc.	1	2020	4	2021
Numerical prediction in support of atmospheric acoustics characterization: Atmospheric Acoustic Propagation (AAP) -- NRL-MRY	1	2020	4	2020
Numerical prediction in support of EM warfare and spectrum operations: RTP: Electromagnetic Spectrum Performance Products Ashore -- NRL-MRY / NRL-DC / SSC-PAC	1	2020	4	2024
Numerical prediction in support of EM warfare and spectrum operations: Improved Atmospheric Models for Electromagnetic Maneuver Warfare -- NPS	1	2020	4	2024
Numerical prediction in support of EM warfare and spectrum operations: Navy Electro-Optical Sensor Performance Prediction -- NRL-MRY	1	2020	4	2024
Numerical prediction in support of EM warfare and spectrum operations: NEOSPP and EMSPPA and SSCPAC Code 55280 TrueView team efforts -- SSC-PAC	1	2020	4	2024
Oceanographic and Ocean Acoustics Database Development: Environmental Post-Mission Analysis - TTS ocean and atmosphere data collection -- NRL-SSC	1	2020	4	2024
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Preparing Tactical Optical Ocean Products from Satellite Sensors -- NRL-SSC	1	2020	4	2024
Scalable, distributed and adaptive ocean data collections methodologies: CAST: Cooperative Autonomous Sensing Team -- APL-UW	1	2020	4	2022
Scalable, distributed and adaptive ocean data collections methodologies: Guidance for Heterogeneous Observation Systems (GHOST) -- NRL-SSC	1	2020	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3405: *Decision Support Products & Dissemination*	0.315	1.052	1.117	1.144	-	1.144	1.171	1.186	1.210	1.234	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Decision Support Products & Dissemination efforts enable the future warfighter to leverage environmental data gathered, assimilated, predicted and exploited by optimizing data formatting, compression, packaging, depiction, data-basing and transfer methodologies that permit the rapid dissemination of actionable battlespace environmental (METOC) information over tactical and reach-back networks. This project ensures warfighters, commanders and those who support them are fully synchronized in terms of environmental data products shared among a multitude of platforms, systems and common operating pictures (COPs). METOC information is highly dynamic. Just as time synchronization is essential to navigation principles, timely METOC knowledge and information are vital to battlespace environmental exploitation, placing the warfighter and support elements in spatial and temporal synchronization, and at a collective advantage, in terms of the current and predicted states of the ocean and atmosphere.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Decision Support Products and Dissemination	1.052	1.117	1.144	0.000	1.144
Articles:	-	-	-	-	-

Description: The Decision Support Products and Dissemination Project (3405) enables the future warfighter to leverage environmental data gathered, assimilated, predicted and exploited under Projects 2341 (METOC Collections), 2342 (METOC processing) and 3404 (METOC exploitation) by optimizing data formatting, compression, packaging, depiction, data-basing and transfer methodologies that permit the rapid dissemination of actionable battlespace environmental (METOC) information over tactical and reach-back networks. This project ensures warfighters, commanders and those who support them are fully synchronized in terms of environmental data products shared among a multitude of platforms, systems and common operating pictures (COPs). METOC information is highly dynamic. Just as time synchronization is essential to navigation principles, timely METOC knowledge and information synchronization is vital to battlespace environmental exploitation, placing the warfighter and all of those who support him on the "same sheet of music" and at a collective advantage, in terms of the current and predicted states of the ocean and atmosphere.

Accomplishments and plans described below are examples for each effort category.

FY 2020 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Evaluate global ocean analyses and forecasts from different national/international centers, with respect to both hydrographic and acoustic properties. Complete Develop ship routing and base preparedness algorithms so that they can be employed on the following systems the Automated Tropical Cyclone Forecast System (ATCF), the Joint METOC Viewer (JMV), and the Advanced Weather Interactive Processing System Version II (AWIPS II). Explore the use of oceanographic confidence estimates derived from model/data comparisons to improve Navy ocean and acoustic models and tactical decision aids. Initiate Leverage lessons learned from ocean analysis and forecast evaluations in order to improve databases, data assimilation techniques and ocean and acoustic models in a more synergistic way. Leverage lessons learned from A3PET to create a holistic approach to realtime ASW mission planning and retasking by exploring machine learning, highperformance computing, cloud computing and "big data analytics" aspects of the ASW mission planning and associated ocean environment problem. Develop a divisionwide system for verification and validation that includes access to statistics for model runs by authorized external users. By leveraging community based tools, we can build a unified verification framework which is consistent across the suite of models and also consistent with our operational partners. Such a framework would allow us to make use of more modern, feature based verification metrics that can assist with identification and diagnosis of specific sources of model error. In addition, this modern framework would allow NRL to better tailor our verification products to inform data assimilation and model development, as well as the needs of the end user. Finally, a consistent model verification framework would aid in collaboration with other U.S. partners (e.g. NCEP, JEDI) who are employing the same community tools. The goal of this project is to create a framework and supporting technologies that will enable sharing and coordination of METOC data across multiple providers, enclaves, and domains. This includes creating a realtime master index of all model output products across multiple providers and domains, a grid generalization system that is able to pull and transform gridded model outputs from multiple sources, and a modular dissemination system that will support a wide variety of METOC data consumers. Each of these components can exist and operate at multiple nodes across agencies and network domains. extend the Adaptive Air ASW Planning and Evaluation Tool (A3PET) realtime ASW missionplanning tool to incorporate critical capabilities request by Fleet Users. This effort will develop additional capability to the existing tool, including modeling of					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Active Sonobuoys, modeling buoy drift and buoy deployment latency, as well as adding in overlay import/export functionality for more efficient MPRA mission planning. This effort extends the A3PET MPRA mission planning tool capability delivered in FY18.migrate the OAML library, administrative, and management functions to a cloud based approach. This will provide more efficient maintenance and distribution of the databases, algorithms and models. It will also provide better compatibility with future programs.Implement wind probabilities for Southern Hemisphere, SMOS winds and fixes, RI aid upgrades or consensus upgraded into ATCF; Evaluation of FNMOC version of WAVEWATCH ensemble based on JTWC forecasts.Apply and develop machine learning methods to modeling efforts to help identify model environments and scenarios that help validate the model against measured acoustics and/or reconstruct active acoustic events.					
FY 2021 Base Plans: Initiate: Develop a unified framework for verification of prediction models across atmosphere, ocean, ice, and space at all spatial and temporal scales, including partnering with other domestic forecast centers to leverage tool suites and infrastructure. Initiate: Deliver capability to access all geospatial information contained within regularly spaced, or Variable Resolution (VR) data files within common GIS software. Initiate: Develops a framework and supporting technologies that will enable sharing and coordination of METOC data across multiple providers, enclaves, and domains. Continue: Evaluate global ocean analyses and forecasts from different national/international centers, with respect to both hydrographic and acoustic properties. Continue: Explore the use of oceanographic confidence estimates derived from model/data comparisons to improve Navy ocean and acoustic models and tactical decision aids. Continue: Leverage lessons learned from A3PET to create a holistic approach to real-time ASW mission planning and re- tasking by exploring machine learning, high-performance computing, cloud computing and "big data analytics" aspects of the ASW mission planning and associated ocean environment problem.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Complete: Leverage lessons learned from ocean analysis and forecast evaluations in order to improve databases, data assimilation techniques and ocean and acoustic models in a more synergistic way. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** There is no significant change from FY2020 to FY2021.					
Accomplishments/Planned Programs Subtotals	1.052	1.117	1.144	0.000	1.144

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Decision Support Products & Dissemination Project to develop, demonstrate and validate products and decision aids to provide environmentally based recommendations to commanders at the Strategic, Operational, and Tactical levels of military operations.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Tactical Environmental Support	WR	NRL : Washington DC	0.111	0.232	Nov 2018	0.500	Nov 2019	0.244	Nov 2020	-		0.244	0.000	1.087	-
METOC Tactical Environmental Support	WR	NRL : Monterey, CA; Dtennis Space Center, MS	0.100	0.100	Nov 2018	0.117	Nov 2019	0.600	Nov 2020	-		0.600	Continuing	Continuing	Continuing
METOC Tactical Environmental Support	C/FFP	Various : Various	0.104	0.720	Nov 2018	0.500	Nov 2019	0.300	Nov 2020	-		0.300	0.000	1.624	-
		Subtotal	0.315	1.052		1.117		1.144		-		1.144	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.315	1.052		1.117		1.144		-		1.144	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

2021PB - 0603207N - 3405

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

2021PB - 0603207N - 3405

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Decisions and Dissemination - assessments				
Numerical predictions skill assessments: Global Ocean Multi-Model Comparison -- NRL-SSC	1	2020	4	2024
Numerical predictions skill assessments: Ocean model performance indicators for operational Navy ocean and acoustic model assessment -- NRL-SSC	1	2020	4	2022
METOC Decisions and Dissemination - targeted and tactical scales				
Forward-based ocean and ocean acoustics modeling and data assimilation: Adaptive Air ASW Planning and Evaluation Tool	1	2020	4	2024
Forward-based ocean and ocean acoustics modeling and data assimilation: Numerical prediction in support of Navy Resource protection: ship routing and base preparedness algorithms	1	2020	4	2024
Numerical prediction in support of EM warfare and spectrum operations: Environmental Performance Surfaces for OTH Radars and HF Communications (AKA, Pearman OTH RADAR Exploitation) -- NRL-SSC	1	2020	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Long duration autonomous hydrographic survey ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Conduct advanced technology development research in Long Duration autonomous hydrographic surveys.	0.000	8.000
Congressional Adds Subtotals	0.000	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 9999 / *Congressional Adds*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Long duration autonomous hydrographic survey	TBD	TBD : TBD	0.000	0.000		8.000	Jun 2020	0.000		-		0.000	0.000	8.000	-
		Subtotal	0.000	0.000		8.000		0.000		-		0.000	0.000	8.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		8.000		0.000		-		0.000	0.000	8.000	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 9999 / *Congressional Adds*

2021PB - 0603207N - 9999

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long duration autonomous hydrographic survey				
Milestone A : Long Duration Autonomous Survey TBD	1	2020	4	2020

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	193.796	7.618	11.919	13.428	-	13.428	13.018	13.278	12.737	12.865	Continuing	Continuing
0584: *Acft Protective Clothing*	104.190	4.543	4.117	6.207	-	6.207	5.922	5.730	5.612	5.597	Continuing	Continuing
0591: *Acft Survivability, Vulnerability & Safety*	47.944	1.456	1.458	1.462	-	1.462	1.501	1.534	1.568	1.599	Continuing	Continuing
0592: *Acft & Ordnance Safety*	37.444	1.043	5.746	5.158	-	5.158	4.980	5.387	4.917	5.016	Continuing	Continuing
1819: *CV Acft Fire Suppress System*	4.218	0.576	0.598	0.601	-	0.601	0.615	0.627	0.640	0.653	Continuing	Continuing

A. Mission Description and Budget Item Justification

Aviation Survivability addresses the issues of aircrew and platform survivability, focusing on enhancing overall opportunity for aircrew and platform protection and enhanced performance. The capabilities addressed under this program element counter emerging threats of next generation operational weapons systems and enhance combat effectiveness in future operational mission scenarios.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.050	11.919	11.502	-	11.502
Current President's Budget	7.618	11.919	13.428	-	13.428
Total Adjustments	0.568	0.000	1.926	-	1.926
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.700	0.000			
• SBIR/STTR Transfer	-0.132	0.000			
• Program Adjustments	0.000	0.000	1.903	-	1.903
• Rate/Misc Adjustments	0.000	0.000	0.023	-	0.023

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*

Change Summary Explanation

FY 2021: Project Unit 0584: Funds increased due to technology maturation to transition smart/rapid solutions essential to understanding, isolating, and quantifying sources to Aircrew neck and back fatigue

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0584: *Acft Protective Clothing*	104.190	4.543	4.117	6.207	-	6.207	5.922	5.730	5.612	5.597	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 0584 develops, demonstrates, and validates technologies designed to enhance warfighter performance, protection, injury prevention, mission effectiveness, and survivability. The project addresses aircrew readiness; life support equipment; physiological episodes; hearing protection and communication intelligibility; advanced helmet vision systems; laser eye protection and supporting technologies; escape and crashworthy systems; active/passive restraint systems; survival and evasion; aircrew/injury modeling; crew centered cockpit design control stations and aircraft maintainer protection. Fully protected and mission ready Aircrew are a critical component of Ready Basic Aircraft. The goal is to ensure they are able to perform their mission effectively on time, safely, every time. Project 0584 responds to a number of operational requirements documents, including OR# 210-05-88 for Chemical and Biological protection, OR# 099-05-087 for Laser Eye Protection, Aircrew Laser Eye Protection (ALEP) joint operation requirements document JORD #513-88-99, and Capabilities Program Document (CPD) Night Vision Cueing and Display (NVCD).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Technology Crew Station	4.543	4.117	6.207	0.000	6.207
Articles:	-	-	-	-	-

FY 2020 Plans:

Continue the development and testing of the military utility of Magnetorheological (MR) based vibration damping systems. Testing will investigate the capability of MR based damping systems to withstand harsh environments found onboard air and ground military vehicles where excessive impacts and vibration is causing debilitating injuries. Prototype seating systems will be subjected to longer periods of exposure to extremely harsh conditions that are more representative of the expected field conditions.

Development of High Resolution Digital Night Vision Goggle will continue as a joint effort with the Army. Begin integration of digital night sensors into both goggle and helmet mounted displays formats. Begin human laboratory and field testing. Assess feasibility of increasing the field of view.

Advanced component development of a Physiological Monitor Warning System will continue. The objective is to mature the development of the system so it will automatically resolve physiological issues. Testing will be conducted to prove component and subsystem maturity.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue to development of a biofidelic model of the entire spinal column based on actual human data and responses to stressors ranging from fatigue to blunt force trauma to better predict and prevent incidents that increase the level of back pain and long term disabilities. Redesign head borne prototype systems to increase functionality while reducing/optimizing loading on the head and spine to reduce strain and possible injury. Continue anthropometric assessments of the head, neck, spine, and whole body to mature a digital human modeling capability for aircrew and cockpit integration. Research is ongoing to develop a simple monitor (a small dot) which is placed on the front surface of eyewear to indicate when the device has reached its maximum amount of solar radiation before eyewear protective coating degradation begins and eyes are exposed to damaging solar rays. The effort will now address whether there's an associated degradation in the impact protection of the polycarbonate protective eye wear as the solar exposure increases. Conduct environmental testing and stability over time of the dielectric protective coating.					
FY 2021 Base Plans: Continue to advance the development of the baseline Physiological Monitor Warning System. The objective is to mature the system by refining the algorithms, improving the technology gaps in the subsystems/sensor components and expanding the monitoring to other physiological episode contributors (e.g., hydration, cognitive state) from the baseline Physiological Monitor. Mature the system from warning to a system that can enact steps to mitigate. Conduct verification and validation testing to prove component and subsystem maturity. Integrate the biofidelic model of the spinal column based on actual human data and responses to stressors into the suite of tools used to design and develop head mounted systems (e.g., helmet mounted displays, helmets, visors, oxygen masks, etc.). Redesign head borne prototype systems to increase functionality while reducing/optimizing loading on the head, neck, and spine to reduce strain and possible injury. Begin definition, integration, and support of Incapacitation Prediction for Readiness in Expeditionary Domains - an Integrated Computational Tool (I-PREDICT). Initiate foundational discussions to shift from a mannequin to a cadaver-based paradigm to improve the design and development of advanced personal protective equipment (PPE) to address chronic and acute pain/injury. The ultimate goal is to predict and prevent incidents that increase the level of back pain and long-term disabilities. Begin new anthropometric technique to assess head, neck, spine vertebral alignment/position to mature a digital human modeling capability for the design of PPE and seating systems. Continue the development and testing of the vibration damping systems, which recently transitioned into the Gunners Seat (H-60 platform). Testing will investigate the capability of MR based damping systems to withstand					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
harsh environments found onboard air, ground, and surface ship military platforms where excessive impact and vibration is causing debilitating neck/spine injuries. Subject prototype-seating systems to longer periods of exposure to extremely harsh conditions that are more representative of the expected field conditions. Continue the development of High Resolution Digital Night Vision Goggle. Begin integration of digital night sensors and displays into both goggle and helmet mounted display formats to include the study of a new wide field of view (FOV) goggle (initially 68 deg. FOV). Study the effect of motion blur on resolution. Address windowing and increased frame rate to reduce/eliminate the negative effects of motion blur. Investigate the possibility of extending the wavelength band/sensitivity of the silicon wafer used in the digital sensor to include Short Wave InfraRed (SWIR) with Near InfraRed. Sensitivity in the SWIR region will improve resolution at extremely low light levels and in degraded visual environments. Address the ballistic test protocol for polycarbonate visors and goggles. Current accepted method has differences in test methodologies that have shown new assets failing upon receipt. Adjudicate the test protocol and investigate redesign of substrates as needed. Continue the development of the solar dots (indicates number of hours of solar exposure) to have either a series of dots or one dot that gradually degrades with exposure time to match the degradation profile seen in polycarbonate visors/goggles. Assess dielectric deposition uniformity and thickness with a goal of increasing optical density. Test environmental stability over time of the enhanced dielectric protective coating from the new on shore supplier. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase will support research and technology development to addresses Chief NAVAL Air Force (CNAF) priorities under "Tactical Performance/Safety/Retention trends". Physiological Monitor: Finish the development of a person mounted physiological monitor that detects human performance degradation. Complete device testing and verify data. Ensure the device provides warning to the aircrew in time to enable descent to safe altitude or recovery before the pilot is incapacitated. Includes continued technology maturation to optimize the anticipated baseline solution in order to address and correct sensing deficiencies (e.g., blood oxygen level, heart rate) to limit / significantly reduce false indications that unnecessarily abort missions. Leverage progress made in vibration damping system in new Gunners Seat and apply to other seating systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Back/Neck Injury Mitigation: Begin the integration of I-PREDICT modeling/design tool to address Musculoskeletal Mitigation Design Criteria to reduce chronic and acute Back and Neck injury. I-PREDICT focuses on head, neck and torso modeling based on data from cadaver/porcine testing.					
Accomplishments/Planned Programs Subtotals	4.543	4.117	6.207	0.000	6.207

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 4268: *Aviation Support Equipment*	37.874	55.915	64.364	-	64.364	71.971	91.325	92.941	89.728	Continuing	Continuing

Remarks

D. Acquisition Strategy

Primary Hardware Development for the Navy Advanced Technology Crew Station efforts will be performed under a Cost Plus Fixed Fee Indefinite Delivery Indefinite Quantity contract.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NAWCAD : Pax River MD	35.467	0.797	Dec 2018	0.663	Dec 2019	0.662	Oct 2020	-		0.662	Continuing	Continuing	Continuing
Primary Hardware Development	C/CPFF	Intevac : San Jose CA	5.607	1.575	Jun 2019	1.006	Jun 2020	1.250	Dec 2020	-		1.250	0.000	9.438	9.668
Primary Hardware Development	MIPR	US Army CERDEC : Ft. Belvoir VA	3.515	0.025	Jul 2019	0.050	Jun 2020	0.050	Dec 2020	-		0.050	0.000	3.640	3.640
Primary Hardware Development	C/CPFF	Innovital : Calverton MD	0.633	0.000	Dec 2018	0.150	Dec 2019	0.150	Dec 2020	-		0.150	0.000	0.933	0.933
Physiological Monitoring	C/CPFF	TBD : TBD	0.000	0.000		1.000	Mar 2020	1.230	Mar 2021	-		1.230	0.000	2.230	1.800
I-PREDICT	C/CPFF	TBD : TBD	0.000	0.000		0.000		1.000	Jun 2021	-		1.000	0.000	1.000	1.000
Laser Eye Protection	C/CPFF	TBD : TBD	0.000	0.000		0.000		0.350	Jun 2021	-		0.350	0.000	0.350	0.350
Prior Year Prod Dev no Longer Funded in Budget Year or Outyears	Various	Various : Various	23.380	0.000		0.000		0.000		-		0.000	0.000	23.380	23.380
Enhanced Visual	C/CPFF	SA Photonics, LLC : TBD	0.000	0.700	Sep 2019	0.000		0.000		-		0.000	0.000	0.700	0.700
		Subtotal	68.602	3.097		2.869		4.692		-		4.692	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Configuration Management	WR	NAWCAD : Pax River MD	3.337	0.504	Dec 2018	0.400	Dec 2019	0.420	Oct 2020	-		0.420	Continuing	Continuing	Continuing
Prior Year Support no Longer Funded in Budget Year or Outyears	Various	Various : Various	3.232	0.000		0.000		0.000		-		0.000	0.000	3.232	3.232
		Subtotal	6.569	0.504		0.400		0.420		-		0.420	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAWCAD : Pax River MD	5.836	0.703	Dec 2018	0.558	Dec 2019	0.705	Oct 2020	-		0.705	Continuing	Continuing	Continuing
Prior Year T&E no Longer Funded in Budget Year or Outyears	Various	Various : Various	18.240	0.000		0.000		0.000		-		0.000	0.000	18.240	18.240
		Subtotal	24.076	0.703		0.558		0.705		-		0.705	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NAWCAD : Pax River MD	4.437	0.224	Dec 2018	0.275	Dec 2019	0.375	Oct 2020	-		0.375	Continuing	Continuing	Continuing
Travel	PO	NAVAIR : Pax River MD	0.496	0.015	Oct 2018	0.015	Oct 2019	0.015	Oct 2020	-		0.015	Continuing	Continuing	Continuing
Prior Year Mgmt Svcs no Longer Funded in Budget Year or Outyears	Various	Various : Various	0.010	0.000		0.000		0.000		-		0.000	0.000	0.010	0.010
		Subtotal	4.943	0.239		0.290		0.390		-		0.390	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	104.190	4.543		4.117		6.207		-		6.207	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

Aircrew Protective Clothing & Devices Project 0584 Schedule

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0584 / *Acft Protective Clothing*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Acft Protective Clothing				
Advanced Integrated Life Support Systems: Contamination of OBOGS	1	2020	4	2021
Advanced Integrated Life Support Systems: Physiologic Monitoring	1	2019	4	2022
Advanced Integrated Life Support Systems: Digital Human Modeling	3	2019	3	2023
Advanced Integrated Life Support Systems: Dielectric Stack Technology	1	2019	4	2024
Advanced Integrated Life Support Systems: Dye Doped Substrates	1	2019	3	2023
Advanced Integrated Life Support Systems: Advanced Test Methodologies	2	2019	4	2022
Advanced Technology Crew Station: Digital Sensor Technologies	1	2019	2	2025
Advanced Technology Crew Station: Digital Display Technologies	1	2019	3	2024
Advanced Technology Crew Station: Ejection / Spine Pain Modeling	1	2019	3	2022
Advanced Technology Crew Station: Energy Absorbing Seats	1	2019	2	2022
Advanced Technology Crew Station: Night Lab Development	1	2019	4	2020
Advanced Technology Crew Station: Vision Standards	1	2019	1	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0591: *Acft Survivability, Vulnerability & Safety*	47.944	1.456	1.458	1.462	-	1.462	1.501	1.534	1.568	1.599	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Aircraft Survivability, Vulnerability and Safety. This project evaluates and develops prototype hardware and software solutions to improve the survivability of Navy and Marine Corps aircraft. This project addresses the likelihood of an aircraft being hit (susceptibility) and the probability of a kill if the aircraft is hit (vulnerability). Types of programs funded under this project include signature reduction efforts, subsystem and component hardening and development of Integrated Aviation Survivability Equipment (iASE) architectures for simulation and training systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Technology Requirements	0.030	0.040	0.045	0.000	0.045
Articles:	-	-	-	-	-
FY 2020 Plans: Planned trade studies include: threats assessments; vulnerability assessments of both rotary wing and fixed wing aircraft; efficacy of USN/USMC simulation training systems within the updated threat system and EW environment. ***FY 2021 Base Plans:*** Planned trade studies include: expansion of threats assessments to include new and/or evolved threats. Update modeling and simulation capabilities to better reflect the evolving threat environment. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Amount increased due to projected labor rate increase.					
Title: Technology Design & Development	1.426	1.218	1.317	0.000	1.317
Articles:	-	-	-	-	-
FY 2020 Plans: Conduct asymmetric threats modeling and analyses based on OASIS simulation study. Integrate iASE architecture within the USN/USMC simulation and training system environment. Advance model development					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
relating to Advanced Electronic Attack, Electro-Magnetic Maneuver Warfare, and spectrum dominance in support of air combat training and Live Virtual Constructive capabilities to improve aircraft survivability and lethality. Conduct combat situational awareness analyses to integrate existing federated capabilities. ***FY 2021 Base Plans:*** Conduct asymmetric threats modeling and analyses based on expansion of the OpNav Aircraft Survivability Integration Study (OASIS) project to include additional aircraft platforms. Continue integration efforts for the iASE architecture within the USN/USMC simulation and training system environment. Model results of combat situational awareness analyses to evaluate effectiveness of proposed solutions. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Airframe integration requirements increased due to application of previous study findings to additional aircraft platforms.					
Title: Technology Test & Evaluation	0.000	0.200	0.100	0.000	0.100
Articles:	-	-	-	-	-
FY 2020 Plans: Integration, laboratory, and flight testing of prototype hardware in support of the Integrated Aircraft Survivability Equipment architecture development and in support of countermeasures simulation hardware. Integrate and chamber test Live Virtual Constructive solutions. Begin testing combat situational awareness capability in a simulated environment. ***FY 2021 Base Plans:*** Continue prototype hardware testing in support of the iASE architecture development and in support of countermeasures simulation hardware. Continue testing combat situational awareness capability in a simulated environment. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Cost decreased as testing for proof-of-concept is finalized and results are evaluated for applicability to increased project scope.					
Accomplishments/Planned Programs Subtotals	1.456	1.458	1.462	0.000	1.462

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Primary Hardware Development will be performed under either a Cost Plus Fixed Fee or a Firm Fixed Price contract.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NAWCAD : Pax River, MD	13.130	0.256	Oct 2018	0.276	Oct 2019	0.255	Oct 2020	-		0.255	Continuing	Continuing	Continuing
Systems Engineering	WR	NAWCWD : China Lake, CA	0.353	0.089	Oct 2018	0.150	Oct 2019	0.087	Jan 2021	-		0.087	Continuing	Continuing	Continuing
Systems Engineering	MIPR	DTIC : Ft. Belvoir, VA	0.713	1.081	Jan 2019	0.692	Jan 2020	0.875	Nov 2020	-		0.875	0.000	3.361	3.361
System Engineering	C/CPFF	TEKLA : Dumfries, VA	0.000	0.000		0.100	Dec 2019	0.100	Apr 2021	-		0.100	0.000	0.200	0.200
Prior Year Prod Dev cost no longer funded in FYDP	Various	Various : Various	21.268	0.000		0.000		0.000		-		0.000	0.000	21.268	21.268
		Subtotal	35.464	1.426		1.218		1.317		-		1.317	Continuing	Continuing	N/A

Remarks

All prior year lines have been consolidated

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Year Support cost no longer funded in FYDP	Various	Various : Various	4.569	0.000		0.000		0.000		-		0.000	0.000	4.569	4.569
		Subtotal	4.569	0.000		0.000		0.000		-		0.000	0.000	4.569	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAWCAD : Patuxent River, MD	2.453	0.000		0.100	Oct 2019	0.050	Apr 2021	-		0.050	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NAWCWD : China Lake, CA	0.000	0.000		0.000		0.050	May 2021	-		0.050	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	C/CPFF	GTRI : Atlanta, GA	0.000	0.000		0.100	Jan 2020	0.000		-		0.000	0.000	0.100	0.100
Prior Year T&E cost no longer funded in FYDP	Various	Various : Various	2.995	0.000		0.000		0.000		-		0.000	0.000	2.995	2.995
		Subtotal	5.448	0.000		0.200		0.100		-		0.100	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NAWCAD : Pax River, MD	1.738	0.030	Oct 2018	0.040	Oct 2019	0.045	Oct 2020	-		0.045	Continuing	Continuing	Continuing
Prior Year Mgmt cost no longer funded in FYDP	Various	Various : Various	0.725	0.000		0.000		0.000		-		0.000	0.000	0.725	0.725
		Subtotal	2.463	0.030		0.040		0.045		-		0.045	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	47.944	1.456		1.458		1.462		-		1.462	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

Aircraft Survivability, Vulnerability and Safety– Project 0591 Schedule

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0591 / *Acft Survivability, Vulnerability & Safety*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Acft Survivability, Vulnerability & Safety				
Technology Des/Development: Future Vertical Lift Trade-Offs	1	2019	4	2025
Technology Des/Development: Miniaturized Self Defense Missile System	1	2019	4	2025
Technology Des/Development: P-8 EW Enhancements	1	2019	4	2025
Technology Test & Evaluation: Test & Evaluation of Miniaturized Self Defense Missile System	1	2020	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0592: *Acft & Ordnance Safety*	37.444	1.043	5.746	5.158	-	5.158	4.980	5.387	4.917	5.016	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Aircraft and Ordnance Safety Program transitions innovative munitions safety technology to Navy and Marine Corps air weapons, to comply with the Chief of Naval Operations direction that all munitions carried aboard Navy ships be insensitive to unplanned stimuli (thermal, impact, and shock events). The Aircraft and Ordnance Safety Program also ensures the safety and protection of personnel, aircraft, ships, and operational facilities, through improved precision targeting, fail-safe ordnance, selective effects munitions and shock/blast force protection technologies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Insensitive Munitions (IM)	1.043	5.746	5.158	0.000	5.158
Articles:	-	-	-	-	-

FY 2020 Plans:

Air-to-Air Demonstration: IM improvement through the integration of solid fuel ramjet technology with traditional solid rocket motor. Continue Sidewinder rocket motor technology risk reduction evaluation in support of PMA-259 planned block III transition with highly-loaded-grain, high-performance motor, and radio frequency cook-off sensor.

Improved Air-Launched Weapons: An insensitive solid propellant tailored to Highly Loaded Grain (HLG) technology. Develop propellants that possess a high burning rate at 1500-2000PSI and high mechanical strain at cold temperatures (-650 C). Continued work with HLG in a 21" diameter motor. Continue Insensitive Munitions (IM) and performance evaluation of a cast/cure minimum smoke composite propellant that will meet -650 C requirement for fixed-wing platforms. Testing will be done in a Hellfire configuration to demonstrate transition ability to a system with equivalent requirements in support of PMA 242 tier III requirements. Continue evaluation of Highly-loaded-grain high performance rocket motor and application of Slow cook- off-sensor technology in Advanced Anti-Radiation Guided Missile (AARGM) configuration for transition to PMA-242 AARGM BLK II upgrade.

Advanced Containment/Case Warhead Materials: Continue working the Metal Matrix Composite case for continued improved IM responses. Distributed Fiber Optic sensing for In-Situ Propellant Health Monitoring (DFOS). DFOS to monitor the temperature and stress/strain within a solid rocket motor. Applied to full-scale HLG motor testing as a stress-strain field characterization to supplement analytical tools. Develop a 3-D model

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
to compare the FMU 139 D/B with previous fuzes which it is slated to replace. The integration of technology developed in the Joint Service Insensitive Munitions Technology Program program will aid in IM improvement in the fuze family. Demonstrate IM performance of the Joint Multiple Effects Warhead System in the new revised configuration for transition to PMA 280.					
FY 2021 Base Plans: Air-to-Air Demonstration: Improved liner system for use in bombs, specifically Mark 80 Series, which will optimize the minimum 8-minute protection during Fast Cook-off. Insensitive Munitions (IM) benefits of integrating Rocket Solid Fuel RamJet Technology with traditional solid rocket motor propellant in IM testing scenario including Fast Cook-off, bullet impact, fragment impact, and shape charge jet. Improved Air-Launched Weapons: Develop a Polymer-bonded Explosive 109 use loaded variant of IM vented Bomb Live Unit 117 for the Navy. Investigate the use of Precision-controlled Additive Manufactured fragments to improve IM response as well as increase lethality over multiple target sets. Perform initial testing to improve warhead initiation system to increase warhead performance. Advanced Containment/Case Warhead Materials: Continue working the Metal Matrix Composite case for continued improved IM responses. Integrate a remote RF sensor into an Evolved Seasparrow Missile, Block III type system capable of igniting the motor prior to cook-off upon generating a signal indicating thermal runaway is imminent. Shock/Blast Barrier Protection Modeling, Demo & Testing: High Impulse Booster - improving performance by supporting a more robust firetrain under hard impacts as it can transfer the shock over large distances that could be encountered due to explosive fill compression. Improve the reaction of the Block 2 RAM rocket motors to the Fast Cook-off and Slow Cook-off tests through the application of a mature Thermally Initiation Venting System technology. Determine the feasibility of shock sensitizing a large failure diameter Polymer-bonded Explosive fill. Single-use fragment projector for reduced cost and improved flexibility. Using Large Scale Gap Test to improve analysis of shock initiation of energetics using energy per unit area technique.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Decrease due to several projects ending in FY20, e.g., Minimum Signature IM Improved Propellant for Next Generation Air-to-Air Ground Weapon Systems, Energetic Materials Additive Manufacturing, and FMU-139 D/B 3-D Modeling.					
Accomplishments/Planned Programs Subtotals	1.043	5.746	5.158	0.000	5.158

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

All planned programs are accomplished via civilian labor and use of government testing facilities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NAWCWD : China Lake, CA	37.436	1.043	Oct 2018	5.746	Oct 2019	5.158	Oct 2020	-		5.158	Continuing	Continuing	Continuing
		Subtotal	37.436	1.043		5.746		5.158		-		5.158	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Year Mgmt no longer funded in FYDP	Various	Various : Various	0.008	0.000		0.000		0.000		-		0.000	0.000	0.008	0.008
		Subtotal	0.008	0.000		0.000		0.000		-		0.000	0.000	0.008	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	37.444	1.043		5.746		5.158		-		5.158	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Acft & Ordnance Safety				
Improved Air to Air Missile Demonstration Testing: Electromagnetic Compatibility (EMC) Motor Case Technology Evaluation	1	2019	3	2025
Improved Air to Air Missile Demonstration Testing: Sidewinder Rocket Motor insensitive munitions (IM) DEMO (1)	1	2019	2	2020
Improved Air to Air Missile Demonstration Testing: Sidewinder Rocket Motor IM DEMO (2)	1	2022	2	2023
Improved Air to Air Missile Demonstration Testing: Sidewinder IM Compatible Warhead DEMO (1)	1	2019	1	2020
Improved Air to Air Missile Demonstration Testing: Sidewinder IM Compatible Warhead DEMO (2)	1	2022	2	2023
Improved Air Launched Weapons: Composite case	1	2019	2	2021
Improved Air Launched Weapons: Bore Coating for Impact Mitigation of Large Motors	1	2019	3	2019
Improved Air Launched Weapons: General Purpose (GP) Bomb Technology Evaluation for Shape Charge Jet	1	2019	2	2020
Improved Air Launched Weapons: Azobis-Isobutyronitrile (AIBN) Evaluation IM PBXN112 and PBXC 139	1	2019	4	2020
Improved Air Launched Weapons: BLU-111 Explosive Fill Evaluation	2	2020	4	2023
Improved Air Launched Weapons: Advanced Anti-Radiation Guided missile (AARGM RM) IM Technology Risk Reduction	1	2019	4	2025
Improved Air Launched Weapons: AARGM RM IM Evaluation	1	2020	3	2023
Improved Air Launched Weapons: Fuze Munitions (FMU)-139 D/B Modeling	1	2020	4	2022
Improved Air Launched Weapons: Impulse Motor	1	2019	4	2023
Improved Air Launched Weapons: Long Range Anti-Ship Missile (LRASM)	1	2019	3	2024
Adv. Containment/Case/Warhead Materials: Composite Case Material DEMO	1	2019	3	2019

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 0592 / *Acft & Ordnance Safety*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Adv. Containment/Case/Warhead Materials: Slow Cook-off (SCO) Mitigation for Large DIA Rocket Motor	1	2019	4	2020
Adv. Containment/Case/Warhead Materials: Joint Multi-Effects Warhead System (JMEWS) Mitigation	1	2020	3	2021
Shock/Blast Barrier Protection Modeling and DEMO: IM Barriers	1	2019	4	2023
Shock/Blast Barrier Protection Modeling and DEMO: Supersonic Range Strike Missile Warhead	1	2019	4	2023
Shock/Blast Barrier Protection Modeling and DEMO: Warhead Initiation	1	2019	3	2023
Shock/Blast Barrier Protection Modeling and DEMO: Warhead Liner	1	2019	2	2023
Shock/Blast Barrier Protection Modeling and DEMO: Remote Sensing of SCO Events	1	2019	4	2025
Shock/Blast Barrier Protection Modeling and DEMO: Precision controlled additive manufacturing (PAM) Fragments	1	2019	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1819: *CV Acft Fire Suppress System*	4.218	0.576	0.598	0.601	-	0.601	0.615	0.627	0.640	0.653	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops improved fire-fighting systems and fire protective measures for aircraft-related fires on aircraft carriers, including assessment of fire properties, definition of fire threats, improvements to fire-fighting agents and delivery systems, fire detection and suppression system performance evaluations, and fire-fighter training improvements.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Fire-Fighting	0.576	0.598	0.601	0.000	0.601
Articles:	-	-	-	-	-

FY 2020 Plans:
Continue support for Naval Air Training and Operating Procedures Standardization improvements, and modeling and simulation for fire prediction. Continue monitoring aqueous film forming foam developments and other clean agents. Continue to monitor new equipment improvements for saws, spreaders, and other improvements to reduce or discontinue the use of Motor Gasoline on ships. Continue evaluations for flash-hood, crash-fire-rescue face shield and firefighter personnel floatation device improvements. Continue to monitor and recommend Electromagnetic Aircraft Launch Systems fire doctrine, Carrier Fixed Wing Aircraft Nuclear hangar bay conflagration management system operations, and unmanned carrier launched airborne surveillance and strike firefighting operations impacts. Continue project looking at firefighter issues related to composites, weapons and fuels and develop procedures to be used aboard ship to rapidly and safely extinguished deep seated smoldering fires with composite materials. Continue to evaluate training and certification requirements and equipment to bring the ship up to aviation boatswains mate capabilities and readiness for Air Capable Ships, ships that rely on the ships damage control team and limited resources. Continue improved weapons cooling scenario testing. Continue project looking at options for firefighter equipment storage on CVN's and LHA/D ships.

FY 2021 Base Plans:
Continue support for Naval Air Training and Operating Procedures Standardization improvements for aircraft fire prediction and protection. Continue monitoring aqueous film forming foam developments and other clean agents. Continue to monitor new equipment improvements for saws, spreaders, and other improvements to reduce or discontinue the use of Motor Gasoline on ships. Continue evaluations for flash-hood, crash-fire-rescue face shield and firefighter personnel floatation device improvements. Continue to monitor and

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
recommend Electromagnetic Aircraft Launch Systems fire doctrine, Carrier Fixed Wing Aircraft Nuclear hangar bay conflagration management system operations, and unmanned carrier launched airborne surveillance and strike firefighting operations impacts. Continue project looking at firefighter issues related to composites, weapons and fuels and develop procedures to be used aboard ship to rapidly and safely extinguished deep-seated smoldering fires with composite materials. Continue to evaluate training and certification requirements and equipment to bring the ship up to aviation boatswains mate capabilities and readiness for Air Capable Ships, ships that rely on the ships damage control team and limited resources to fight aircraft related fires. Continue improved weapons cooling scenario testing. Continue project looking at options for firefighter equipment storage on CVN's and LHA/D ships. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Amount increased due to projected NAWC labor rate increase.					
Accomplishments/Planned Programs Subtotals	0.576	0.598	0.601	0.000	0.601

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This is a non-ACAT program. Procurement strategy is determined by market survey and cooperative opportunities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NAWCWD : China Lake, CA	0.199	0.043	Oct 2018	0.062	Oct 2019	0.075	Oct 2020	-		0.075	Continuing	Continuing	Continuing
Prior Yr Prod Dev no longer funded in the FYDP	Various	Various : Various	0.335	0.000		0.000		0.000		-		0.000	0.000	0.335	0.335
		Subtotal	0.534	0.043		0.062		0.075		-		0.075	Continuing	Continuing	N/A

Remarks

All prior year lines have been consolidated.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support	C/CPFF	ICI : Virginia Beach, VA	0.105	0.000	Nov 2018	0.030	Nov 2019	0.000		-		0.000	0.000	0.135	0.135
Engineering Support	WR	NAWCWD : China Lake, CA	0.457	0.150	Oct 2018	0.176	Oct 2019	0.186	Oct 2020	-		0.186	Continuing	Continuing	Continuing
Engineering Support	C/CPFF	Hughes Associates : Baltimore, MD	0.097	0.035	Nov 2018	0.030	Nov 2019	0.010	Nov 2020	-		0.010	0.000	0.172	0.172
Engineering Support	C/CPFF	AVW : Chesapeake, VA	0.149	0.000		0.000		0.000		-		0.000	0.000	0.149	0.149
Engineering Support	WR	NRL : Washington, DC	0.019	0.010	May 2019	0.010	May 2020	0.010	May 2021	-		0.010	Continuing	Continuing	Continuing
		Subtotal	0.827	0.195		0.246		0.206		-		0.206	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technology Test & Evaluation	WR	NAWCWD : China Lake, CA	1.586	0.260	Oct 2018	0.180	Oct 2019	0.210	Oct 2020	-		0.210	Continuing	Continuing	Continuing
Technology Test & Evaluation	C/FFP	Hughes Associates : Baltimore, MD	0.578	0.030	Nov 2018	0.050	Nov 2019	0.060	Nov 2020	-		0.060	0.000	0.718	0.718

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior yr T&E no longer funded in the FYDP	Various	Various : Various	0.329	0.000		0.000		0.000		-		0.000	0.000	0.329	0.329
		Subtotal	2.493	0.290		0.230		0.270		-		0.270	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	WR	NAWCWD : China Lake, CA	0.364	0.048	Oct 2018	0.060	Oct 2019	0.050	Oct 2020	-		0.050	Continuing	Continuing	Continuing
		Subtotal	0.364	0.048		0.060		0.050		-		0.050	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	4.218	0.576		0.598		0.601		-		0.601	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*

Aircraft Fire Suppression Systems– Project 1819 Schedule

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603216N / *Aviation Survivability*	**Project (Number/Name)** 1819 / *CV Acft Fire Suppress System*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
CV Acft Fire Suppress System				
Product Development-Systems Engineering: Monitor Systems (Aqueous Film Forming Foam, Cleaning Agents, Electro Magnetic Aircraft Launch System (EMALS), etc.)	1	2019	4	2025
Product Development-Systems Engineering: MV-22 CO2 Engine Nacelle Firefighting Wand	1	2019	4	2020
Engineering Support: Firefighting NATOPS	1	2019	4	2025
Engineering Support: Air Capable Ship (ACS) Aviation Firefighting Readiness	1	2019	4	2025
Engineering Support: Carrier Aviation Nuclear (CVN) Firefighting Equipment Store	1	2019	1	2020
Test & Evaluation: Aircraft Rescue Systems	1	2019	4	2025
Test & Evaluation: Aircraft Firefighting Personal Protective Equipment (PPE)	1	2019	4	2022
Test & Evaluation: Firefighting Hazards (Composite)	1	2019	4	2025
Test & Evaluation: Weapons Cooling	1	2019	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	0.000	2.350	-	2.350	2.314	2.100	2.200	2.443	Continuing	Continuing
3444: *Airfield/Port Damage Repair*	0.000	0.000	0.000	2.350	-	2.350	2.314	2.100	2.200	2.443	Continuing	Continuing

Note

This PE is a new start

A. Mission Description and Budget Item Justification

Project 3444 directly supports resilient and agile logistics in accordance with the National Defense Strategy (NDS) of 2018, A Design for Maintaining Maritime Superiority 2.0, and the NAVFAC Strategic Design 2.0 Guidance. This program will deliver new capabilities to overcome expeditionary performance limitations in the areas of airfield damage repair (ADR), port damage repair (PDR), and expeditionary engineering and materials to maximize resiliency and agility.

Investment in ADR technologies enhance Navy force response plans, and Joint Force Commander's flexibility to deploy and employ from expeditionary airfields, as well as deliver and sustain warfighting capabilities at the point of effect. This includes "right size, just-in-time" technologies that can facilitate both conventional and autonomous rapid assessment, repair, and re-constitution of expeditionary airfields.

Innovative PDR capabilities enable the reviving, re-armament, repair, re-fueling, re-calibration and re-constitution of fleet platforms at Navy Port Facilities of opportunity. This effort will develop technologies that facilitate just-in-time assessment and rapid repair of piers, quay-walls, fleet moorings, critical expeditionary waterfront facilities and infrastructure, and port facilities above, at, and below the waterline.

Development of alternative expeditionary engineering materials will maximize agility and resilience while minimizing supply chain risk. These technologies will enable in-the-field production of parts (including original and spare parts for expeditionary equipment) and in-situ fabrication of expeditionary structures. This includes production equipment (such as additive manufacturing systems), raw materials (such as locally sourced construction materials), inspection and quality certification equipment, as well as support methods and criteria to employ these systems in the expeditionary environment. New concepts for expeditionary engineering equipment technologies enhance expeditionary engineering operations, to include site identification, selection, and planning; site clearing and preparation; construction activities; site operations support (including local material handling, damage repair, etc.); and site deconstruction and retrograde activities. Technologies demonstrated will provide required engineer support capability while maximizing deployability (by minimizing size and weight) and enhancing operator safety (by providing direct operator protection or allowing for remote or autonomous operation).

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	2.350	-	2.350
Total Adjustments	0.000	0.000	2.350	-	2.350
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	2.350	-	2.350

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*	**Project (Number/Name)** 3444 / *Airfield/Port Damage Repair*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3444: *Airfield/Port Damage Repair*	0.000	0.000	0.000	2.350	-	2.350	2.314	2.100	2.200	2.443	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is a new start

A. Mission Description and Budget Item Justification

Project 3444 directly supports resilient and agile logistics in accordance with the National Defense Strategy (NDS) of 2018, A Design for Maintaining Maritime Superiority 2.0, and the NAVFAC Strategic Design 2.0 Guidance. This program will deliver new capabilities to overcome expeditionary performance limitations in the areas of airfield damage repair (ADR), port damage repair (PDR), and expeditionary engineering and materials to maximize resiliency and agility.

Investment in ADR technologies enhance Navy force response plans, and Joint Force Commander's flexibility to deploy and employ from expeditionary airfields, as well as deliver and sustain warfighting capabilities at the point of effect. This includes "right size, just-in-time" technologies that can facilitate both conventional and autonomous rapid assessment, repair, and re-constitution of expeditionary airfields.

Innovative PDR capabilities enable the reviving, re-armament, repair, re-fueling, re-calibration and re-constitution of fleet platforms at Navy Port Facilities of opportunity. This effort will develop technologies that facilitate just-in-time assessment and rapid repair of piers, quay-walls, fleet moorings, critical expeditionary waterfront facilities and infrastructure, and port facilities above, at, and below the waterline.

Development of alternative expeditionary engineering materials will maximize agility and resilience while minimizing supply chain risk. These technologies will enable in-the-field production of parts (including original and spare parts for expeditionary equipment) and in-situ fabrication of expeditionary structures. This includes production equipment (such as additive manufacturing systems), raw materials (such as locally sourced construction materials), inspection and quality certification equipment, as well as support methods and criteria to employ these systems in the expeditionary environment. New concepts for expeditionary engineering equipment technologies enhance expeditionary engineering operations, to include site identification, selection, and planning; site clearing and preparation; construction activities; site operations support (including local material handling, damage repair, etc.); and site deconstruction and retrograde activities. Technologies demonstrated will provide required engineer support capability while maximizing deployability (by minimizing size and weight) and enhancing operator safety (by providing direct operator protection or allowing for remote or autonomous operation).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Naval Expeditionary	0.000	0.000	2.350	0.000	2.350
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*	**Project (Number/Name)** 3444 / *Airfield/Port Damage Repair*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** -Development of methodologies for airfield damage repair -Technologies that facilitate port damage repair -Expeditionary engineering materials and equipment to maximize agility and resilience while minimizing supply chain risk and enhance expeditionary engineering operations. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This project is a new start to address capability gaps for the Expeditionary Construction Domain.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	2.350	0.000	2.350

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Projects identified in this budget are carefully selected to respond to resiliency considerations of evolving and aging airfields, ports, expeditionary operations, and to facilitate rational risk based decisions and solutions to protect and decrease risk levels for Department of the Navy-critical expeditionary waterfront facilities and infrastructure. The results of these projects will be the development of design and construction criteria and or components that directly influence Navy-critical expeditionary waterfront facilities and infrastructure.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*	**Project (Number/Name)** 3444 / *Airfield/Port Damage Repair*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Airfield Damage Repair	WR	NAVFAC EXWC : Pt Hueneme, CA	0.000	0.000		0.000		0.240	Oct 2020	-		0.240	Continuing	Continuing	Continuing
Port Damage Repair	WR	NAVFAC EXWC : Pt Hueneme, CA	0.000	0.000		0.000		0.780	Oct 2020	-		0.780	Continuing	Continuing	Continuing
Port Damage Repair	Various	ERDC : Vicksburg, MS	0.000	0.000		0.000		1.000	Oct 2020	-		1.000	Continuing	Continuing	Continuing
Expeditionary Engineering Materials and Equipment	Reqn	NAVFAC EXWC : Pt Hueneme, CA	0.000	0.000		0.000		0.080	Nov 2020	-		0.080	Continuing	Continuing	Continuing
Expeditionary Engineering Materials and Equipment	Reqn	ERDC : Vicksburg, MS	0.000	0.000		0.000		0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		2.350		-		2.350	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		2.350		-		2.350	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*	**Project (Number/Name)** 3444 / *Airfield/Port Damage Repair*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603239N / *(U)NAVAL CONSTRUCTION FORCES*	**Project (Number/Name)** 3444 / *Airfield/Port Damage Repair*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3444				
Airfield Damage Group: Saltwater Concrete	1	2021	2	2022
Airfield Damage Group: P-8 Poseidon for Airfield Damage Repairs	1	2022	4	2024
Airfield Damage Group: Autonomous Airfield and Port Inspection	2	2023	2	2025
Port Damage Repair: PDR JCIDS	1	2021	3	2022
Port Damage Repair: MRSD Testing	1	2021	3	2022
Port Damage Repair: Expedient Pier Assessment and Repair	1	2021	2	2024
Port Damage Repair: Quaywall Repair	1	2021	2	2023
Port Damage Repair: Pillar Trng Packg.& Pier Recon & Assesment Tool (PRAT)	1	2022	1	2023
Port Damage Repair: Aerial Port Assesment System (APAS)	1	2022	2	2025
Port Damage Repair: Port Assessment Process	1	2021	1	2025
Port Damage Repair: Improving the Speed and Agility of Port and Airfield Repairs	1	2021	1	2023
Port Damage Repair: Deployable Automated Construction	1	2024	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	21.200	0.790	1.473	0.418	-	0.418	0.423	0.383	0.000	0.000	0.000	24.687
3331: *C-2 System Development*	21.200	0.790	1.473	0.418	-	0.418	0.423	0.383	0.000	0.000	0.000	24.687

A. Mission Description and Budget Item Justification

This program element supports the study, evaluation, optimization and enhancements of fielded aircraft systems not supported by a system specific Research, Development, Test and Evaluation, Navy program element. The supported efforts will provide a basis to recommend options for improved efficiency, minimization of life cycle cost, and other affordable options. As naval aircraft systems age, and analysis of the programmatic and /or reliability enhancements options allows the Department of the Navy to more effectively understand and manage system lifecycle costs and implications in future airborne platforms.

This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.793	1.473	1.522	-	1.522
Current President's Budget	0.790	1.473	0.418	-	0.418
Total Adjustments	-0.003	0.000	-1.104	-	-1.104
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.003	0.000			
• Program Adjustments	0.000	0.000	-0.989	-	-0.989
• Rate/Misc Adjustments	0.000	0.000	-0.115	-	-0.115

Change Summary Explanation

Technical: The FY2021 funding request was reduced by $0.189 million to account for the availability of prior year execution balances.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3331: *C-2 System Development*	21.200	0.790	1.473	0.418	-	0.418	0.423	0.383	0.000	0.000	0.000	24.687
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The C-2A Greyhound is a high wing monoplane, twin engine turbo-prop aircraft capable of operating from both a shore base and all operational United States Navy aircraft carrier classes. The mission of the C-2A is to provide rapid response Carrier Onboard Delivery of fleet essential supplies, repair parts, and personnel to sustain at sea operations of deployed battle groups. In addition, the C-2A provides airdrop delivery and mobilization support for special operations forces from land bases and carriers, Search and Rescue, and Humanitarian Relief.

This project will fund required development and obsolescence analysis of other subsystems required to operate the C-2A to the end of its service life.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Combat Readiness	0.790	1.473	0.418	0.000	0.418
Articles:	-	-	-	-	-
Description: C-2 Combat Readiness establishes an enduring capacity to address obsolescence, safety, and readiness degrader issues for the C-2A(R) aircraft until the end of it's service life. ***FY 2020 Plans:*** Continue developing prototype for Chassis Assembly (Qty 3). C-2A subsystem studies and analysis for obsolescence analysis for emergency transformer rectifier. Prototype and assisted test & evaluation of the Advanced Arresting Gear (AAG) and braking system. ***FY 2021 Base Plans:*** Provide C-2A studies and analysis for Secure Voice and Data Over the Horizon communication. Begin prototype for the Secure Voice and Data communication. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding decrease from FY20 to FY21 due to current program plan.					
Accomplishments/Planned Programs Subtotals	0.790	1.473	0.418	0.000	0.418

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• APN/0556: *C-2A Series*	8.261	13.747	9.525	-	9.525	4.627	0.000	0.000	0.000	0.000	537.488

Remarks

D. Acquisition Strategy

The C-2A Operational Ground Controllability strategy will be exercised under an Engineering Change Proposal.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior year Prod Dev no longer funded in the FYDP	Various	Various : Various	11.151	0.000		0.000		0.000		-		0.000	0.000	11.151	11.151
		Subtotal	11.151	0.000		0.000		0.000		-		0.000	0.000	11.151	N/A

Remarks

Totals may not add due to rounding.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	North Island : North Island, CA	1.153	0.400	Jan 2019	0.000		0.000		-		0.000	0.000	1.553	Continuing
Development Support	WR	Department of Energy : Kansas City, MO	0.389	0.390	Jan 2019	0.573	Jan 2020	0.137	Jan 2021	-		0.137	0.267	1.756	Continuing
Prior year Support no longer funded in the FYDP	Various	Various : Various	5.573	0.000		0.000		0.000		-		0.000	0.000	5.573	-
		Subtotal	7.115	0.790		0.573		0.137		-		0.137	0.267	8.882	N/A

Remarks

Totals may not add due to rounding.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAWCAD : Pax River, MD	2.908	0.000		0.900	Nov 2019	0.281	Nov 2020	-		0.281	0.539	4.628	Continuing
		Subtotal	2.908	0.000		0.900		0.281		-		0.281	0.539	4.628	N/A

Remarks

Totals may not add due to rounding.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Various	Various : Various	0.026	0.000		0.000		0.000		-		0.000	0.000	0.026	0.026
		Subtotal	0.026	0.000		0.000		0.000		-		0.000	0.000	0.026	N/A

Remarks

Totals may not add due to rounding.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	21.200	0.790		1.473		0.418		-		0.418	0.806	24.687	N/A

Remarks

Totals may not add due to rounding.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*

DON 21 RDT&E Report

C-2 System Development

Snapshot Date: 1/6/2020

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603251N / *Aircraft Systems*	**Project (Number/Name)** 3331 / *C-2 System Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Combat Readiness				
Systems Development: Development Support: Studies	1	2019	4	2023
Test & Evaluation: Technical Evaluation: Developmental Test - AAG & Braking System	3	2020	4	2020
Test & Evaluation: Technical Evaluation: Developmental Test - Secure Voice & Data Communication	3	2021	4	2021

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	136.238	6.877	7.172	15.719	-	15.719	18.205	16.654	17.509	20.768	Continuing	Continuing
1292: *Adv ASW Sensors & Proc*	136.238	6.877	7.172	15.719	-	15.719	18.205	16.654	17.509	20.768	Continuing	Continuing

A. Mission Description and Budget Item Justification

Includes RDT&E funds for advanced development and developmental testing of airborne anti-submarine warfare (ASW) systems, including aircraft, equipment, and devices for use against all types of submarine targets.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.044	7.172	7.298	-	7.298
Current President's Budget	6.877	7.172	15.719	-	15.719
Total Adjustments	-0.167	0.000	8.421	-	8.421
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.167	0.000			
• Program Adjustments	0.000	0.000	8.323	-	8.323
• Rate/Misc Adjustments	0.000	0.000	0.098	-	0.098

Change Summary Explanation

Technical: Not applicable.

Schedule: Next Generation Airborne Passive System (NGAPS) - Additional component maturation required for NGAPS Future Naval Capability resulting in a two year delay.

Funding: FY21 increase for Undersea Advantage prototype system development and at-sea demonstration for the next generation of Multistatic Active Coherent (MAC) system components addresses gaps in critical, wide area search capabilities against fielded and emerging advanced ASW threats.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603254N / *ASW Systems Development*				Project (Number/Name) 1292 / *Adv ASW Sensors & Proc*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
1292: *Adv ASW Sensors & Proc*	136.238	6.877	7.172	15.719	-	15.719	18.205	16.654	17.509	20.768	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This program provides Air Anti-Submarine Warfare (ASW) effectiveness through development and maturation of advanced hardware and software associated with airborne acoustic and non-acoustic systems. This includes sensors and components, processing, post-processing, data recording and display capabilities to address regional threat scenarios against surfaced or submerged conventionally and nuclear powered submarines. Key objectives are platform accommodations of advanced active and passive sensors and components, improved detection, classification, localization and tracking; and increased capacity and flexibility to handle multi-sensor data loads. Furthermore, technologies that can be affordably implemented as payloads across fixed wing, rotary and unmanned platforms engaged in ASW will be pursued. Technology evaluations include Over the Horizon (OTH) communications, sonobuoy communication link to/from aircraft, Distributed Netted Sensors, transient signals, and source and receiver improvement technologies that will enhance passive and multistatic active sensor systems capabilities. Programs being funded during the FYDP will provide for the development and maturation of persistent tactical search technologies that will allow transition to the localization and attack phase in all operationally relevant environments. In addition, the program will provide for the development and subsequent experimentation, including data collection and engineering measurement, of the next generation of Multistatic Active Coherent (MAC) sources and receivers, laser technologies, electro-optical and multi-spectral camera technologies, radar, and Magnetic Anomaly Detection (MAD) sensors. Those technologies that are deemed mature and provide increased operational capability will be approved for transition, maturation, and implementation in a production Rapid Capability Insertion (RCI) build. The test articles, which consist of sensors, components and associated processors, will support at-sea trials and experiments.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: System performance assessments	6.877	7.172	15.719	0.000	15.719
Articles:	100	100	100	-	100
FY 2020 Plans: Design, mature, and prototype test articles, models, processors, and algorithms for laboratory and at-sea demonstrations to validate technical maturity and operational performance. Conduct sensor and system performance assessments for the next generation of airborne wide area search. Evaluate advancements in passive sensing for deep ocean ASW operations. Employ effects chain gap analysis and performance modeling to verify capability improvements for acoustic and non-acoustic technologies. Conduct data analyses to evaluate and mature the prototype hardware and signal processing algorithms leveraging science and technology, research and development, and operational fleet-collected data.					
FY 2021 Base Plans: Undersea Advantage funding to develop and validate an air-deployable prototype sensor as the next generation multistatic receiver. Conduct sensor and system performance assessments, gap analyses of the effects-					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
chains, rapid prototyping, and demonstration of the next generation of Multi-Static Active Coherent (MAC) system components, advancements in passive sensing and other acoustic and non-acoustic enhancements for traditional and high altitude ASW operations. Develop and mature prototype signal processing and hardware for data collections and at-sea experimentation. Employ the related test articles, models, processors and algorithms in at-sea demonstrations and related laboratory or in-water experiments to validate technical maturity and operational performance. Conduct data analyses to evaluate and mature the prototype hardware and signal processing algorithms leveraging science and technology, research and development, and operational fleet-collected data. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 increase for Undersea Advantage prototype system development and at-sea demonstration for the next generation of Multistatic Active Coherent (MAC) system components addresses gaps in critical, wide area search capabilities against fielded and emerging advanced ASW threats. Specifically, this effort includes development and fabrication of additional representative prototype sonobuoys, the design and maturation of the related signal processing algorithms, and the verification of the associated phenomenology in the open-ocean operating environment and through modeling and simulation. The FY21 increase will also fund additional critical at-sea demonstrations to collect data to further enhance our ability to transition this capability to the Fleet. Collectively, this FY21 effort directly supports a documented capability gap for Airborne ASW. At-sea data gathering events will be conducted in FY20 to identify Critical Technology Elements (CTEs) and associated contributions for the development of signal processing, the development of a sonobuoy specification in parallel with system development, and the identification and establishment of contractual vehicles to facilitate rapid prototyping and mature prototype signal processing and hardware.					
Accomplishments/Planned Programs Subtotals	6.877	7.172	15.719	0.000	15.719

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDT&E/0480: *ASW Sensors & Proc*	37.635	43.045	43.215	-	43.215	44.001	47.557	46.705	47.641	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

D. Acquisition Strategy

Develop and mature promising acoustic and non-acoustic ASW technologies that have high potential for meeting documented capability gaps and Fleet requirements. As funding permits, transition those technologies into acquisition programs of record for eventual Fleet release on ASW platforms.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hdw Development	Various	Various : Various	4.530	1.134	Dec 2018	1.622	Dec 2019	5.002	Dec 2020	-		5.002	Continuing	Continuing	Continuing
		Subtotal	4.530	1.134		1.622		5.002		-		5.002	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development	WR	NAWCAD : PATUXENT RIVER, MD	6.307	1.050	Dec 2018	1.075	Dec 2019	3.610	Dec 2020	-		3.610	0.000	12.042	-
Studies & Analysis	WR	NAWCAD : PATUXENT RIVER, MD	8.871	1.100	Dec 2018	0.880	Dec 2019	1.925	Dec 2020	-		1.925	Continuing	Continuing	Continuing
		Subtotal	15.178	2.150		1.955		5.535		-		5.535	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Dev Test & Eval	Various	Various : Various	25.780	2.000	Dec 2018	1.911	Dec 2019	3.058	Dec 2020	-		3.058	Continuing	Continuing	Continuing
		Subtotal	25.780	2.000		1.911		3.058		-		3.058	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Eng Spt	Various	Various : Various	22.483	1.000	Dec 2018	1.050	Dec 2019	1.276	Dec 2020	-		1.276	Continuing	Continuing	Continuing
ENG & TECH SVCS (NON-FFRDC)	Various	Various : Various	3.094	0.100	Dec 2018	0.100	Dec 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
MGT & PROF SVCS (FFRDC)	Various	Various : Various	1.557	0.100	Dec 2018	0.100	Dec 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Eng Spt	WR	NAWCAD : PATUXENT RIVER, MD	63.452	0.385	Dec 2018	0.426	Dec 2019	0.640	Dec 2020	-		0.640	Continuing	Continuing	Continuing
Travel	Various	VARIOUS : VARIOUS	0.164	0.008	Dec 2018	0.008	Dec 2019	0.008	Dec 2020	-		0.008	Continuing	Continuing	Continuing
		Subtotal	90.750	1.593		1.684		2.124		-		2.124	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	136.238	6.877		7.172		15.719		-		15.719	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603254N / *ASW Systems Development*	**Project (Number/Name)** 1292 / *Adv ASW Sensors & Proc*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj: 1292 - Adv ASW Sensors & Processors				
Performance Assessment: Data Analysis/Engineering Measurement	1	2019	4	2025
Performance Assessment: OTH Comms	1	2019	4	2020
Performance Assessment: Advanced ASW sensing / Undersea Advantage	1	2021	4	2025
Performance Assessment: Next Generation Airborne Passive System	1	2022	4	2025
Transition Decision: OTH Comms	4	2020	4	2020
Transition Decision: Initial Demonstration	4	2024	4	2024
Software: Software Development	1	2019	4	2025
Experiment/Exercise Participation: Experiment/Exercise Participation	1	2019	4	2025
Trade Studies: Trade Studies	1	2019	4	2025
Deliveries: Test Articles: Test Article Deliveries (8)	1	2019	1	2019
Deliveries: Test Articles: Test Article Deliveries (9)	1	2020	1	2020
Deliveries: Test Articles: Test Article Deliveries (10)	1	2021	1	2021
Deliveries: Test Articles: Test Article Deliveries (11)	1	2022	1	2022
Deliveries: Test Articles: Test Article Deliveries (12)	1	2023	1	2023
Deliveries: Test Articles: Test Article Deliveries (13)	1	2024	1	2024
Deliveries: Test Articles: Test Article Deliveries (14)	1	2025	1	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	79.908	3.537	3.419	3.411	-	3.411	3.481	3.760	3.696	3.769	Continuing	Continuing
2467: *UxS Common Standards, Interoperability and Integration*	79.908	3.537	3.419	3.411	-	3.411	3.481	3.760	3.696	3.769	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element funds efforts to develop common technical and interoperability standards for current and future unmanned platforms, sensors, communications, and networking capabilities to achieve the required integration and interoperability of Unmanned Systems (UxS) represented in approved Naval Concept of Operations (CONOPS).

This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	3.540	3.419	3.430	-	3.430
Current President's Budget	3.537	3.419	3.411	-	3.411
Total Adjustments	-0.003	0.000	-0.019	-	-0.019
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.003	0.000			
• Program Adjustments	0.000	0.000	-0.052	-	-0.052
• Rate/Misc Adjustments	0.000	0.000	0.033	-	0.033

Change Summary Explanation

Technical: Not applicable to baseline.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2467: *UxS Common Standards, Interoperability and Integration*	79.908	3.537	3.419	3.411	-	3.411	3.481	3.760	3.696	3.769	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Naval Unmanned Aircraft Systems (UAS) strategy employs a family of UAS to perform various missions in support of naval and joint service missions from forward bases/platforms and naval ships.

In support of the Navy and Marine Corps' overall UAS strategy, this program develops common technical and interoperability standards for current and future unmanned platforms, sensors, communications, and networking capabilities to achieve the integration and interoperability of UAS represented in approved Naval Concept of Operations (CONOPS). Leveraging fleet input based on current operations and informed by future operational plans, these efforts ensure the desired interoperability and integration of Unmanned Systems (UxS) throughout the battlespace is achieved. This program also establishes the common architecture, including command & control, for all unmanned systems to support and inform future CONOPS development. This effort provides for a cross program view of naval unmanned systems and is the entry point for DoN and other services to address commonality and interoperability opportunities.

Specifically:
- Provides studies and demonstrations in support of Naval UAS Family of Systems (FoS) CONOPS development.
- Horizontally integrates across the Naval UAS FoS through the development of Naval Interoperability Profiles to achieve required unmanned capabilities and interoperability.
- Provides support for development of common and interoperable UAS standards for use throughout the Department of Defense (DoD) and the North Atlantic Treaty Organization (NATO).
- Conducts CONOPS studies, demonstrations, advanced development/prototyping, exercises for vehicle control, targeting, and weapons, sensor and payload employment.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Studies and Demonstrations	1.917	1.960	1.923	0.000	1.923
Articles:	-	-	-	-	-
Description: Studies and demonstrations to support CONOPS development from an interoperability perspective for effective integration of UAS. Develop a UAS architecture environment to allow for effective modeling and simulation of common UAS components in representative battlespace architectures.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Continue development of the UAS modeling and simulation of Fleet CONOPS scenarios. Demonstrate Manned/ Unmanned Interoperability. Provide technical government engineering support. ***FY 2021 Base Plans:*** Continue development of the UAS modeling and simulation of Fleet CONOPS scenarios. Demonstrate Manned/ Unmanned Interoperability. Provide technical government engineering support. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease of $0.037M is due to rate adjustments.					
Title: Naval Interoperability & Standardization	1.620	1.459	1.488	0.000	1.488
Articles:	-	-	-	-	-
Description: Develop UAS common technical standards implementations to achieve desired capabilities and interoperability between manned/unmanned systems. ***FY 2020 Plans:*** Continue to develop Unmanned Systems Naval Interoperability Profiles in support of approved Naval CONOPS. Support DoN, Joint Service and NATO coalition interoperability efforts. Provide government engineering support and contract services. ***FY 2021 Base Plans:*** Continue to develop Unmanned Systems Naval Interoperability Profiles in support of approved Naval CONOPS. Support DoN, Joint Service and NATO coalition interoperability efforts. Provide government engineering support and contract services. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase of $0.029M is due to rate adjustments.					
Accomplishments/Planned Programs Subtotals	3.537	3.419	3.411	0.000	3.411

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The department will leverage existing government facilities and resources to develop common technical and interoperability standards for current and future unmanned sensors, communications, and networking capabilities to achieve the required interoperability and integration of unmanned systems represented in approved Naval Concept of Operations (CONOPS). Government engineering support will be used for standards development, architectural analysis, modeling and simulation efforts and testing.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior year Prod Dev no longer funded in the FYDP	Various	Various : Various	18.711	0.000		0.000		0.000		-		0.000	0.000	18.711	-
		Subtotal	18.711	0.000		0.000		0.000		-		0.000	0.000	18.711	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Studies & Demonstrations	WR	NAWCAD : Pax River, MD	5.153	0.245	Dec 2018	0.250	Dec 2019	0.217	Dec 2020	-		0.217	Continuing	Continuing	Continuing
Standards Development	C/CPFF	Engility : Lexington Park, MD	4.212	1.400	Jan 2019	1.334	Jan 2020	1.360	Jan 2021	-		1.360	Continuing	Continuing	Continuing
Prior year Support no longer funded in the FYDP	Various	Various : Various	29.815	0.000		0.000		0.000		-		0.000	0.000	29.815	-
		Subtotal	39.180	1.645		1.584		1.577		-		1.577	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior year Test & Eval no longer funded in the FYDP	Various	Various : Various	2.627	0.000		0.000		0.000		-		0.000	0.000	2.627	-
		Subtotal	2.627	0.000		0.000		0.000		-		0.000	0.000	2.627	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	Various	Various : Various	5.251	0.218	Jan 2019	0.125	Jan 2020	0.128	Jan 2021	-		0.128	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NAWCAD : Pax River, MD	12.531	1.672	Dec 2018	1.710	Dec 2019	1.706	Dec 2020	-		1.706	Continuing	Continuing	Continuing
Travel	WR	NAVAIR HQ : Pax River, MD	0.558	0.002	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Prior year Mgmt Services no longer funded in the FYDP	Various	Various : Various	1.050	0.000		0.000		0.000		-		0.000	0.000	1.050	-
		Subtotal	19.390	1.892		1.835		1.834		-		1.834	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	79.908	3.537		3.419		3.411		-		3.411	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

2021PB - 0603261N - 2467

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603261N / *Tactical Airborne Reconnaissance*	**Project (Number/Name)** 2467 / *UxS Common Standards, Interoperability and Integration*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UxS Common Standards, Interoperability and Integration				
Studies and Demonstrations:	1	2019	4	2025
Naval Interoperability and Standardization:	1	2019	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	72.944	38.674	57.947	70.218	-	70.218	49.000	51.715	51.655	52.691	Continuing	Continuing
0324: *Adv Combat System Technology*	70.618	1.743	1.797	1.299	-	1.299	2.196	2.126	1.950	1.989	Continuing	Continuing
2480: *SSL-TM*	0.000	0.000	3.922	11.909	-	11.909	5.434	3.992	0.000	0.000	0.000	25.257
3416: *HIJENKS*	0.000	0.000	0.000	14.981	-	14.981	16.945	24.690	0.000	0.000	0.000	56.616
3422: *SHARC Surface Platform*	2.301	6.754	5.731	14.741	-	14.741	3.814	0.000	0.000	0.000	0.000	33.341
3423: *LOCUST*	0.013	1.879	2.960	3.561	-	3.561	6.425	5.949	0.000	0.000	0.000	20.787
3424: *Heterogeneous Collaborative Unmanned Systems (HCUS)*	0.012	0.962	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.974
3437: *EMW/SEWIP/SSEE Accelerator*	0.000	14.389	23.630	21.508	-	21.508	1.250	0.822	0.000	0.000	0.000	61.599
3438: *Innovative Naval Prototype (INP) Transition (6.4)*	0.000	12.947	19.907	2.219	-	2.219	4.996	5.085	34.716	35.413	Continuing	Continuing
3443: *Advanced Long Range Targeting (ALRT)*	0.000	0.000	0.000	0.000	-	0.000	7.940	9.051	14.989	15.289	Continuing	Continuing

Note

In FY2021, PE 0603382N Advanced Combat System Tech, partial funding from PU 3438 Innovative Naval Prototype (INP) Transition (6.4)was moved to new PU 3416 HIJENKS.

A. Mission Description and Budget Item Justification

Open architecture sets standards for technology fields to promote interoperability. For defense systems, standards enable interconnectivity across services and in coalition operations at machine-to-machine speeds. Reducing barriers associated with proprietary software speeds development and delivery of warfighting advantage. The Advanced Combat System Technology line is to evolve the technical and business practices for programs to change to an open architecture construct. The program was constructed to mature both technical and business model integration for C5I systems programs of record in an open architecture environment. The priority was incorporating the principles of modular design and design disclosure, reusable application software, interoperability and secure information exchange, lifecycle affordability and encouraging competition and collaboration.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*

Project Unit 0324: Funding is to fully implement the Naval Open (Systems) Architecture (OSA) strategy. The implementation of this strategy provides the tools and leadership for assisting programs and the Naval Research and Development Establishment through the technical, business and cultural transition to OSA. The primary tools and assistance is established through a limited set of technical reference frameworks, consistent contract language guidance, Intellectual Property strategies and improvements in transparency of design disclosure and information exchange on past and current investments to support portfolio management and cross-program reuse. The OSA transformation effort will be applied to programs of record and coupled with rapid prototyping efforts being realized as management efficiencies both within programs and in accelerated acquisition efforts. Those elements include ensuring that all naval systems, families of systems, programs and prototypes move to modular OSA in accordance with Department of Defense (DoD) Instruction 5000.01 of 7 January 2015 which mandates that all DoD programs utilize Modular OSA to rapidly field affordable and interoperable systems. This project facilitates a strategic shift in the technical and business methods to establish cooperation and cross-domain/COI business relationships. This improves innovation and economies of scale throughout the Navy and Marine Corps. This leadership effort has identified the business case and potential return on investment for moving the Navy towards an open systems approach, supported the development of open systems technologies, and integrated best business and technical practices for open systems development within Naval acquisition. Naval OSA ensures Navy-wide system architectures become extensible and scalable in function, capacity, and workload to meet Joint warfighting requirements. This also includes the identification and development of common software components, functions, reuse methodologies, and extensible product lines.

Project Unit 2480: The efforts described in this mission area address the advanced component development and prototype demonstration associated with the Navy's Solid State Laser Technology Maturation (SSL-TM) Innovative Naval Prototypes (INP) Program and the Leap Ahead Technology (LA-Tech) investments. The SSL-TM program is developing an integrated Laser Weapons System Demonstrator (LWSD). SSL-TM will provide a new capability to the Fleet to address known capability gaps against asymmetric threats (UAS, small boats, and ISR sensors) and will inform future acquisition strategies, system designs, integration architectures, and fielding plans for laser weapon systems.

Project Unit 3422: The SHARC Surface Platforms demonstration project is part of the Department of Defense Third Offset Strategy as one element in the Sensor Grid category for 24/7 autonomy infused Situational Awareness (SA). This project will purchase Commercial-off-the-Shelf SHARC Platforms (wave gliders) and integrate four (4) unique Government-owned classified mission payloads focused on the detection of threats. These capabilities will enable CONOPS development in an operationally relevant environment to demonstrate how these technologies can improve the SA to the battlespace Commanders.

Project Unit 3423: The LOCUST demonstration is part of the Department of Defense Third Offset Strategy as one element in the Effector Grid category for small autonomous systems. LOCUST leverages the BA-3 Innovative Naval Prototype program developing and demonstrating swarming technology. The BA-3 effort is developing both the air vehicle, UAS swarming behaviors, and miniaturized sensor systems. ONR has demonstrated an autonomous system capable of launching 33 UASs in 40 seconds and flying them in a coordinated swarm. This BA-4 effort is trailing the BA-3 demonstration of technologies by a fiscal quarter and then demonstrating the technology in operationally relevant environments with military mission applications.

Project Unit 3424: The Heterogeneous Collaborative Unmanned Systems (HCUS) demonstration is part of the Department of Defense Third Offset Strategy as one element in the Effector Grid category for small autonomous systems. HCUS provides autonomous, tactical monitoring of an adversary's port-sized littoral area for an extended period of time with capability to apply limited offensive effects on-demand. Vehicles and sensors are intended to be used in contested environments - employing local communications nets, autonomous vehicle behavior, low bandwidth command links and local navigation with no requirement for GPS input.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*

HCUS systems can be encapsulated and deployed as a single payload, or a small number of payload packages designed for specific missions. The payloads can be carried into theater by various manned or unmanned platforms depending on the degree of stealth required. A week-long project demonstration will simulate covert deployment, operations of autonomous UAVs over the area of interest, data exfiltration to a remote operator, autonomous UAV recharging via USVs and/or UUVs, deployment of unmanned ground sensors for persistent sensing, and remote operator on-demand offensive attack on a simulated target.

Project 3437: The EMW/SEWIP/SSEE Accelerator is part of the Department of Defense Third Offset Strategy to improve real time Electro-Magnetic Maneuver Warfare operations. This effort will develop integrated cross platform active and passive sensing solutions, next generation network and real time spectrum operations.

Project 3438: This activity addresses the advanced component development and prototype demonstration associated with ONR's Innovative Naval Prototypes (INP) Program and the Leap Ahead Technology (LA-Tech) investments. INP and LA-Tech investments represent game changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature as they would dramatically change the way naval forces fight. INPs and LA-Techs push the imagination of our nation's technical talent to deliver transformational warfighting capabilities. Investments may include such mission areas as Unmanned and Autonomous Systems, Directed Energy / Electric Weapons, Electromagnetic Maneuver Warfare, Cyber Warfare, and Undersea Warfare. Funding to be realigned from the Unmanned Rapid Prototype Development project (Project Number 0399) in FY 2019.

Advanced Component Development and Prototypes (ACD&P) efforts necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment are funded in this PE. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 6 (system/subsystem model or prototype demonstration in a relevant environment) and TRL 7 (system prototype demonstration in an operational environment).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	39.240	64.694	76.309	-	76.309
Current President's Budget	38.674	57.947	70.218	-	70.218
Total Adjustments	-0.566	-6.747	-6.091	-	-6.091
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-6.747			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.566	0.000			
• Program Adjustments	0.000	0.000	-6.034	-	-6.034
• Rate/Misc Adjustments	0.000	0.000	-0.057	-	-0.057

Change Summary Explanation

The FY 2021 funding request was reduced by $6.091 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0324: *Adv Combat System Technology*	70.618	1.743	1.797	1.299	-	1.299	2.196	2.126	1.950	1.989	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Funding is to fully implement the Naval Open (Systems) Architecture (OSA) strategy. The implementation of this strategy provides the tools and leadership for assisting programs and the Naval Research and Development Establishment through the technical, business and cultural transition to OSA. The primary tools and assistance is established through a limited set of technical reference frameworks, consistent contract language guidance, Intellectual Property strategies and improvements in transparency of design disclosure and information exchange on past and current investments to support portfolio management and cross-program reuse. The OSA transformation effort will be applied to programs of record. Those elements include ensuring that all naval systems, families of systems, programs and prototypes move to modular OSA in accordance with DoD Instruction 5000.01 of 7 Jan 2015 which mandates that all DoD programs utilize Modular OSA to field affordable and interoperable systems. This project facilitates a strategic shift in the technical and business methods to establish cooperation and cross-domain/COI business relationships. This improves innovation and economies of scale throughout the Navy and Marine Corps. This leadership effort has identified the business case and potential return on investment for moving the Navy towards an open systems approach, supported the development of open systems technologies, and integrated best business and technical practices for open systems development within Naval acquisition. Supports Systems engineering and acquisition services to deliver capabilities through acquisition, development, integration, production, test, deployment and sustainment of interoperable command, control, communication, computers, intelligence, surveillance reconnaissance, cyber, and information technology capabilities enabling Information Warfare; and other functions. Naval OSA ensures Navy-wide system architectures become extensible and scalable in function, capacity, and workload to meet Joint warfighting requirements. This also includes the identification and development of common software components, functions, reuse methodologies, and extensible product lines.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Align the Naval Enterprise Across All Domains to Implement OA	0.492	0.560	0.199	0.000	0.199
Articles:	-	-	-	-	-
FY 2020 Plans: The FY 2020 budget will be utilized to support the initiated Modular Open Systems Architecture projects. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The FY21 budget will be utilized to generate Web-accessible reference resource providing OA-related policy and guidance. Efforts include an updated contracting guidebook, interface standards, or proprietary data rights. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This task is complete and resources will be aligned with Knowledge Products for Implementing OSA.					
Title: Change the Naval and Marine Corps policy and guidance to Institutionalize OA Principle ***Articles:*** ***FY 2020 Plans:*** The FY 2020 budget will be utilized to support the initiated Modular Open Systems Architecture projects. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts. ***FY 2021 Base Plans:*** The FY 2021 budget will be utilized to continue to execute the FY 2020 plan supporting the initiated Modular Open Systems Architecture projects in conjunction with platform/ system block upgrades. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This task is in the final phases of completion and therefore funding is reduced and aligned with Knowledge Products for Implementing OSA.	0.619 -	0.610 -	0.100 -	0.000 -	0.100 -
Title: OA Systems Engineering Leadership ***Articles:*** ***FY 2020 Plans:*** The FY 2020 budget will be utilized to support the initiated Modular Open Systems Architecture projects. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts. ***FY 2021 Base Plans:***	0.232 -	0.217 -	0.100 -	0.000 -	0.100 -

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The FY 2021 budget will be utilized to support the initiated Modular Open Systems Architecture projects. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This task is in the final phases of completion and therefore funding is reduced to Knowledge Products for Implementing OSA.					
Title: Knowledge Products for Implementing OSA	0.400	0.410	0.900	0.000	0.900
Articles:	-	-	-	-	-
FY 2020 Plans: The FY 2020 budget will be utilized to supporting the initiated Modular Open Systems Architecture projects in conjunction with platform/system block upgrades. Additionally, it will promote policy changes and standards development that support the implementation and standardization of Modular Open Systems Architecture for POR interoperability efforts. Supports Systems engineering and acquisition services to deliver capabilities through acquisition, development, integration, production, test, deployment and sustainment of interoperable command, control, communication, computers, intelligence, surveillance reconnaissance, cyber, and information technology capabilities enabling Information Warfare; and other functions. ***FY 2021 Base Plans:*** The FY 2021 budget will be utilized to continue FY2020 tasks supporting Modular Open Systems Architecture projects conjunction with platform/system block upgrades. Additionally, it will promote policy changes and standards development that support the implementation and standardization of and to award new projects aligning with strategic imperatives and project transition opportunities in conjunction with platform/system block upgrades. Anticipated areas of emphasis will be OA support to Distributed Maritime Operations, particularly for Marine Corps, ISR and strike systems. Supports Systems engineering and acquisition services to deliver capabilities through acquisition, development, integration, production, test, deployment and sustainment of interoperable command, control, communication, computers, intelligence, surveillance reconnaissance, cyber, and information technology capabilities enabling Information Warfare; and other functions. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The OA products are evolving and different products are being delivered at different times. Resources are being realigned to Knowledge Products for the implementation of OSA across domains.					
Accomplishments/Planned Programs Subtotals	1.743	1.797	1.299	0.000	1.299

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This has been a Navy Acquisition Executive directed effort to fundamentally alter the business, technical and policy for warfare systems acquisition to result in improved cost, increased access to innovation, a reduction in time to field, and promote cultural environment change. The Navy's OSA Enterprise effort built off past successes such as the Acoustic Rapid Commercial-off-the-Shelf Insertion started program and established this core OA Budget line (policy statement dated 5 August 2004). The strategy was further refined in the Deputy Chief of Naval Operations (DCNO)requirement of 23 December 2005, the Naval OSA Strategy of 2011 and extended for applicability to the other Defense Services under the DoD Better Buying Power initiative. This effort continues to expand into and support the related strategic shift to Rapid Prototyping, Experimentation and Demonstration.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SE/OA Domain Support	C/FP	APL/ IET Contract : VARIOUS	2.576	0.000		0.000		0.000		-		0.000	0.000	2.576	Continuing
Systems Engineering	MIPR	NSWC / Dahlgren : Dahlgren, VA	13.307	0.000		0.000		0.000		-		0.000	0.000	13.307	Continuing
Systems Engineering	WR	NSWC/CRANE, Carderock, DISA : VARIOUS	3.119	0.000		0.000		0.000		-		0.000	0.000	3.119	Continuing
Systems Engineering	C/CPAF	ASSETT; Lockheed Martin, NJ; Gartner, VA : Washington DC	5.114	0.000		0.000		0.000		-		0.000	0.000	5.114	Continuing
OA DOMAIN SUPPORT	WR	NUWC/Newport, Spawar, Navair : VARIOUS	11.931	0.000		0.000		0.000		-		0.000	0.000	11.931	Continuing
SE/Signal Processor	C/CPAF	Lockheed Martin : VARIOUS	6.000	0.000		0.000		0.000		-		0.000	0.000	6.000	Continuing
SE/Signal Processor	C/CPAF	BAE : VARIOUS	0.300	0.000		0.000		0.000		-		0.000	0.000	0.300	Continuing
SE/Signal Processor	C/CPAF	Raytheon : VARIOUS	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	Continuing
SE/Signal Processor	WR	NSWC/DD, NRL, PHD : VARIOUS	0.600	0.000		0.000		0.000		-		0.000	0.000	0.600	Continuing
Align the Naval Enterprise Across All Domains to Implement OA	WR	NSWCDD : VARIOUS	2.619	0.492	Oct 2018	0.560	Oct 2019	0.199	Oct 2020	-		0.199	0.000	3.870	-
Change the Naval and Marine Corps policy and guidance to Institutionalize OA Principle	WR	NSWC, NRL, NUWC, NAWC : VARIOUS	0.953	0.619	Oct 2018	0.610	Oct 2019	0.100	Oct 2020	-		0.100	0.000	2.282	-
OA Systems Engineering Leadership	WR	NSWC, NRL, NUWC, NAWC : VARIOUS	0.545	0.232	Oct 2018	0.217	Oct 2019	0.100	Oct 2020	-		0.100	0.000	1.094	-
Knowledge Products for Implementing OSA	WR	NSWC, NRL, NUWC, NAWC NUW, NEWPORT,	0.836	0.400	Oct 2018	0.410	Oct 2019	0.900	Oct 2020	-		0.900	0.000	2.546	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		NSWC CRANE : VARIOUS													
		Subtotal	48.000	1.743		1.797		1.299		-		1.299	0.000	52.839	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Industry Development	C/FP	IBM, ANGLE, TBD (New IET Contract) : VARIOUS	9.805	0.000		0.000		0.000		-		0.000	0.000	9.805	Continuing
Technical Data-Academia	WR	NPS-Monterey/DAU : MONTEREY, CA	2.348	0.000		0.000		0.000		-		0.000	0.000	2.348	Continuing
Software Development	C/FP	TRIDENT, ASSET : VARIOUS	0.309	0.000		0.000		0.000		-		0.000	0.000	0.309	Continuing
		Subtotal	12.462	0.000		0.000		0.000		-		0.000	0.000	12.462	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Operational Test & Evaluation	WR	NSWC/DD : DAHLGREN, VA	2.216	0.000		0.000		0.000		-		0.000	0.000	2.216	Continuing
OA Asset Repository (SBIR Account)	WR	Miscellaneous : VARIOUS	0.150	0.000		0.000		0.000		-		0.000	0.000	0.150	Continuing
		Subtotal	2.366	0.000		0.000		0.000		-		0.000	0.000	2.366	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPAF	Miscellaneous : VARIOUS	3.021	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SBIR Assessment (Cong Add)	WR	NSWC/DD : DAHLGREN, VA	4.748	0.000		0.000		0.000		-		0.000	0.000	4.748	Continuing
DAWDF	TBD	TBD : TBD	0.021	0.000		0.000		0.000		-		0.000	0.000	0.021	Continuing
		Subtotal	7.790	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	70.618	1.743		1.797		1.299		-		1.299	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 0324 / *Adv Combat System Technology*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0324				
Incorporate OA Principles in Acquisition Strategies and Contracts	1	2019	3	2025
Change Culture through OA Education, Outreach and Training	1	2019	4	2025
Conduct Program/Prototype Assessments	2	2019	2	2025
Adapt ONR Technologies/NR&DE Technologies	1	2019	3	2025
Publish Updates to Guidebooks	3	2019	3	2025
Host Contracting/Industry Symposium	1	2019	4	2025
Deliver Report to Congress	1	2019	4	2025
Host OA Naval Laboratory Consortium	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2480: *SSL-TM*	0.000	0.000	3.922	11.909	-	11.909	5.434	3.992	0.000	0.000	0.000	25.257
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project unit (PU) was established in FY 2020 from funding internally realigned in the PE out of Project Unit 3438. This is not a new start. This PU 2480 includes Solid State Laser Technology Maturation (SSL-TM) resources and associated plans intended to provide advanced component development and prototyping for selected SSL-TM technologies maturing out of ONR's supporting Innovative Naval Prototype (INP) BA3 portfolio.

A. Mission Description and Budget Item Justification

The efforts described in this mission area address the advanced component development and prototype demonstration associated with the Navy's Solid State Laser Technology Maturation (SSL-TM) Innovative Naval Prototypes (INP) Program investments. The SSL-TM program is developing an integrated Laser Weapons System Demonstrator (LWSD). SSL-TM will provide a new capability to the Fleet to address known capability gaps against asymmetric threats (UAS, small boats, and ISR sensors) and will inform future acquisition strategies, system designs, integration architectures, and fielding plans for laser weapon systems.

INP and LA-Tech investments represent game changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature as they would dramatically change the way naval forces fight. INPs and LA-Techs push the imagination of our nation's technical talent to deliver transformational warfighting capabilities. Successful demonstrations are intended to present the Department of the Navy with a programmatic challenge as these new capabilities can lead to the obsolescence of existing capabilities and significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future.

ONR manages a continuum of INP and LA-Tech development from BA2 to BA3 to BA4. The goal of these BA4 investments is to further mature development and expend efforts necessary to evaluate integrated technologies, representative modes or prototype systems in high fidelity and realistic operating environments. This BA4 investment includes system specific efforts that help expedite technology transition from the laboratory to operational use. Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems and may involve risk reduction initiatives. Projects in this category involve efforts prior to Milestone B and are referred to as advanced component development activities and include technology demonstrations. It is the goal of these projects to achieve Technology Readiness Levels 6 or 7. Successful experimentation and demonstration highlights the viability of new technological capabilities that could be implemented if an acquisition program were to be established to support further development. The portfolio is periodically refreshed through the selection of new INPs and LA-Tech investments as existing ones are completed.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Solid State Laser Technology Maturation (SSL-TM)	0.000	3.922	11.909	0.000	11.909
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: The Solid State Laser Technology Maturation (SSL-TM) Program is developing an integrated Laser Weapons System Demonstrator (LWSD) that will be installed on USS Portland (LPD-27) during FY 2019 with investments funded in the BA3 Innovative Naval Prototypes Program Element 0603801N. The investment programmed in Program Element 0603382N, Advanced Combat Systems Technology, funds costs for extended at-sea experimentation, operations, and support of the installed system on LPD-27 in the Pacific operating areas. SSL-TM will provide a new capability to the Fleet to address known capability gaps against asymmetric threats (UAS, small boats, and ISR sensors) and will inform future acquisition strategies, system designs, integration architectures, and fielding plans for laser weapon systems. ***FY 2020 Plans:*** Conduct extended experimentation and laser weapons systems capabilities demonstration on USS Portland during fleet operations and experiments. ***FY 2021 Base Plans:*** Continue extended experimentation and laser weapons system capability demonstrations on USS Portland during fleet operations and experiments. Develop lesson learned and document system technical performance during operations, demonstrations and experiments. Groom events will include detailed inspection of LWSD system on ship to determine material condition and identify any repairs that are needed. Operators and maintenance personnel will be trained prior to deployment. System sustainment will be provided by deployed sailors with support from contractor and government maintenance experts as well as reach-back capability to address questions and issues beyond deployed maintenance team capability. A test team will be deployed during demonstrations and experiments to support coordination of demonstration and test execution, data collection and report writing requirements. The system will be available to support daily operational mission requirements and two (2) focused demonstration /experimentation events are planned during 2 and 3 Quarters of 2021. The scheduled will be adjusted as additional information about the USS Portlands schedule is defined ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding increases from FY20 to FY21 to support test system demonstrations deployment operations in maturation.					
Accomplishments/Planned Programs Subtotals	0.000	3.922	11.909	0.000	11.909

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 1319/ 0603801N/ 3400: *Solid State Laser Technology Maturation*	51.300	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	51.300
• 1319/ 0603801N/ 2480: *Solid State Laser Technology Maturation*	0.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

Remarks

D. Acquisition Strategy

The projects identified for execution are non-acquisition programs. The Office of Naval Research will provide Government oversight to the projects. Each project will develop a project plan to support execution. Project plans will include a schedule and the necessary technical requirements and objectives to measure and evaluate performance. Additionally, each project will be subjected to experimentation then demonstrated in operationally relevant environments to assess their ability to meet warfighter requirements. Project deliverables will include the actual integrated hardware/software prototype systems, test reports, and technical data, necessary to support decision making. These decisions include the transition of technologies to acquisition, further refinement of the technology, or termination and reinvestment of remaining funds to other technologies that add military value.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SSL-TM Experimentation and Testing	WR	Naval Surface Warfare Center Dahlgren Division : Dahlgren, VA	0.000	0.000		1.922	Oct 2019	1.759	Oct 2020	-		1.759	0.000	3.681	-
SSL-TM Experimentation and Sustainment	WR	Naval Surface Warfare Center, Port Hueneme Divisio : Port Hueneme, CA	0.000	0.000		1.000	Oct 2019	7.150	Oct 2020	-		7.150	0.000	8.150	-
SSL-TM Technical and Engineering T&E	C/CPFF	Northrup Grumman : Redondo Beach, CA	0.000	0.000		1.000	Oct 2019	3.000	Oct 2020	-		3.000	0.000	4.000	-
		Subtotal	0.000	0.000		3.922		11.909		-		11.909	0.000	15.831	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		3.922		11.909		-		11.909	0.000	15.831	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 2480 / *SSL-TM*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2480				
SSL-TM: Sustainment & Maintenance (Groom Events): Sustainment & Maintenance (Groom Events)	1	2020	2	2023
SSL-TM: Initial Demonstration & System Checkout: Initial Demonstration & System Checkout	1	2020	2	2020
SSL-TM: System Checkout and Data Collection: System Checkout and Data Collection	1	2020	4	2022
SSL-TM: Training, Demonstration & Experimentation Events: Training, Demonstration & Experimentation Events	4	2020	3	2023
SSL-TM: De-installation: De-installation	1	2023	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3416: *HIJENKS*	0.000	0.000	0.000	14.981	-	14.981	16.945	24.690	0.000	0.000	0.000	56.616
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

In FY2021, PE 0603382N Advanced Combat System Tech, partial funding from PU 3438 Innovative Naval Prototype (INP) Transition (6.4)was moved to new PU 3416 HIJENKS. This is not a new start.

A. Mission Description and Budget Item Justification

High Power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) System Integration, T&E and Alternate Platform development and test activity will focus on software development for integration of new High Power Microwave (HPM) capabilities into control systems and mission planning software.

Technical objectives of HIJENKS focus on improving the robustness of HPM systems in new airborne platforms and improving the mission planning capability for HPM engagement scenarios. The prototype will mature several of these areas to enable operational capability in a phased approach for multi-platform integration and demonstration combined with validation/certification paths of software and hardware architectures. Activities are intended as risk reduction, operational analysis, and system level environmental test in order to reduce transition program cost for platform capability.

Phase 2 FY-2021
Phase 2 brings component level environmental testing and certification as well as software development for limited pre- planned missions

Phase 3 FY-2022
Phase 3 brings system level environmental and EMC testing and certification as well as software development for limited dynamic mission planning and expanded target class surrogate development and test

Phase 4 FY-2023
Phase 4 brings integration and certification of mission planning and weapon control software to reduce transition costs for Program of Record

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: HIJENKS Operational Acceleration	0.000	0.000	14.981	0.000	14.981
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: HIJENKS System Integration, T&E and Alternate Platform development and test activity will focus on software development for integration of new High Power Microwave (HPM) capabilities into control systems and mission planning software. Technical objectives of HIJENKS focus on improving the robustness of HPM systems in new airborne platforms and improving the mission planning capability for HPM engagement scenarios. The prototype will mature several of these areas to enable operational capability in a phased approach for multi-platform integration and demonstration combined with validation/certification paths of software and hardware architectures. Activities are intended as risk reduction, operational analysis, and system level environmental test in order to reduce transition program cost for platform capability. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Phase 2 FY-2021 Phase 2 brings component level environmental testing and certification as well as software development for limited pre-planned missions. Environmental test and evaluation of critical HPM sub-systems. Functional testing on existing system surrogate Navy test simulators. Control interface testing with representative platform surrogate control systems. Mission planning tool assessment and early modification activities for launch and mission execution certification. Joint Munitions Effectiveness Manual (JMEM) and weaponeering accreditation process activities. Alternative platform integration work towards T&E demonstration and scaled ASuW testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 increase is due to the transition from HIJENKS PU 3438 Innovative Naval Prototype (INP) to this PU 3416 HIJENKS. Additionally, the increase will include investments in manufacturing of payload subsystems critical to transition with focused development in materials to meet storage shelf life and other environmental requirements as well as range extension.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	14.981	0.000	14.981

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 1319/0602792N/0000: *Directed Energy/ Electric Weapons*	29.825	22.046	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	51.871
• 1319/0603801N/3400: *Directed Energy/ Electric Weapons*	8.190	14.225	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	22.415
• RDTEN/0603801N/3416: *HIJENKS*	0.000	0.000	14.465	-	14.465	7.656	0.000	0.000	0.000	0.000	22.121
• RDTEN/0602792N/3416: *HIJENKS*	0.000	0.000	22.320	-	22.320	9.943	0.000	0.000	0.000	0.000	32.263

Remarks

D. Acquisition Strategy

The projects identified for execution are non-acquisition programs. The Office of Naval Research will provide Government oversight to the projects. Each project will develop a project plan to support execution. Project plans will include a schedule and the necessary technical requirements and objectives to measure and evaluate performance. Additionally, each project will be subjected to experimentation then demonstrated in operationally relevant environments to assess their ability to meet warfighter requirements. Project deliverables will include the actual integrated hardware/software prototype systems, test reports, and technical data, necessary to support decision making. These decisions include the transition of technologies to acquisition, further refinement of the technology, or termination and reinvestment of remaining funds to other technologies that add military value.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
HIJENKS Mission Planning Software Development	WR	NAVAIR : Patuxent, MD	0.000	0.000		0.000		0.330	Jan 2021	-		0.330	0.000	0.330	-
HIJENKS Launch System Software/Hardware Integration	WR	NAVAIR : Patuxent, MD	0.000	0.000		0.000		0.500	Nov 2020	-		0.500	0.000	0.500	-
HIJENKS System Requirements and CONEMPS	WR	NAVAIR : Patuxent, MD	0.000	0.000		0.000		0.250	Oct 2020	-		0.250	0.000	0.250	-
HIJENKS Airborne Launch Study	C/CPFF	Platform Prime : Available SECRET	0.000	0.000		0.000		0.500	Apr 2021	-		0.500	0.000	0.500	-
HIJENKS Mission Analysis	C/FFP	JHU-APL : Laurel, MD	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	0.000	0.500	-
HIJENKS T&E Launcher	C/FFP	Platform Prime : Available SECRET	0.000	0.000		0.000		0.200	Apr 2021	-		0.200	0.000	0.200	-
HIJENKS Safe and Arm	C/UCA	Platform Prim : Available SECRET	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	0.000	0.500	-
HIJENKS Hard Tube Capability	WR	Multiple Awards : Various	0.000	0.000		0.000		0.800	Jan 2021	-		0.800	0.000	0.800	-
HIJENKS Target Procurement and Testing	C/UCA	NRL : Washington, DC	0.000	0.000		0.000		0.750	Oct 2020	-		0.750	0.000	0.750	-
HIJENKS T&E Platform-Payload Source Development	C/BPA	Lockheed Martin : Grand Prairie, TX	0.000	0.000		0.000		3.000	Oct 2020	-		3.000	0.000	3.000	-
HIJENKS T&E Platform-Payload Source Development	C/BPA	General Atomics : San Diego, CA	0.000	0.000		0.000		4.000	Nov 2020	-		4.000	0.000	4.000	-
HIJENKS T&E Platform-Payload Source Development	C/BPA	Raytheon : Albuquerque, NM	0.000	0.000		0.000		2.700	Oct 2020	-		2.700	0.000	2.700	-
NSWCDD and HIJENKS Program Support	WR	NSWCDD : Dahlgren, VA and NAWCWD China Lake, CA	0.000	0.000		0.000		0.400	Oct 2020	-		0.400	0.000	0.400	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NSWCDD Government Pulsed Power GFE Hardware	WR	NSWCDD : Dahlgren, VA and NAWCWD China Lake, CA	0.000	0.000		0.000		0.551	Oct 2020	-		0.551	0.000	0.551	-
		Subtotal	0.000	0.000		0.000		14.981		-		14.981	0.000	14.981	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		14.981		-		14.981	0.000	14.981	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

Proj 3416	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
HIJENKS System Integration, T&E and Alternate Platform																												
Mission Planning Tools																												
Alternative Platform Integration																												
Alt Platform TRL 8 Demonstration																												
Expanded Target Testing																												
System Environmental Test																												
Launch System Safety Cert																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3416 / *HIJENKS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3416				
HIJENKS System Integration, T&E and Alternate Platform: Mission Planning Tools: Mission Planning Tools	1	2020	4	2021
HIJENKS System Integration, T&E and Alternate Platform: Alternative Platform Integration: Alternative Platform Integration	1	2021	3	2022
HIJENKS System Integration, T&E and Alternate Platform: Alt Platform TRL 8 Demonstration: Alt Platform TRL 8 Demonstration	3	2022	2	2023
HIJENKS System Integration, T&E and Alternate Platform: Expanded Target Testing: Expanded Target Testing	1	2023	4	2023
HIJENKS System Integration, T&E and Alternate Platform: System Environmental Test: System Environmental Test	1	2023	3	2023
HIJENKS System Integration, T&E and Alternate Platform: Launch System Safety Cert: Launch System Safety Cert	3	2023	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3422: *SHARC Surface Platform*	2.301	6.754	5.731	14.741	-	14.741	3.814	0.000	0.000	0.000	0.000	33.341
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Sensor Hosting Autonomous Remote Craft (SHARC) Surface Platforms demonstration project is part of the Department of Defense Third Offset Strategy as one element in the Sensor Grid category for 24/7 autonomy infused Situational Awareness (SA). This project will purchase Commercial-off-the-Shelf (COTS) SHARC Platforms (wave gliders) and integrate unique Government-owned classified mission payloads and enhanced capabilities including the detection of threats with persistence. The focus of this effort is to accelerate demonstration of capabilities to meet Combatant Commander (COCOM) requirements that do not exist elsewhere in DoD and provide the fleet with a low cost, asymmetric advantage in support of multiple classified missions. This includes persistent, autonomous situational awareness and early warning of submarines or related submarine activity in potential support of TASWO/TRAPS as well as broad area, clandestine implementation of capabilities that enhance Intelligence Preparation of the Battlefield (IPB) and strike missions. Successful payload integration and system demonstration will support high priority warfighting mission areas and future prototype operations. These capabilities will enable Concepts of Operation (CONOPS) development in an operationally relevant environment to demonstrate how these technologies can improve the SA to the battlespace Commanders.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Sensor Hosting Autonomous Remote Craft (SHARC)	6.754	5.731	14.741	0.000	14.741
Articles:	-	-	-	-	-

Description: This project will demonstrate the warfighting utility of multiple, long endurance platforms with classified payloads conducting critical Intelligence, Surveillance and Reconnaissance (ISR) missions with simultaneous, wideband data links for signal and imagery data transmission between host assets and Operational level processing systems. Emerging technologies and engineering innovations from Naval/DoD research and development and industry, will be integrated to demonstrate secure and reliable collection, analysis, tactical level access to host asset ISR data and fusion of ISR and targeting data from organic assets and sensors.

FY 2020 Plans:
- Conduct system level test, evaluation, and analysis to assess performance on baseline program sensors, payloads and delivery systems against vetted Measures of Effectiveness (MOE).
- Deliver 7 Systems and Assessment Reports from the baseline classified SHARC program to COCOM and PEOSUBS-PMS485 for potential transition of technology and consideration of lessons learned to support DSS Program of Record.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue requirements analysis and update component and subsystem specifications as required. Continue CONOPS development for execution of multiple prototype operations. - Integrate mature technologies developed in the areas of C2 and Information Assurance (IA), high data rate exchange, long-range multi-band and wideband links, software-defined modes, encryption, and signal processing modules. - Complete payload adaptation design for classified Intelligence Preparation of the Battlefield (IPB) mission. Conduct integration on SHARC, with functional lab and at-sea testing followed by mission equivalent demonstration. - Obtain six (6) SHARC platforms, payload systems, and associated subsystems for priority IPB Prototype Operations to meet COCOM ISR mission requirements. - Additional details are available at higher classification levels.					
FY 2021 Base Plans: FY 2021 Base Plans: - Complete development, integration and testing of twelve (12) SHARC platforms, payload systems, and associated subsystems for a total of sixteen (16) SHARC systems by the end of FY21. The full mission test requires a total of 20 SHARC systems to demonstrate the capability for priority IPB Prototype Operations to meet PACOM ISR mission requirements. Additional information is available at higher classification Levels. - Finalize C2, IA/Cybersecurity implementation for payload integration and IPB prototype mission execution and Complete CONOPS. - Conduct full up prototype mission testing, payload performance evaluation, analysis and assessment. - Incorporate engineering modifications based on system design, build, test, and analysis/assessment. - Execute government acceptance testing for all systems. - Develop design specifications and purchase support equipment to include storage and transport systems. - Complete design and build of the initial Rapid Deployment Systems (RDS). The RDS includes support equipment that will enable minimal manning for rapid deployment of the wave glider from multiple ships/vessels to meet mission requirements. - Full system integration, test and delivery of twenty prototype ready-for-issue systems to COCOM. - Design and build planned variants for baseline system to meet stakeholder CONOPS					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The increase from FY20 to FY21 is required to develop and integrate the remaining systems (total of 20) to meet PACOM mission requirements and is consistent with the overall program plan. An operationally relevant mission demonstration requires a total of 20 systems by the end of FY21 for final operational demonstration, assessment, and delivery for transition to a program of record (POR) in mid-FY22 as originally scheduled. Critical Program Execution and Full Mission Demonstration is being executed in FY21/22.					
Accomplishments/Planned Programs Subtotals	6.754	5.731	14.741	0.000	14.741

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

FY 2019: T&E Milestone: Developmental Test (DT) and assessment of initial payloads installed on SHARC platforms
FY 2020: T&E Milestone: DT and assessment of additional payloads installed on SHARC platforms
FY 2021: T&E Milestone: Build and validate readiness of integrated Prototype Operational units

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Requirements and CONOPS Development	MIPR	Naval Undersea Warfare Center (NUWC) : Keyport, WA	0.225	0.450	Oct 2018	0.600	Oct 2019	0.500	Oct 2020	-		0.500	0.000	1.775	-
System & Payload Design, Engineering, and Integration	MIPR	Space and Naval Warfare System Center Pacific (SSC : San Diego, CA	0.644	2.907	Oct 2018	1.919	Oct 2019	4.976	Oct 2020	-		4.976	0.000	10.446	-
Purchase COTS SHARC platforms	C/FFP	Space and Naval Warfare System Center Pacific (SSC : San Diego, CA	1.274	2.500	Dec 2018	1.772	Oct 2019	7.175	Dec 2020	-		7.175	0.000	12.721	-
		Subtotal	2.143	5.857		4.291		12.651		-		12.651	0.000	24.942	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation Phase	MIPR	PMS-485 Maritime Surveillance Systems, SSCPAC : San Diego, CA	0.158	0.245	Mar 2019	0.480	Mar 2020	1.110	Apr 2021	-		1.110	0.000	1.993	-
		Subtotal	0.158	0.245		0.480		1.110		-		1.110	0.000	1.993	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	MIPR	PMS-485 Maritime Surveillance Systems, SSCPAC : San Diego, CA	0.000	0.652	Oct 2018	0.960	Oct 2019	0.980	Oct 2020	-		0.980	0.000	2.592	-
		Subtotal	0.000	0.652		0.960		0.980		-		0.980	0.000	2.592	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	2.301	6.754		5.731		14.741		-		14.741	0.000	29.527	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3422 / *SHARC Surface Platform*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3422				
SHARC technology demonstration: Requirements and CONOPS Development: Requirements and CONOPS Development	1	2019	4	2020
SHARC technology demonstration: Purchase COTS SHARC platforms: Purchase COTS SHARC platforms	1	2019	2	2021
SHARC technology demonstration: Build/ Assemble/Integrate Phase/Lab Test: Build/ Assemble/Integrate Phase/Lab Test	1	2019	4	2021
SHARC technology demonstration: Test and Evaluation, Prototype Ops: Test and Evaluation, Prototype Ops	2	2020	4	2022
SHARC technology demonstration: Program Management: Program Management	1	2019	4	2022

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603382N / *Advanced Combat Systems Tech*	Project (Number/Name) 3423 / *LOCUST*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3423: *LOCUST*	0.013	1.879	2.960	3.561	-	3.561	6.425	5.949	0.000	0.000	0.000	20.787
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Low-Cost Uav Swarming Technology (LOCUST) demonstration is part of the Department of Defense (DOD) Third Offset Strategy as one element in the Effector Grid category for small autonomous systems. LOCUST leverages the BA-3 Innovative Naval Prototype program developing and demonstrating swarming technology. The BA-3 effort is developing both the air vehicle, UAS swarming behaviors, and miniaturized sensor systems. ONR has demonstrated an autonomous system capable of launching 33 UASs in 40 seconds and flying them in a coordinated swarm. This BA-4 effort is trailing the BA-3 demonstration of technologies by a fiscal quarter and then demonstrating the technology in operationally relevant environments with military mission applications. Due to limitation of funding, FY 2018 accomplishments were limited to just the planned warfighter workshops and program planning. The LOCUST budget and schedule have been adjusted accordingly to reflect this situation.

To achieve ability to operative in relevant environment with military applications, the LOCUST effort is ruggedizing the air platform to survive extended deployments in high shock and vibration environments while in the launchers as well as in-flight for adverse electromagnetic and weather conditions. Significant additional effort is being done to integrate the air platform, command and control, and launchers into and onto several different manned and unmanned host platforms for mission deployment. Scale-up considerations for manufacturing and supply-chain assurance/vulnerability are being pursued.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Low-Cost Uav Swarming Technology (LOCUST)	1.879	2.960	3.561	0.000	3.561
Articles:	-	-	-	-	-

Description: This Project focuses on demonstration of mixed-initiative UAV swarming behaviors, enabling the development of payload appropriate CONOPS/TTPs for Many Vehicle/Many Salvo swarms, and provides unmanned system capability to degrade threat Integrated Air Defense Systems (IADS) in support of follow-on manned system operations.

FY 2020 Plans:
In FY 2020, the LOCUST efforts will initiate transition from the Phase I efforts into Phase II demonstrating multi-domain launch of swarming UAVs' to provide information, surveillance, reconnaissance (ISR) and kinetic attack for strike of land and sea targets in support of follow-on manned missions. Specifically, Phase II will develop and demonstrate an unmanned undersea vehicle (UUV)-launched Swarm for conducting counter-Integrated Air Defense Systems missions in support of naval units. This project will demonstrate mixed-initiative UAV swarming behaviors developed by the BA-3 activity, enable the development of payload appropriate CONOPS/TTPs for

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3423 / *LOCUST*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Many Vehicle/Many Salvo swarms, and provide unmanned system capability to degrade threat IADS in support of follow-on manned system operations ***FY 2021 Base Plans:*** In FY 2021, the LOCUST efforts will continue activities initiated in FY2020 and conduct an operational demonstration of one mission scenario involving operator in-the-loop autonomous strike missions against adversary threat systems that will be completed in 2QFY2021. Activities will initiate towards a second mission relevant scenario addressing counters to adversary defensive systems. Additional technology areas being addressed are improved mission planning to minimize/reduce operator workload and manned/unmanned operations. Hardware procurements to support increased flight testing and complexity of demonstration scenarios is also planned. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change					
Accomplishments/Planned Programs Subtotals	1.879	2.960	3.561	0.000	3.561

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0602792N/3423: *LOCUST*	0.000	0.000	22.046	-	22.046	5.553	0.000	0.000	0.000	0.000	27.599
• RDTEN/0603801N/3423: *LOCUST*	0.000	0.000	12.750	-	12.750	3.396	0.000	0.000	0.000	0.000	16.146

Remarks

D. Acquisition Strategy

There are multiple phases for this non-acquisition project.

Phase 1 - Marine Corps Warfighting Laboratory (MCWL) Air Combat Element (ACE) will lead the Phase I effort in FY 2018 & FY 2019. MCWL will procure additional launchers, LOCUST platforms and payloads. MCWL will work with the Common Launch Tube Program of Record to procure the multiple missile Common Launch Tube. MCWL will task NAWC AD to help integrate the launcher system onto the MV-22 and support flight test and flight certification. MCWL will use a supporting Warfare Center to integrate the launcher onto a Marine Corps Polaris Corporation M-RZR vehicle or M-RZR trailer. MCWL ACE will closely coordinate with the BA-3 LOCUST program manager to procure the new 6" diameter, additive manufactured, air frame (purchase through BA-3 activity contract). MCWL Experimental Division

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3423 / *LOCUST*

will define CONOPS/TTPs, the experimental parameters and measures of effectiveness, and operational experiments suitable to apply the capability in a relevant operational environment to evaluate the military utility of the system to a small Marine Corps maneuver element. The Center for Naval Analysis will consolidate the post demonstration report for the systems military utility.

Phase II -ONR execute a multi-domain swarm effort in FY 2020-2023 to demonstrate the advantages of small swarming UAVs against adversary defenses. ONR will work with the Naval Warfare Development Center (NWDC) to develop CONOPS / TTPS for this mission capability and fleet experimentation. NSWC Panama City Division (NSWC PCD) will provide operational and logistics support for the launch and recovery of the vehicles. Initiation of Phase II in FY2020 intentionally follows the 6.3 INP by two fiscal years to allow the INP to develop and mature the miniaturized payloads required for an operational demo. Additionally, close coordination and involvement with acquisition community through these NWDC events and well as simulation exercises and the objective experiments and demonstrations is being done to shape requirements and budget submissions

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3423 / *LOCUST*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Multi-Rotor Platform Procur	MIPR	NRL : Wash, DC	0.013	0.000		0.000		0.000		-		0.000	0.000	0.013	-
Multi-Rotor Platform Payload	MIPR	MITRE : Mclean, VA	0.000	0.350	Dec 2018	0.000		0.000		-		0.000	0.000	0.350	-
Payload Procurement	C/CPFF	Raytheon : Tucson, AZ	0.000	0.704	Feb 2019	0.000		0.400	Nov 2020	-		0.400	0.000	1.104	-
Multi-Rotor Tests	MIPR	NSWC : Indian Head, MD	0.000	0.025	Feb 2019	0.000		0.000		-		0.000	0.000	0.025	-
Fixed-Wing Procurement	C/CPFF	Raytheon : Tuxson, AZ	0.000	0.800	Feb 2019	0.000		1.723	Nov 2020	-		1.723	0.000	2.523	-
Platform Specific Launcher Development	Various	Various : Various	0.000	0.000		1.290	Nov 2019	0.000		-		0.000	0.000	1.290	-
Command and Control Integration	Various	Various : Various	0.000	0.000		0.560	Nov 2019	0.000		-		0.000	0.000	0.560	-
Fixed Wing Tests	Various	Various : Various	0.000	0.000		0.950	Jun 2020	1.338	May 2021	-		1.338	0.000	2.288	-
		Subtotal	0.013	1.879		2.800		3.461		-		3.461	0.000	8.153	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Management	TBD	Not Specified : Not Specified	0.000	0.000		0.160	Oct 2019	0.100	Oct 2020	-		0.100	0.000	0.260	-
		Subtotal	0.000	0.000		0.160		0.100		-		0.100	0.000	0.260	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.013	1.879		2.960		3.561		-		3.561	0.000	8.413	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3423 / *LOCUST*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3423 / *LOCUST*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3423				
LOCUST Systems Demonstration - Phase I: Procure Multi Rotor Platforms: Procure Multi Rotor Platforms	1	2019	2	2019
LOCUST Systems Demonstration - Phase I: Multi-Rotor Platform Payload Integration: Multi-Rotor Platform Payload Integration	2	2019	3	2019
LOCUST Systems Demonstration - Phase I: Payload Procurement: Payload Procurement	3	2019	4	2019
LOCUST Systems Demonstration - Phase I: Multi-Rotor Tests: Multi-Rotor Tests	4	2019	4	2019
LOCUST Systems Demonstration - Phase I: Fixed-wing Procurement: Fixed-wing Procurement	2	2019	1	2020
LOCUST Systems Demonstration - Phase II: LOCUST Requirements Analysis: LOCUST Requirements Analysis	1	2020	2	2020
LOCUST Systems Demonstration - Phase II: Procure Coyote, Launcher and Payloads: Procure Coyote, Launcher and Payloads	2	2020	4	2022
LOCUST Systems Demonstration - Phase II: Coyote, Launcher and Payloads Integration: Coyote, Launcher and Payloads Integration	3	2021	4	2022
LOCUST Systems Demonstration - Phase II: Conduct Experiment: Conduct Experiment	3	2022	1	2023
LOCUST Systems Demonstration - Phase II: Assess technical performance and operational utility: Assess technical performance and operational utility	2	2023	2	2023
LOCUST Systems Demonstration - Phase II: Support CONOPS/TTP refinement and transition through User Operational Evaluation System delivery: Support CONOPS/ TTP refinement and transition through User	2	2023	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3424 / *Heterogeneous Collaborative Unmanned Systems (HCUS)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3424: *Heterogeneous Collaborative Unmanned Systems (HCUS)*	0.012	0.962	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.974
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project funding is being realigned in FY 2020 to project 3438 Innovative Naval Prototype (INP) Transition (6.4) within PE 0603382N Advanced Combat Systems Tech.

A. Mission Description and Budget Item Justification

The HCUS demonstration is part of the Department of Defense Third Offset Strategy as one element in the Effector Grid category for small autonomous systems. HCUS provides autonomous, tactical monitoring of an adversary's port-sized littoral area for an extended period of time with capability to apply limited offensive effects on-demand. Vehicles and sensors are intended to be used in contested environments - employing local communications nets, autonomous vehicle behavior, low bandwidth command links and local navigation with no requirement for GPS input.

HCUS systems can be encapsulated and deployed as a single payload, or a small number of payload packages designed for specific missions. The payloads can be carried into theater by various manned or unmanned platforms depending on the degree of stealth required. A week-long project demonstration will simulate covert deployment, operations of autonomous UAVs over the area of interest, data exfiltration to a remote operator, autonomous UAV recharging via USVs and/or UUVs, deployment of unmanned ground sensors for persistent sensing, and remote operator on-demand offensive attack on a simulated target.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Heterogeneous Collaborative Unmanned Systems (HCUS)	0.962	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	0.962	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3424 / *Heterogeneous Collaborative Unmanned Systems (HCUS)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

NSWCDD will provide Government oversight to the project and develop a multi-domain mission planning system compatible with the Aegis Combat System and Ship Self Defense System (SSDS) capable of tasking the JHU-APL autonomous systems. University Affiliated Research Center John Hopkins University: Applied Physics Laboratory will be responsible for the design and development of additive manufactured quad-copters, UUV launch system for UAV launch, low-profile USVs with commercial sensor systems, and unattended ground sensors (UGS) with a UGS deployment capability, the network backbone and long haul communications back to a combat system or Maritime Operations Center.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
HCUS System Development	MIPR	DLA : Alexandria, VA	0.000	0.416	Jan 2019	0.000		0.000		-		0.000	0.000	0.416	-
HCUS System Development	MIPR	Naval Surface Warfare Center DD : Panama City, FL	0.000	0.496	Dec 2018	0.000		0.000		-		0.000	0.000	0.496	-
HCUS System Development	MIPR	SPAWAR : San Diego, CA	0.000	0.050	Dec 2018	0.000		0.000		-		0.000	0.000	0.050	-
		Subtotal	0.000	0.962		0.000		0.000		-		0.000	0.000	0.962	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Management and Oversight	MIPR	NSWC : Dalhgren, VA	0.012	0.000		0.000		0.000		-		0.000	0.000	0.012	-
		Subtotal	0.012	0.000		0.000		0.000		-		0.000	0.000	0.012	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.012	0.962		0.000		0.000		-		0.000	0.000	0.974	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3424 / *Heterogeneous Collaborative Unmanned Systems (HCUS)*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3424 / *Heterogeneous Collaborative Unmanned Systems (HCUS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3424				
HCUS System Development: Procurement UUV Hardware: Procurement UUV Hardware	1	2019	4	2019
HCUS System Development: Conduct Experiment: Conduct Experiment	1	2019	4	2019

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3437 / *EMW/SEWIP/SSEE Accelerator*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3437: *EMW/SEWIP/SSEE Accelerator*	0.000	14.389	23.630	21.508	-	21.508	1.250	0.822	0.000	0.000	0.000	61.599
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This was a new project in FY 2019 - Electromagnetic Maneuver Warfare/Surface Electronic Warfare Improvement Program to improve real time Electro-Magnetic Maneuver Warfare operations.

A. Mission Description and Budget Item Justification

The Electromagnetic Maneuver Warfare/Surface Electronic Warfare Improvement Program/Ship's Signals Exploitation Equipment (EMW/SEWIP/SSEE) Accelerator is part of the Department of Defense Third Offset Strategy to improve real time Electro-Magnetic Maneuver Warfare operations. EMW/SEWIP/SSEE Accelerator leverages the S&T Budget Activity (BA)-3 Electro-Magnetic Maneuver Warfare technology developments specifically in cross platform operations. The BA-3 effort is developing high speed sensor and electro-magnetic networking, real time spectrum operations and passive targeting technologies. ONR has demonstrated elements of next generation networking, passive tracking, and cross platform combat system coordination. This BA-4 effort is trailing the BA-3 demonstration of technologies deploying and demonstrating the technology in operationally relevant environments with military mission applications. The deployment will allow the ONR to significantly reduce risk, incorporate early warfighter improvements and test with real world data and scenarios.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: EMW/SEWIP/SSEE Accelerator	14.389	23.630	21.508	0.000	21.508
Articles:	-	-	-	-	-
Description: EMW/SEWIP/SSEE accelerator builds off of two BA-3 efforts: Surface platform arrays, radios and control software were developed under the Multi-Link CDL System Future Naval Capability and airborne relay were developed within the High Altitude Relay and Routing Future Naval Capability. To date ONR has demonstrated 4-beam CDL surface arrays, radios and controls via land based motion simulators, while the airborne relay functionality has been demonstrated on a P-3 platform in a relevant environment. This was a new project for this PE in FY 2019 to develop integrated cross platform active and passive sensing solutions, next generation network and real time spectrum operations.					
FY 2020 Plans: FY 2020 efforts will develop dual frequency airborn network arrays and networking waveform; test compatibility of					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3437 / *EMW/SEWIP/SSEE Accelerator*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
airborne systems with fielded surface next gen network arrays; and, for the deployed surface systems, develop and field autojoin and low probability of intercept (LPI) waveforms. This investment will fund expand deployed network capabilities and provide one additional ship set and one airborne relay prototype; provide additional deployed ESM hardware and decoy technologies; and provide Fifth generation fighter integration. Shipsets to be procured include 1 shipboard and 1 airborne deployed prototype. ***FY 2021 Base Plans:*** - Continue developing the directional networking waveform to include routing along with dynamic spectrum allocation. A frequency division overlay will be incorporated into the waveform which will allow greater node capacity and reduced latency. The addition of software-defined networking capabilities will enable distributed sensor data dissemination and interoperability with legacy platforms that use nonstandard networking protocols. -Acquire additional hardware for expanded at sea testing aboard deployed surface platforms and continue the development of airborne systems. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease from FY20 to FY21 is the result of a FY21 funding realignment for navy priorities.					
Accomplishments/Planned Programs Subtotals	14.389	23.630	21.508	0.000	21.508

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Projects identified for execution under this project number are non-acquisition programs. Each project will develop a project plan to support project execution. Project plans will include a project schedule and technical requirements and objectives to measure project performance. Based on prior BA-3 work prototype contracts are in place and can be used to develop hardware for at sea trials. Software and ship installation will are expected to use a combination of existing shipyard contracts and government field activities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3437 / *EMW/SEWIP/SSEE Accelerator*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prototype Development	MIPR	NSWC : various	0.000	6.056	Oct 2018	12.910	Oct 2019	11.763	Oct 2020	-		11.763	0.000	30.729	-
Prototype Development	PO	NAWC : various	0.000	3.333	Oct 2018	6.747	Oct 2019	6.145	Oct 2020	-		6.145	0.000	16.225	-
Prototype Development	MIPR	SUPSHIP : Bath Maine	0.000	2.000	Oct 2018	1.987	Oct 2019	1.800	Oct 2020	-		1.800	0.000	5.787	-
Prototype Development	MIPR	NRL : Washington, DC	0.000	3.000	Oct 2018	1.986	Oct 2019	1.800	Oct 2020	-		1.800	0.000	6.786	-
Prototype Development	Various	TBD : TBD	0.000	0.000	Sep 2020	0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.000	14.389		23.630		21.508		-		21.508	0.000	59.527	N/A

Remarks

NSWC: Prototype development of shipboard next generation networking apertures and EMW cross platform software.
NAWC: Prototype development of airborne next generation apertures and networking software.
SUPSHIP: Installation and testing of Cross platform EMW accelerator prototype on 2 Navy test vessels.
NRL: Installation and testing of Cross platform EMW accelerator prototype on Navy maritime patrol aircraft.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	14.389		23.630		21.508		-		21.508	0.000	59.527	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3437 / *EMW/SEWIP/SSEE Accelerator*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3437 / *EMW/SEWIP/SSEE Accelerator*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3437				
EMW/SEWIP/SSEE Accelerator: K, Ku Airborne Relay: K, Ku Airborne Relay	1	2019	3	2021
EMW/SEWIP/SSEE Accelerator: Airborne Testing: Airborne Testing	3	2020	4	2021
EMW/SEWIP/SSEE Accelerator: Multi-Beam Ku Arrays: Multi-Beam Ku Arrays	1	2019	2	2020
EMW/SEWIP/SSEE Accelerator: System Controller: System Controller	1	2020	4	2021
EMW/SEWIP/SSEE Accelerator: DDG - Test & Integrate: DDG - Test & Integrate	1	2020	4	2021
EMW/SEWIP/SSEE Accelerator: Networking Waveform: Networking Waveform	2	2019	3	2021
EMW/SEWIP/SSEE Accelerator: Virtual Twin Distributive Combat System: Virtual Twin Distributive Combat System	1	2019	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*				**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3438: *Innovative Naval Prototype (INP) Transition (6.4)*	0.000	12.947	19.907	2.219	-	2.219	4.996	5.085	34.716	35.413	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This is a new project unit (PU) in FY 2019. This PU is intended to provide advanced component development and prototyping for selected technologies maturing out of or supporting ONR's Leap Ahead Technology (LA-Tech) and Innovative Naval Prototype (INP) BA3 portfolio.

Changes from FY 2019 to FY 2020 includes the new HIJENKS program activity initiated in the PE and Project Unit 3438 as work in this program is transitioning in FY 2020 from Budget Activity (BA) 3 Advanced Technology Development to the BA4 Advanced Component Development and Prototypes phase of development.

A. Mission Description and Budget Item Justification

The efforts described in this mission area address the advanced component development and prototype demonstration associated with ONR's Innovative Naval Prototypes (INP) Program and the Leap Ahead Technology (LA-Tech) investments. INP and LA-Tech investments represent game changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature as they would dramatically change the way naval forces fight. INPs and LA-Techs push the imagination of our nation's technical talent to deliver transformational warfighting capabilities. Successful demonstrations are intended to present the Department of the Navy with a programmatic challenge as these new capabilities can lead to the obsolescence of existing capabilities and significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future.

ONR manages a continuum of INP and LA-Tech development from BA2 to BA3 to BA4. The goal of these BA4 investments is to further mature development and expend efforts necessary to evaluate integrated technologies, representative modes or prototype systems in high fidelity and realistic operating environments. This BA4 investment includes system specific efforts that help expedite technology transition from the laboratory to operational use. Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems and may involve risk reduction initiatives. Projects in this category involve efforts prior to Milestone B and are referred to as advanced component development activities and include technology demonstrations. It is the goal of these projects to achieve Technology Readiness Levels 6 or 7. Successful experimentation and demonstration highlights the viability of new technological capabilities that could be implemented if an acquisition program were to be established to support further development. The portfolio is periodically refreshed through the selection of new INPs and LA-Tech investments as existing ones are completed.

INP, LA-Tech, and supporting technology investments may include R-2 Activities mission areas such as Unmanned and Autonomous Systems, Directed Energy / Electric Weapons, Electromagnetic Maneuver Warfare, Cyber Warfare, and Undersea Warfare.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Unmanned and Autonomous Systems: Advanced ASW sensor array package for medium sized unmanned surface vehicles. ***Articles:*** ***Description:*** This is a new project beginning in FY 2019 that will develop, integrate, experiment and demonstrate onboard a medium sized unmanned surface vehicle an advanced ASW sensor array package. This package is intended to be used on a platform being developed with Innovative Prototype (INP) and Leap Ahead Technology (LA-Tech) investments. That platform will serve as host for a wide variety of operationally focused capability payloads such as the advance ASW sensor array package being developed in this activity. These warfighter focused packages will enable Unmanned and Autonomous Systems platforms to support the requirement to augment manned systems with less expensive, unmanned, fully autonomous systems that can operate in all domains. ***FY 2020 Plans:*** Prototype demonstration, in an operational environment, by deploying, recovering and towing an advanced ASW sensor array package capable of operational use onboard a medium sized autonomous, unmanned surface vehicle. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project ended in FY20	5.291 -	5.315 -	0.000 -	0.000 -	0.000 -
Title: Unmanned and Autonomous Systems: Advanced ASW kinetic effects package for medium sized unmanned surface vehicle. ***Articles:*** ***Description:*** This is a new project beginning in FY 2019 that will develop, integrate, experiment and demonstrate onboard a medium sized unmanned surface vehicle an advanced ASW kinetic effects package. This capability package is intended to be used on a platform being developed with Innovative Prototype (INP) and Leap Ahead Technology (LA-Tech) investments. That platform will serve as host for a wide variety of operationally focused capability payloads such as the advance ASW kinetic effects package being developed	5.656 -	5.815 -	0.000 -	0.000 -	0.000 -

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
in this activity. These warfighter focused packages will enable Unmanned and Autonomous Systems platforms to support the requirement to augment manned systems with less expensive, unmanned, fully autonomous systems that can operate in all domains. ***FY 2020 Plans:*** Prototype demonstration, in an operational environment, by launching from a manned vessel and engagement of a surrogate of an advanced ASW kinetic effects package capable of operational use onboard a medium sized autonomous, unmanned surface vehicle. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease from FY 2020 to FY 2021 is a result of the project ending in FY 2020					
Title: Unmanned and Autonomous Systems: Advanced aerial lift package for medium sized unmanned surface vehicle.	2.000	3.967	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This is a new project beginning in FY 2019 that will develop, integrate, experiment and demonstrate onboard a medium sized unmanned surface vehicle an advanced aerial lift package. This capability package will dramatically increase the range of regard of various sensor payloads that will be carried aloft. It is intended to be used on a platform being developed with Innovative Prototype (INP) and Leap Ahead Technology (LA-Tech) investments. That platform will serve as host for a wide variety of operationally focused capability payloads such as the advance aerial lift package being developed in this activity. These warfighter focused payloads will enable Unmanned and Autonomous Systems platforms to support the requirement to augment manned systems with less expensive, unmanned, fully autonomous systems that can operate in all domains. ***FY 2020 Plans:*** Prototype demonstration, in an operational environment, by demonstrating automated TALONs, an advanced aerial lift package capable of operational use, onboard a medium sized autonomous, unmanned surface vehicle. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project ending in FY 2020					
Title: HIJENKS Operational Acceleration	0.000	4.810	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: HIJENKS System Integration, T&E and Alternate Platform development and test activity will focus on software development for integration of new High Power Microwave (HPM) capabilities into control systems and mission planning software. Technical objectives of HIJENKS focus on improving the robustness of HPM systems in new airborne platforms and improving the mission planning capability for HPM engagement scenarios. The prototype will mature several of these areas to enable operational capability in a phased approach for multi-platform integration and demonstration combined with validation/certification paths of software and hardware architectures. Activities are intended as risk reduction, operational analysis, and system level environmental test in order to reduce transition program cost for platform capability. Phase 1 FY 2020 The first phase of the prototype will focus on initiating platform integration activities for software, mission planning and environmental hardening and alternate platform analysis ***FY 2020 Plans:*** HIJENKS System Integration, T&E and Alternate Platform Phase 1 FY 2020 Initiate first phase of the prototype development to focus on initiating platform integration activities for software, mission planning and environmental hardening and alternate platform analysis. Detailed FY 2020 technical plans and objectives at a higher classification to be briefed separately upon request. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY2021, PE 0603382N Advanced Combat System Tech, funding moves from PU 3438 Innovative Naval Prototype (INP) Transition (6.4)to new PU 3416 HIJENKS.					
Title: Advanced Long Range Targeting (ALRT)	0.000	0.000	2.219	0.000	2.219
Articles:	-	-	-	-	-
Description: This is a new effort beginning in FY 2021 that transitioned out of 6.3 FNC into 6.4 INP. This effort will remain in INP transition for a period of one year for integration experimentation and demonstration of an Advanced Long Range Targeting (ALRT) capability. This capability will utilize a family of systems that will dramatically increase the range at which the U.S. Navy can provide targeting solutions and hold targets at risk. It will cross multiple platforms, sensors and warfare domains and leverage technology developments from a broad set of Future Naval Capability (FNC) and Innovative Prototype (INP) investments. It will perform integration, experimentation and demonstration of sensors, communications and battle management command and control (BMC2) technologies to enable integrated and distributed forces that are capable of dynamic synchronized actions ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Efforts will focus on planning for the integration, experimentation and demonstration activities including obtaining the needed certifications and technology. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase from FY 2020 to FY 2021 is a result of the Advanced Long Range Targeting (ALRT) efforts starting in FY21.					
Accomplishments/Planned Programs Subtotals	12.947	19.907	2.219	0.000	2.219

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The projects identified for execution are non-acquisition programs. The Office of Naval Research will provide Government oversight to the projects. Each project will develop a project plan to support execution. Project plans will include a schedule and the necessary technical requirements and objectives to measure and evaluate performance. Additionally, each project will be subjected to experimentation then demonstrated in operationally relevant environments to assess their ability to meet warfighter requirements. Project deliverables will include the actual integrated hardware/software prototype systems, test reports, and technical data, necessary to support decision making. These decisions include the transition of technologies to acquisition, further refinement of the technology, or termination and reinvestment of remaining funds to other technologies that add military value.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced ASW sensor payload	MIPR	NUWC : Newport, Rhode Island	0.000	1.200	Oct 2018	1.340	Oct 2019	0.000		-		0.000	0.000	2.540	-
Advanced ASW sensor payload	MIPR	JHU-APL : Columbia, Maryland	0.000	2.100	Oct 2018	1.340	Oct 2019	0.000		-		0.000	0.000	3.440	-
Advanced ASW sensor payload	MIPR	SSC-PAC : San Diego, California	0.000	0.890	Oct 2018	1.302	Oct 2019	0.000		-		0.000	0.000	2.192	-
Advanced ASW sensor payload	MIPR	NASA Jet Propulsion Lab : Pasedena, California	0.000	1.157	Oct 2018	1.333	Oct 2019	0.000		-		0.000	0.000	2.490	-
Advanced ASW kinetic payload	MIPR	PSU -ARL : State College, Pennsylvania	0.000	4.000	Oct 2018	3.889	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced ASW kinetic payload	MIPR	SSC-PAC : San Diego, California	0.000	1.400	Oct 2018	1.026	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced ASW kinetic payload	MIPR	NASA Jet Propulsion Lab : Pasedena, California	0.000	0.312	Oct 2018	0.900	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced aerial lift payload	MIPR	NSWC-CD : Bethesda, Maryland	0.000	0.200	Oct 2018	1.336	Oct 2019	0.000		-		0.000	0.000	1.536	-
Advanced aerial lift payload	MIPR	NASA Jet Propulsion Lab : Pasedena, California	0.000	0.000	Oct 2018	1.335	Oct 2019	0.000		-		0.000	0.000	1.335	-
Advanced aerial lift payload	MIPR	SSC-PAC : San Diego, California	0.000	1.688	Oct 2018	1.296	Oct 2019	0.000		-		0.000	0.000	2.984	-
HIJENKS Mission Planning Software Development	WR	NAVAIR : Patuxent River, Md	0.000	0.000		0.330	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
HIJENKS Launch System Software/Hardware Integration	WR	NAVAIR : Patuxent River, Md	0.000	0.000		0.500	Nov 2019	0.000		-		0.000	0.000	0.500	-
HIJENKS System Requirements and CONEMPS	WR	NAVAIR : Patuxent River, Md	0.000	0.000		0.250	Oct 2019	0.000		-		0.000	0.000	0.250	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
HIJENKS Airborne Launch Study	C/CPFF	Platform Prime : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
HIJENKS Mission Analysis	FFRDC	JH APL : Laurel, MD	0.000	0.000		0.303	Oct 2019	0.000		-		0.000	0.000	0.303	-
HIJENKS T&E Launcher	C/CPFF	Platform Prime : TBD	0.000	0.000		0.300	Apr 2020	0.000		-		0.000	0.000	0.300	-
HIJENKS Safe and Arm Design	C/FFP	Platform Prime : TBD	0.000	0.000		0.500	Jan 2020	0.000		-		0.000	0.000	0.500	-
HIJENKS Environmentally Hardened Payload Activities	C/UCA	DOTC - Multiple Awards : Various	0.000	0.000		0.500	Mar 2020	0.000		-		0.000	0.000	0.500	-
HIJENKS Target Procurement and Testing	WR	NRL : Washington, DC	0.000	0.000		0.500	Oct 2019	0.000		-		0.000	0.000	0.500	-
HIJENKS Hard Tube Capability	C/CPFF	Multiple Awards - Various : TDB	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
HIJENKS T&E Platform Payload Source Devlopment	C/UCA	DOTC - Multiple Awards : Various	0.000	0.000		0.927	Nov 2019	0.000		-		0.000	0.000	0.927	-
HIJENKS T&E Platform-Payload Source Development	C/BPA	Lockheed Martin, : Grand Prairie, TX	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
HIJENKS Program Support	WR	NSWCDD and NAWCWD : Dahlgren, VA	0.000	0.000		0.200	Oct 2019	0.000		-		0.000	0.000	0.200	-
HIJENKS T&E Platform-Payload Source Development	C/BPA	General Atomics : San Diego, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
HIJENKS T&E Platform-Payload Source Development	WR	Raytheon, Albuquerque, NM : Albuquerque, NM	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
NSWCDD Government Pulsed Power GFE Hardware	WR	NSWCDD Dahlgren, VA : Dahlgren, VA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
ALRT BMC2 Integration	C/CPFF	TBD : TBD	0.000	0.000		0.000		0.924	Oct 2020	-		0.924	0.000	0.924	-
ALRT Program Support	WR	TBD : TBD	0.000	0.000		0.000		0.700	Oct 2020	-		0.700	0.000	0.700	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ALRT Sensor IntegrationALRT Sensor Integration	C/CPFF	TBD : TBD	0.000	0.000		0.000		0.595	Oct 2020	-		0.595	0.000	0.595	-
		Subtotal	0.000	12.947		19.907		2.219		-		2.219	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	12.947		19.907		2.219		-		2.219	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3438 / *Innovative Naval Prototype (INP) Transition (6.4)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3438				
Unmanned and Autonomous Systems: Advanced ASW sensor payload for medium sized unmanned surface vehicles: Advanced ASW sensor payload for medium sized unmanned surface vehicles	1	2019	4	2020
Unmanned and Autonomous Systems: Advanced ASW kinetic payload for medium sized unmanned surface vehicle: Advanced ASW kinetic payload for medium sized unmanned surface vehicle	1	2019	4	2020
Unmanned and Autonomous Systems: Advanced aerial lift payload for medium sized unmanned surface vehicle: Advanced aerial lift payload for medium sized unmanned surface vehicle	1	2019	4	2020
ALRT: Sensor Integation: Sensor Integration	1	2020	4	2020
ALRT: BMC2 Integration: BMC2 Integration	1	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603382N / *Advanced Combat Systems Tech*	**Project (Number/Name)** 3443 / *Advanced Long Range Targeting (ALRT)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3443: *Advanced Long Range Targeting (ALRT)*	0.000	0.000	0.000	0.000	-	0.000	7.940	9.051	14.989	15.289	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This capability will utilize a family of systems that will dramatically increase the range at which the U.S. Navy can provide targeting solutions and hold targets at risk. It will cross multiple platforms, sensors and warfare domains and leverage technology developments from a broad set of Future Naval Capability (FNC) and Innovative Prototype (INP) investments. It will perform integration, experimentation and demonstration of sensors, communications and battle management command and control (BMC2) technologies to enable integrated and distributed forces that are capable of dynamic synchronized actions. Activity in this phase will focus on prototyping, integration, experimentation and demonstration activities to transition this capability to the U.S. Navy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	136.397	116.113	407.800	52.358	-	52.358	57.289	57.129	58.270	59.431	Continuing	Continuing
1234: *Unmanned Surface Vehicle (USV)*	103.279	27.703	31.519	19.167	-	19.167	18.929	19.304	19.684	20.073	Continuing	Continuing
2989: *Barracuda*	20.572	27.739	28.641	33.191	-	33.191	38.360	37.825	38.586	39.358	Continuing	Continuing
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	273.327	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	273.327
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	50.413	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.413
3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	2.690	23.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.590
9999: *Congressional Adds*	12.546	57.981	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	70.527

Note

Beginning in FY21, funding for Projects 3066, 3067, and 3428 was realigned to PE 0603178N.

A. Mission Description and Budget Item Justification

This program element provides resources for development of mine countermeasures systems to provide minehunting, minesweeping, and mine neutralization to counter known and projected mine threats. The mine countermeasures systems provide mobile, quick reaction forces capable of land- or sea-based minehunting and minesweeping operations worldwide. Resources are for developing and deploying advanced minehunting and minesweeping systems and the intelligence and oceanographic capabilities that will enable mine warfare superiority. Tactics and techniques used vary across a diversity of environments and a diversity of threats, including both asymmetric and emerging. Resources provide for systems and support of mine warfare systems, maritime systems, and expeditionary systems to allow for continuous operations of the Navy's warships and support vessels, other military vessels, and commercial vessels. Core capabilities include forward presence, deterrence, sea control, power projection, maritime security, humanitarian assistance and disaster response to maintain freedom of the seas. Increased capability includes conducting minefield reconnaissance (mine density and location) at high area search rates, improving detection capability, decreasing sensor false alarm rates, reducing or eliminating post-mission analysis detect, classify, identify, decide time, improving neutralization time, improving network communications, automatic target recognition, and achieving in-stride detect-to-engage capability. Concept of operations includes development of cooperative, unmanned, modular systems; the establishment of a capable networked command and control system; and standing up an accurate and interactive environmental system with the ability to form and disseminate a Common Environmental Picture. Efforts benefit the Mine Countermeasure (MCM) force by transforming the Navy from the platform-centered legacy set of systems to a capability-centered force that is distributed, networked, and able to provide unique maritime influence and access across the entire maritime domain.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*

The Surface Mine Countermeasures (SMCM) programs are in general platform independent and will provide detection, classification, localization, identification, neutralization, and influence clearance capabilities. Programs develop: (1) unmanned minehunting capability for surface platforms; (2) the integration and improvement of new and existing systems; (3) support for systems which detect, localize, classify, identify, and neutralize all mine types across MCM Avenger Class and other platforms; (4) systems for neutralizing mines and light obstacles through the entire water column to include deep water, open water, shallow water, very shallow water, surf zones, and beach landing craft zones in support of operations; (5) integrate hardware for experimental testing related to surface ship, aircraft, and other cross platform applications; and (6) provide for the future unmanned portion of the Future Surface Combatant (FSC) strategy.

Medium Unmanned Surface Vehicles (MUSVs) and Large Unmanned Surface Vessels (LUSVs) are segments of the Navy's Unmanned Surface Vehicle Family of Systems (FoS). MUSV is defined as having a reconfigurable mission capability which is accomplished via modular payloads with an initial mission capability to support Battlespace Awareness through Intelligence, Surveillance and Reconnaissance (ISR) and Electronic Warfare (EW). LUSV is defined as having a reconfigurable, multi-mission capability which is accomplished via an organic warfare capability and may be augmented with additional modular payloads. Initial LUSV missions include Anti-Surface Warfare (ASuW) and Strike. MUSVs and LUSVs provide low cost, high endurance, reconfigurable ships able to accommodate various payloads for unmanned missions and augment the Navy's manned surface force. MUSVs and LUSVs will be capable initially of semi-autonomous operation, with operators in-the-loop or on-the-loop. USV Command and Control (C2) will be maintained via the afloat element (i.e., embarked on a United States Navy (USN) combatant/support ship) or via the ashore element (C2 station ashore). While MUSV and LUSV will logically share common Government Furnished Equipment(GFE) C2 systems to support fleet integration and operations and may share other autonomy and mechanical technologies (depending on acquisition approaches), they will be primarily differentiated by size and cost as driven by payload capability, capacity and LUSV's organic warfare capability.

Future missions for both MUSV and LUSV will be informed by the Navy's Future Surface Combatant Force (FSCF) Analysis of Alternatives (AoA) and as future payloads and concept of operations (CONOPs) are refined. Under the FSCF, MUSV and LUSV will be referred to as Future Surface Combatant USVs (FSC USVs) and are projected to include missions for Anti-Submarine Warfare (ASW), Logistics, MCM, Counter Swarm, Armed Escort, and Mine Warfare (i.e., mining). MUSV and LUSV are key enablers of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to forward deploy (alone or in teams/swarms), team with individual manned combatants or augment battle groups. Fielding of MUSV and LUSV will provide the Navy increased capability and necessary capacity at lower procurement and sustainment costs, reduced risk to sailors and increased readiness by offloading missions from manned combatants.

While unmanned surface vehicles are new additions to fleet units, MUSV and LUSV are intended to combine robust and proven commercial vessel designs with existing military payloads to rapidly and affordably expand the capacity and capability of the surface fleet. Both programs benefit from years of investment and full scale demonstration efforts in autonomy, endurance, command and control, payloads and testing from the Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/ Sea Hunter (FY 2017 to FY 2021) and Office of the Secretary of Defense Strategic Capabilities Office (OSD SCO) Ghost Fleet Overlord Large USV experimentation effort (FY 2018 to FY 2021). The combination of fleet-ready C2 solutions developed by the Ghost Fleet Overlord program and initial man-in-the-loop or man-on-the-loop control will reduce the risk of fleet integration of unmanned surface vehicles and allow autonomy and payload technologies to develop in parallel with fielding vehicles with standardized interfaces.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*

These efforts are broken out into three (3) Project Units (PUs): Medium Unmanned Surface Vehicle (MUSV) (Project 3428), Large Unmanned Surface Vessel (LUSV) (Project 3066) and Unmanned Surface Vehicle Enabling Capabilities (Project 3067).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	120.348	507.000	813.251	-	813.251
Current President's Budget	116.113	407.800	52.358	-	52.358
Total Adjustments	-4.235	-99.200	-760.893	-	-760.893
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-99.200			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.013	0.000			
• SBIR/STTR Transfer	-4.222	0.000			
• Program Adjustments	0.000	0.000	-760.963	-	-760.963
• Rate/Misc Adjustments	0.000	0.000	0.070	-	0.070

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Medium Displacement Unmanned Surface Vehicle*	40.519	0.000
Congressional Add: *Navy Identified MCM USV Requirement*	13.603	0.000
Congressional Add: *Navy Identified UISS Requirement*	3.859	0.000
Congressional Add Subtotals for Project: 9999	57.981	0.000
Congressional Add Totals for all Projects	57.981	0.000

Change Summary Explanation

Program Adjustments:
FY19: -$4,222K SBIR, -$13K miscellaneous reduction
FY20: -$79,200K Project 3066 long lead material early to need; -$20,000K Project 3066 initial incremental non-VLS concept design only
FY21: -$296,916K LUSV program adjustment; -$464,047K USV PE re-alignment; +$70K rate adjustments

Technical: Not applicable.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1234: *Unmanned Surface Vehicle (USV)*	103.279	27.703	31.519	19.167	-	19.167	18.929	19.304	19.684	20.073	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

In FY 2019, UISS received a Congressional Add of $4.000M in Project Unit 9999/C444. In FY 2019, MCM USV received a Congressional Add of $14.100M in Project Unit 9999/C443. In FY 2020, the UISS program was subsumed into the MCM USV program.

A. Mission Description and Budget Item Justification

This project provides resources for development, improvement and integration of Unmanned Surface Vehicle (USV) Mine Countermeasure (MCM) systems. A description of the major planned programs includes the following:

1) The Unmanned Influence Sweep System (UISS) utilizes an Unmanned Surface Vehicle (USV) integrated with an Unmanned Surface Sweep System (US3), a magnetic/acoustic sweep system developed to sweep acoustic/magnetic influence mines. It can be deployed from the Littoral Combat Ship (LCS) or a Vessel of Opportunity (VOO).

2) Mine Hunting USVs (MHUs) were delivered in FY 2014 to 5th Fleet in response to an Urgent Operational Need (UON) from Naval Forces Central Command concerning MCM capacity and capability gaps. Four systems (referred to as MHUs 1-4) were provided to Combined Task Force (CTF) 52 to conduct Minehunting Operations. Each MHU consists of a USMI Naval Special Warfare (NSW) 11-meter Rigid Hull Inflatable Boat (RHIB), which was converted to a USV by Naval Undersea Warfare Center (NUWC) Division Newport, and tows an AN/AQS-24B Minehunting sonar. The systems are controlled from a Command and Control (C2) container located on either an underway host platform or on pier-side. MHUs 1-4 are currently in sustainment and will support CTF52 until MCM Mission Packages are deployed to United States 5th Fleet (C5F) Area of Responsibility (AOR). In FY 2016-2017, Speed to Fleet (S2F) funding supported the design and fabrication of an additional minehunting asset (referred to as "MHU 5") based on the MCM USV craft and integrating the AQS-24B. Beyond FY 2017, all future efforts with MHU 5 are within the MCM USV program.

3) The Mine Countermeasures Unmanned Surface Vehicle (MCM USV) program leverages the USV from the UISS Program of Record (PoR) and adds a modular mission capability through the addition of multiple payloads. MCM USV w/ AQS-20C integrates the existing AQS-20C minehunting sonar. MCM USV w/ AQS-24B continues the Minehunting efforts. In FY 2019, the MCM USV program began initial design efforts to support integration with a Mine Neutralization capability (Barracuda). Minesweeping payloads will be subsumed by the MCM USV PoR in FY 2020.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: UISS Product Development	0.958	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: UISS Support	1.225	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: UISS Test and Evaluation	1.600	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: UISS Management Services	0.130	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: MHU Support	0.900	0.913	0.926	0.000	0.926
Articles:	-	-	-	-	-
FY 2020 Plans: - Provide program management, engineering and logistics support for product improvements to forward-deployed MHU 1-4 USVs and C2 Station. Maintain Cybersecurity compliance by developing, managing and installing software updates on fielded MHUs and the C2 container. ***FY 2021 Base Plans:*** - Provide program management, engineering and logistics support for product improvements to forward-deployed MHU 1-4 USVs and C2 Station. Maintain Cybersecurity compliance by developing, managing and installing software updates on fielded MHUs and the C2 container. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Minor increase in FY 2021 for continued MHU support.					
Title: MCM USV Product Development	14.499	19.184	11.460	0.000	11.460
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete integration of an AQS-20C and AQS-24B with the MCM USV. - Demonstrate system capability from LCS and/or shore operations through Integration Testing. - Finalize technical data packages for MCM USV and sonar deploy and retrieve systems. - Continue integration testing with sonar payloads. - Continue Engineering Change Proposal (ECP) development for EDM and LRIP units. - Commence systems engineering efforts in support of LRIP production integration and test efforts.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue tactics development, requirements definition and design of Mine Neutralization (Barracuda) payload and integration with MCM USV. ***FY 2021 Base Plans:*** - Continue tactics development, requirements definition and design of Mine Neutralization (Barracuda) payload and integration with MCM USV. - Achieve Ready for Training (RFT) status. - Commence MCM MP Development Testing (DT) and Technical Evaluation. - Conduct MCM USV + MH DT and User Operational Evaluation System (UOES). - Continue ECP development for Engineering Development Model (EDM), Low Rate Initial Production (LRIP), and Full Rate Production (FRP) units. - Continue systems engineering efforts in support of program and test efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in FY 2021 due to the completion of integration of the AQS-20C and AQS-24B with the MCM USV in FY 2020.					
Title: MCM USV Support	4.000	5.532	3.295	0.000	3.295
Articles:	-	-	-	-	-
FY 2020 Plans: - Support testing and assessment of system capabilities to determine Military utility. - Conduct efforts in support of Full Rate Production (FRP) preparations and Request for Proposal (RFP) release. - Continue to update MCM USV documentation to include Mine Neutralization, Minehunting, and Minesweeping. - Procure initial spares for test events. - Continue engineering, management and logistics support to achieve FRP decisions in FY 2021. - Continue to support MCM MP integration and testing. - Conduct efforts in support of FRP source selection and award. ***FY 2021 Base Plans:*** - Continue to support testing and assessment of system capabilities to determine Military utility. - Support program efforts under the USV Indefinite Delivery, Indefinite Quantity contract. - Continue to update MCM USV documentation to include Mine Neutralization, Minehunting, and Minesweeping.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Procure additional spares for test events. - Continue to support MCM MP integration and testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in FY 2021 due to the completion of engineering, management and logistics support for the FRP decision in FY 2021.					
Title: MCM USV Test and Evaluation	4.150	5.500	3.255	0.000	3.255
Articles:	-	-	-	-	-
FY 2020 Plans: - Conduct UISS IOT&E testing - Continue contractor integration testing of MCM USV w/ AQS-24B and MCM USV w/ AQS-20C. - Conduct UOES testing with AQS-20C and AQS-24B. - Commence MCM USV DT with AQS-20C. - Commence MCM MP DT support. - Conduct UISS test and evaluation efforts associated with ECP incorporation. ***FY 2021 Base Plans:*** - Continue MCM MP DT support. - Conduct MCM USV test and evaluation efforts associated with ECP incorporation. - Commence support of MCM MP Technical Evaluation efforts. - Complete contractor integration testing of MCM USV w/ AQS-24B and MCM USV w/ AQS-20C. - Complete MCM USV DT with AQS-20C. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in FY 2021 due to the completion of contractor integration testing and UOES testing.					
Title: MCM USV Management Services	0.241	0.390	0.231	0.000	0.231
Articles:	-	-	-	-	-
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Provide program planning, management and acquisition document updates for the MCM USV program. - Conduct FRP proposal evaluation and manage award of FRP contract. ***FY 2021 Base Plans:*** - Provide program planning, management and acquisition document updates for the MCM USV program. - Manage FRP contract and options. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in FY 2021 due to the award of the FRP contract in FY 2021.					
Accomplishments/Planned Programs Subtotals	27.703	31.519	19.167	0.000	19.167

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 0603596N: *LCS Mission Modules*	5.000	1.800	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	64.129
• OPN/1601: *LCS MCM Mission Modules*	98.901	64.789	218.822	-	218.822	222.754	234.330	243.187	247.949	1,111.812	2,666.795
• RDTE/0603502N/9999: *Congressional Add*	57.981	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	70.527
• OPN/2622: *Minesweeping System Replacement*	32.367	19.448	15.744	-	15.744	16.301	16.811	17.020	17.345	Continuing	Continuing

Remarks

RDT&E/0603596N - Funding shown only reflects funding for required USV development efforts.

RDT&E/0603502N/9999 - The above funding line accounts for several programs, of which the Unmanned Surface Vehicle programs are only a portion.

OPN/1601 - The above funding line accounts for several programs, of which the Unmanned Surface Vehicle programs are only a portion.

OPN/2622 - The above funding line accounts for several programs, of which the Unmanned Surface Vehicle programs are only a portion.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

D. Acquisition Strategy

UISS - Requirements are documented in the Unmanned Influence Sweep System (UISS) Capability Production Document (CPD). An Engineering and Manufacturing Development (E&MD) contract was awarded in FY 2014 with options for Low Rate Initial Production (LRIP) in FY 2019. In FY 2019-2020, MCM USV is developing a Capability Development Document (CDD) leveraging existing requirements (UISS, AN/AQS-20, MCM MP, etc.). In FY 2021, MCM USV anticipates a Full Rate Production (FRP) decision and will conduct a full and open competition for FRP contract(s). In FY 2020, MCM USV anticipates LRIP awards for up to 4 craft with sweep, following a Milestone C Decision.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603502N / *Surface & Shallow Water MCM*	Project (Number/Name) 1234 / *Unmanned Surface Vehicle (USV)*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Product Development	C/CPIF	Textron Systems, Inc : Hunt Valley, MD	32.187	0.958	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MHU: Product Development	SS/CPFF	JHU APL : Laurel, MD	12.215	0.000		0.000		0.000		-		0.000	0.000	12.215	-
MHU: Product Development	C/FPIF	Textron Systems, Inc : Hunt Valley, MD	7.545	0.000		0.000		0.000		-		0.000	0.000	7.545	-
MHU: Product Development	WR	NSWC PC : Panama City, FL	0.922	0.000		0.000		0.000		-		0.000	0.000	0.922	-
MHU: Product Development	WR	NUWC N : Newport, RI	0.740	0.000		0.000		0.000		-		0.000	0.000	0.740	-
MHU: Product Development	WR	NSWC CD : Bethesda, MD	0.235	0.000		0.000		0.000		-		0.000	0.000	0.235	-
MHU: Product Development	WR	Various : Various	0.570	0.000		0.000		0.000		-		0.000	0.000	0.570	-
MCM USV: Product Development 1	C/CPIF	Textron Systems, Inc : Hunt Valley, MD	0.000	0.000		2.084	Jan 2020	0.000		-		0.000	0.000	2.084	-
MCM USV: Product Development 2	C/FPIF	Textron Systems, Inc : Hunt Valley, MD	12.220	3.339	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MCM USV: Product Development1	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	0.000	3.100	Jan 2019	9.000	Nov 2019	6.583	Nov 2020	-		6.583	Continuing	Continuing	Continuing
MCM USV: Product Development	SS/CPFF	Raytheon : Portsmouth, RI	10.202	1.975	Feb 2019	2.000	Nov 2019	1.000	Feb 2021	-		1.000	Continuing	Continuing	Continuing
MCM USV: Product Development	SS/CPFF	JHU APL : Laurel, MD	0.000	0.750	Feb 2019	2.000	Feb 2020	1.000	Feb 2021	-		1.000	Continuing	Continuing	Continuing
MCM USV: Product Development	WR	NSWC PC : Panama City, FL	0.925	2.610	Jan 2019	3.000	Nov 2019	1.823	Nov 2020	-		1.823	Continuing	Continuing	Continuing
MCM USV: Product Development	WR	NUWC N : Newport, RI	0.770	0.675	Jan 2019	0.500	Nov 2019	0.296	Nov 2020	-		0.296	Continuing	Continuing	Continuing
MCM USV: Product Development	WR	NSWC CD : Bethesda, MD	0.980	2.050	Jan 2019	0.600	Nov 2019	0.758	Nov 2020	-		0.758	Continuing	Continuing	Continuing
		Subtotal	79.511	15.457		19.184		11.460		-		11.460	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Engineering Support	WR	NUWC N : Newport, RI	0.600	0.250	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Engineering Support	WR	NSWC PC : Panama City, FL	2.089	0.200	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Engineering Support	WR	NSWC CD : Bethesda, MD	1.811	0.100	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Engineering Support	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	1.170	0.100	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Integrated Logistics	WR	NSWC PC : Panama City, FL	0.490	0.175	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Integrated Logistics	WR	NSWC CD : Bethesda, MD	0.751	0.200	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Integrated Logistics	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	0.928	0.200	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MHU: Engineering Support	WR	SSC PAC : San Diego, CA	0.338	0.030	Dec 2018	0.036	Dec 2019	0.040	Dec 2020	-		0.040	Continuing	Continuing	Continuing
MHU: Engineering Support	WR	NSWC PC : Panama City, FL	0.933	0.840	Feb 2019	0.841	Feb 2020	0.846	Feb 2021	-		0.846	Continuing	Continuing	Continuing
MHU: Engineering Support	WR	NUWC N : Newport, RI	0.853	0.000		0.000		0.000		-		0.000	0.000	0.853	-
MHU: Engineering Support	WR	NSWC CD : Bethesda, MD	0.278	0.030	Dec 2018	0.036	Dec 2019	0.040	Dec 2020	-		0.040	Continuing	Continuing	Continuing
MHU: Engineering Support	WR	Various : Various	0.520	0.000		0.000		0.000		-		0.000	0.000	0.520	-
MCM USV: Engineering Support	WR	NSWC PC : Panama City, FL	3.828	1.300	Jan 2019	1.750	Nov 2019	1.038	Nov 2020	-		1.038	Continuing	Continuing	Continuing
MCM USV: Engineering Support	WR	NUWC N : Newport, RI	2.120	0.800	Jan 2019	0.750	Nov 2019	0.443	Nov 2020	-		0.443	Continuing	Continuing	Continuing
MCM USV: Engineering Support	WR	NSWC CD : Bethesda, MD	0.300	0.000		0.400	Dec 2019	0.235	Nov 2020	-		0.235	0.000	0.935	-
MCM USV: Engineering Support	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	0.000	0.215	Jan 2019	1.000	Nov 2019	0.590	Nov 2020	-		0.590	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MCM USV: Integrated Logistics	WR	NSWC PC : Panama City, FL	0.000	0.000		0.062	Dec 2019	0.099	Nov 2020	-		0.099	0.000	0.161	-
MCM USV: Integrated Logistics	WR	NSWC CD : Bethesda, MD	0.000	0.000		0.061	Dec 2019	0.089	Nov 2020	-		0.089	0.000	0.150	-
MCM USV: Integrated Logistics	SS/CPFF	Raytheon : Portsmouth, RI	0.000	0.400	Jan 2019	0.400	Dec 2019	0.178	Jan 2021	-		0.178	Continuing	Continuing	Continuing
MCM USV: Integrated Logistics	SS/CPFF	Northrup Grumman : Annapolis, MD	0.000	0.300	Mar 2019	0.300	Mar 2020	0.178	Jan 2021	-		0.178	Continuing	Continuing	Continuing
MCM USV: Integrated Logistics	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	0.000	0.985	Feb 2019	0.809	Feb 2020	0.445	Dec 2020	-		0.445	Continuing	Continuing	Continuing
		Subtotal	17.009	6.125		6.445		4.221		-		4.221	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Test and Evaluation	WR	NSWC PC : Panama City, FL	1.030	1.025	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Test and Evaluation	WR	NSWC CD : Bethesda, MD	1.331	0.400	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Test and Evaluation	C/CPIF	Textron Systems, Inc : Hunt Valley, MD	1.709	0.175	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MCM USV: Test and Evaluation	WR	NSWC PC : Panama City, FL	0.000	2.050	Mar 2019	2.500	Dec 2019	1.465	Dec 2020	-		1.465	Continuing	Continuing	Continuing
MCM USV: Test and Evaluation	WR	NSWC CD : Bethesda, MD	0.000	0.200	Mar 2019	1.500	Dec 2019	0.879	Dec 2020	-		0.879	Continuing	Continuing	Continuing
MCM USV: Test and Evaluation	SS/CPFF	Raytheon : Portsmouth, RI	0.000	0.400	Mar 2019	0.500	Dec 2019	0.325	Dec 2020	-		0.325	Continuing	Continuing	Continuing
MCM USV: Test and Evaluation	C/CPFF	Textron Systems, Inc : Hunt Valley, MD	0.000	1.500	Mar 2019	1.000	Dec 2019	0.586	Dec 2020	-		0.586	0.000	3.086	-
		Subtotal	4.070	5.750		5.500		3.255		-		3.255	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Travel	WR	NAVSEA : Washington, DC	0.275	0.020	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
UISS: Management	C/CPAF	TBD : TBD	2.164	0.110	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MCM USV: Travel	WR	NAVSEA : Washington, DC	0.100	0.100	Jan 2019	0.120	Jan 2020	0.069	Jan 2021	-		0.069	Continuing	Continuing	Continuing
MCM USV: Management	C/CPAF	TBD : TBD	0.150	0.141	Nov 2018	0.270	Nov 2019	0.162	Nov 2020	-		0.162	Continuing	Continuing	Continuing
		Subtotal	2.689	0.371		0.390		0.231		-		0.231	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	103.279	27.703		31.519		19.167		-		19.167	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UISS				
Acquisition Milestones: Milestone C Documentation	1	2019	2	2020
Acquisition Milestones: Milestones: Milestone C	2	2020	2	2020
Acquisition Milestones: Milestones: Initial Operational Capability	1	2021	1	2021
System Development: Engineering & Manufacturing Development Phase: Engineering & Manufacturing Development Phase	1	2019	2	2020
System Development: Test and Evaluation: DT Testing	1	2019	1	2020
System Development: Test and Evaluation: LCS L&R	2	2020	4	2020
System Development: Test and Evaluation: Initial Operational Test & Evaluation	4	2020	4	2020
Production Milestones: Low Rate Initial Production: LRIP Contract Award	2	2020	2	2020
Production Milestones: Low Rate Initial Production: LRIP Production	2	2020	2	2022
Mine Hunting USV (MHU)				
System Development: Design/Implement Cyber Updates ECP 1: Design/Implement Cyber Updates ECP 1	1	2019	4	2019
System Development: Install ECPs and Cybersecurity Updates 1: Install ECPs and Cybersecurity Updates 1	4	2019	4	2019
System Development: Design/Implement Cyber Updates ECP 2: Design/Implement Cyber Updates ECP 2	1	2020	4	2020
System Development: Install ECPs and Cybersecurity Updates 2: Install ECPs and Cybersecurity Updates 2	4	2020	4	2020
System Development: Design/Implement Cyber Updates ECP 3: Design/Implement Cyber Updates ECP 3	1	2021	4	2021
System Development: Install ECPs and Cybersecurity Updates 3: Install ECPs and Cybersecurity Updates 3	4	2021	4	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
System Development: Design/Implement Cyber Updates ECP 4: Design/Implement Cyber Updates ECP 4	1	2022	4	2022
System Development: Install ECPs and Cybersecurity Updates 4: Install ECPs and Cybersecurity Updates 4	4	2022	4	2022
MCM USV				
System Development: USV Fabrication: 2 USV Fabrication	1	2019	1	2019
System Development: Minehunting Payload Fabrication: AQS-20 PDS Fabrication	1	2019	2	2019
System Development: Minehunting Payload Fabrication: AQS-24 PDS Fabrication	1	2019	1	2019
System Development: Mine Neutralization Payload Fabrication: Barracuda Launcher Payload Initial Design	2	2019	1	2022
System Development: Mine Neutralization Payload Fabrication: Barracuda Launcher Payload Detailed Design	2	2022	4	2022
System Development: Mine Neutralization Payload Fabrication: Barracuda Launcher Fabrication	4	2022	3	2023
System Development: System Integration & Test: System Integration and Test	2	2019	1	2021
System Development: System Integration & Test: Barracuda System Integration & Test	2	2023	4	2024
System Development: Test and Evaluation: UOES	4	2020	2	2021
System Development: Test and Evaluation: Minehunt Development Test	4	2020	2	2021
System Development: Test and Evaluation: Minehunt Initial Operational Test & Evaluation (IOT&E)	4	2021	1	2022
System Development: MCM Mission Package Testing: Developmental Testing	2	2021	3	2021
System Development: MCM Mission Package Testing: MCM MP DT-C10	4	2021	1	2022
System Development: MCM Mission Package Testing: IOT&E	1	2022	2	2022
Advanced Autonomy and MCM Systems: Advanced Autonomy Development	1	2023	4	2025
Advanced Autonomy and MCM Systems: High Temperature Superconductor (HTS)	2	2023	4	2025
Reliability ECPs: Long-term Reliability Enhancements	1	2023	4	2025
Milestones: Acquisition Milestones: Full Rate Production Decision Review	3	2021	3	2021

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 1234 / *Unmanned Surface Vehicle (USV)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Milestones: Acquisition Milestones: Full Rate Production	3	2021	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2989: *Barracuda*	20.572	27.739	28.641	33.191	-	33.191	38.360	37.825	38.586	39.358	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Barracuda system is an expendable, modular, mine neutralizer launched from the Mine Countermeasures (MCM) Unmanned Surface Vessel (USV) as part of the Littoral Combat Ship (LCS) MCM Mission Package (MP) to autonomously reacquire and neutralize previously detected near-surface mines. Upon entering the water, the vehicle will conduct a search, capture an image and, use a communications buoy to send the image to the operator in the MCM MP to evaluate the image and order the weapon to fire, abort, or continue searching. Future capabilities may include launch from manned or unmanned aircraft or vessels of opportunity as well as the ability to neutralize mines in volume and on the bottom.

The Barracuda detailed design and development contract (awarded April 2018) funds system design, program management, systems engineering, software development, integrated product support and contractor testing.

FY2021 funds the detailed design and development contract.

Engineering Development Models (EDMs) will be purchased starting in FY 2023 for tests starting in Q1 FY2023. There is a 12-month lead time between procurement and delivery.
Low Rate Initial Production (LRIP) units will be purchased following Milestone C.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Barracuda: Product Development	22.764	23.785	28.238	0.000	28.238
Articles:	-	-	-	-	-
FY 2020 Plans: Continue detailed system design in support of Critical Design Review (CDR). The program will conduct long-lead time risk reduction for warhead, fuze, and autonomy. Conduct contractor prototyping and development in advance of CDR.					
FY 2021 Base Plans: Conduct PDR for product support and test support equipment. Conduct contractor prototyping and development in support of CDR.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increased funding will support ramp up required to support CDR.					
Title: Barracuda: Engineering Support	4.758	4.621	4.621	0.000	4.621
Articles:	-	-	-	-	-
FY 2020 Plans: Continue detailed system design for CDR. Conduct and manage safety reviews as design matures. Evaluate and manage contractor deliverables, overseeing system engineering design and establish system configuration management. The program will conduct risk reduction for warhead, fuze, and autonomy. ***FY 2021 Base Plans:*** Conduct and manage safety reviews as design matures. Evaluate and manage contractor deliverables, overseeing system engineering design and maintain system configuration management. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A					
Title: Barracuda: Management Services	0.217	0.235	0.332	0.000	0.332
Articles:	-	-	-	-	-
FY 2020 Plans: Continue to provide program management, financial management and engineering support. ***FY 2021 Base Plans:*** Continue to provide program management, financial management and engineering support. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increased FY 2021 management costs support ramp up of support required to support CDR.					
Accomplishments/Planned Programs Subtotals	27.739	28.641	33.191	0.000	33.191

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Barracuda program awarded a competitive contract in FY 2018 to Raytheon Integrated Defense Systems (IDS) in Middletown RI. The Barracuda program is developing a semi-autonomous mine neutralization system as part of the LCS MCM MP. Initial concepts were based on small UUVs developed as part of the ONR Single Sortie, Detect to Engage Future Naval Capabilities project (FY15-18). The overall engineering approach is to leverage known technologies and established interfaces in addition to early prototyping and qualification testing to retire risk before purchasing units for developmental testing.

In FY 2020 the program will continue detailed design in advance of CDR as part of the program rebaseline. The program will prioritize risk reduction efforts on warhead, fuze and autonomy. Contractor will commence contractor prototyping.

In FY 2021, the program will conduct and manage safety reviews as design matures as a risk reduction method. The contractor will conduct the second phase of prototyping.

In FY 2022, the program will conduct CDR and the contractor will complete the final phase prototyping.

In FY 2023, the EDM contract for 150 neutralizers will be awarded and contractor testing will commence with delivery in FY24.

In FY 2024, the contractor will complete Contractor testing. The Barracuda program will take delivery of the neutralizer EDMs and complete developmental testing (DT). An operational assessment will be conducted from a vessel of opportunity using surrogate test support equipment or MCM USV to evaluate Barracuda performance. As test platforms are available, Barracuda will conduct MCM USV and LCL MCM MP integration in advance of Milestone C and LRIP procurement in FY2025.

In FY 2025, Milestone C will be accomplished and LRIP Option 1 will be exercised.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603502N / *Surface & Shallow Water MCM*	Project (Number/Name) 2989 / *Barracuda*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Barracuda Hardware/ Support	C/CPIF	Raytheon (Integrated Defense Systems) : Portsmouth, RI	16.118	22.764	Jan 2019	23.785	Jan 2020	28.238	Dec 2020	-		28.238	0.000	90.905	92.000
		Subtotal	16.118	22.764		23.785		28.238		-		28.238	0.000	90.905	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Barracuda Engineering Support	WR	NUWC NPT : Newport, RI	0.544	0.449	Dec 2018	0.569	Dec 2019	1.040	Dec 2020	-		1.040	Continuing	Continuing	Continuing
Barracuda Engineering Services	C/CPIF	JHU APL : Baltimore, MD	0.598	0.710	Dec 2018	0.801	Dec 2019	0.658	Dec 2020	-		0.658	Continuing	Continuing	Continuing
Barracuda Engineering Support	WR	NSWC, PC : Panama City, FL	1.322	1.352	Dec 2018	1.400	Dec 2019	1.708	Dec 2020	-		1.708	Continuing	Continuing	Continuing
Barracuda Support	WR	NSWC, IHD : Indian Head, MD	1.257	1.359	Dec 2018	1.275	Dec 2019	0.723	Dec 2020	-		0.723	0.000	4.614	-
Barracuda Support	WR	Naval Research Lab : Washington, DC	0.193	0.578	Dec 2018	0.302	Dec 2019	0.212	Dec 2020	-		0.212	0.000	1.285	-
Barracuda Support	WR	NSWC, Carderock : Bethesda, MD	0.254	0.310	Dec 2018	0.274	Dec 2019	0.280	Dec 2020	-		0.280	0.000	1.118	-
		Subtotal	4.168	4.758		4.621		4.621		-		4.621	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Barracuda Management Support	WR	NSWC, PC : Panama City, FL	0.286	0.217	Dec 2018	0.235	Dec 2019	0.332	Dec 2020	-		0.332	0.000	1.070	-
		Subtotal	0.286	0.217		0.235		0.332		-		0.332	0.000	1.070	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*	

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	20.572	27.739		28.641		33.191		-		33.191	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 2989 / *Barracuda*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Acquisition Milestones				
Barracuda Acquisition Documentation: Preliminary Design Review	3	2019	3	2019
Barracuda Acquisition Documentation: Critical Design Review	3	2022	3	2022
Barracuda Acquisition Documentation: Milestone C	2	2025	2	2025
Barracuda Acquisition Documentation: Engineering Development Models (EDM)	2	2023	2	2023
Barracuda Acquisition Documentation: Low Rate Initial Product Units #1	3	2025	3	2025
System Development: Barracuda Development	1	2019	2	2024
Test and Evaluation: Development Testing	2	2024	3	2024
Test and Evaluation: Operational Assessment	4	2024	4	2024
Test and Evaluation: Contractor Qual Testing	1	2023	2	2024
System Deliveries: Incremental Engineering Development Model Deliveries	2	2024	2	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603502N / *Surface & Shallow Water MCM*				Project (Number/Name) 3066 / *Large Unmanned Surface Vessel (LUSV)*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3066: *Large Unmanned Surface Vessel (LUSV)*	0.000	0.000	273.327	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	273.327
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The Large Unmanned Surface Vessel (LUSV) project was a new start effort in FY 2020 that leveraged efforts under PE 0604250D8Z through the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) Ghost Fleet - Overlord project. In FY 2021, the Navy will continue efforts started in FY 2020 and will procure Overlord prototypes, based on commercial ship designs and intended to employ modular payloads.

FY 2021 and future funding for Project 3066 were realigned to Program Element 0603178N.

A. Mission Description and Budget Item Justification

The Large Unmanned Surface Vessel (LUSV) project provides resources for the detailed design, construction, testing, fleet introduction, and support of the LUSV.

LUSVs will provide affordable, high endurance, ships able to accommodate various payloads augmenting the Navy's manned surface force in supporting the Future Surface Combatant Force (FSCF) program and Distributed Maritime Operations (DMO) concept. The platforms will be capable of weeks-long deployments and trans-oceanic transits and operate aggregated with Carrier Strike Groups (CSGs), Amphibious Ready Groups (ARGs), Surface Action Groups (SAGs), and individual manned combatants.

The LUSV will be delivered and fielded initially as research and development prototype vessels intended to demonstrate successful integration of government furnished Command, Control, Communications, Computers and Intelligence (C4I) and combat systems and the reliability of automated hull, mechanical, and electrical (HM&E) systems. In FY 2020, the Navy intends to procure Overlord prototypes capable of employing modular payloads but also integrating the organic capability needed for the LUSV program. These vessels will also continue to build on the lessons learned through the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) Ghost Fleet - Overlord project. Future LUSVs will incorporate reservations in the design for future combat capabilities as a step toward the desired goal of delivering a LUSV in FY 2026 with an integrated combat system and organic payloads supporting Anti-Surface Warfare (ASuW) and Strike mission areas. Other potential future LUSV capabilities are being informed by the Navy's FSCF Analysis of Alternatives (AoA) and will be refined as future payloads and concepts of operations (CONOPs) are developed. Fielding of LUSV will provide the Navy increased capability and necessary capacity at lower projected procurement and sustainment costs, reduced risk to sailors and increased readiness by assuming missions from manned combatants.

LUSVs will be based on commercial specifications and greater than 190ft in length in order to provide a long-endurance platform with sufficient margin in the design to support the incorporation of combat systems and future payloads. LUSVs will be capable of autonomous navigation, transit planning, and COLREGS-compliant maneuvering and will be designed with automated propulsion, electrical generation, and support systems. LUSV missions will be conducted with operators in-the-

loop (with continuous or near-continuous observation or control) or on-the-loop (autonomous operation that prompts operator action/intervention from sensory input or autonomous behaviors).

The LUSV integrated combat system will be developed under the Unmanned Surface Vehicle Enabling Capabilities (Project 3067). Modular payloads may be developed separately by other programs or prototyping efforts and will be further developed and/or integrated into LUSV under the Enabling Capabilities project that supports both the LUSV and MUSV projects. Key combat systems and payload technologies and enablers will continue to be developed and matured, leading to an at-sea capstone demonstration of the complete firing chain remotely commanded from a surface combatant in FY 2022.

The LUSV equipped with an integrated combat system and organic payload capability will not be capable of autonomous payload engagement or execution of a complete detect-to-engage sequence. The vessel will be incapable of payload activation, deactivation, or engagement without the deliberate action of a remote, off-hull human operator. The LUSV's combat systems and C4I configuration will ensure that a remote human operator must always positively command all payload activation, deactivation, and engagement.

The LUSV program will integrate current Navy combat systems programs of record that have been adapted to enable remote monitoring and operational control from an off-hull command and control point, and will not be equipped with components that would enable payload engagement from onboard the vessel. USV Command and Control (C2) will be maintained via an afloat element (i.e., embarked on a United States Navy (USN) combatant/support ship), or via the ashore element (C2 station ashore). LUSV C2, combat and/or weapon system integration will employ tamper proofing and security controls to prevent disclosure of data and electronic warfare defenses during autonomous operation. LUSVs will employ a Risk Management Framework (RMF) approach with physical, technical and administrative security controls and LUSVs will have hardware and software components to protect classified/sensitive functions, countermeasures designed to thwart adversary exploitation, anti-tamper mechanisms to prevent disclosure of data, and electronic warfare defenses.

LUSV will continue to leverage efforts external to this project unit accomplished through the OSD SCO Ghost Fleet - Overlord project that will complete in FY 2021. Overlord converts existing commercial fast supply vessels into experimentation LUSVs, with the end goal to demonstrate relevant Navy Surface Warfare missions utilizing modular prototype payloads. The Overlord systems are advancing the technology needed for autonomous operation of pier-launched vessels as well as increase the reliability and redundancy required to support Hull, Mechanical, and Electrical (HM&E) systems for unmanned vessels. The two existing Ghost Fleet Overlord prototypes procured in FY 2019 will be turned over to the Navy at the conclusion of the testing program at the end of FY 2021. The Navy's Surface Development Squadron (SURFDEVRON) will use the vessels for continued testing, experimentation, and refinement of unmanned platform CONOPs and Tactics, Techniques, and Procedures (TTPs) to operate and fight alongside crewed platforms. Each vessel is anticipated to provide up to 1,000 hours annually of experimentation time, which will be used to further test and prove autonomous behaviors and reliability and automation of hull, mechanical, and electrical systems.

In FY 2020, the Navy will procure two Overlord prototypes which will deliver in FY 2021. One vessel will be procured from each of the vendors on the current Washington Headquarters Services contract. Additional Overlord prototype(s) will be procured in FY21.

Conceptual Design contracts are planned for award in FY 2020 to develop a LUSV with reservations in the design to support integration of future capabilities, supporting a competitive Detail Design and Construction contract for a prototype LUSV hull form in FY 2022 and subsequent LUSV vessels.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	252.311	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: In order to reduce risk and ensure technology reaches the required maturity level to support LUSV plans in FY 2021, the Navy plans to procure quantity two (2) Ghost Fleet Overlord Block 2 experimentation vessels via the existing Ghost Fleet - Overlord contract vehicle established under PE 0604250D8Z through the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) in FY 2020. These vessels are based on commercial designs. The Navy will procure and provide GFE in the form of communications gear, USV Command and Control (C2) software, and prototype modular payloads (also developed by separate OSD SCO programs). While these systems will be deployable assets, the Navy plans to place these units in a Surface Development Squadron to ensure Tactics, Techniques and Procedures (TTPs) are refined to allow the fleet to operate and fight alongside manned systems. The OSD SCO Ghost Fleet - Overlord project will influence the requirements and specifications for the Navy's desired LUSV. The Navy will award multiple Conceptual Design efforts in FY 2020 to develop a Performance Specification for a LUSV design based on commercial vessel specifications capable of integrating future combat systems and payloads. The Conceptual Design effort will continue into FY 2021. Efforts in FY 2020 will also include technology development and maturation efforts to integrate government furnished combat systems and C4I equipment into the LUSV design. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Support	0.000	19.016	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Award Conceptual Design contract(s) to develop a LUSV Performance Specification for design capable of integrating future combat systems and payloads. Support technology development and maturation efforts and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
the development of requirements and acquisition documentation including a Capability Development Document, System Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan, and Program Protection Plan (PPP). ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Management Services	0.000	2.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Develop all governing documentation as required to support activities leading up to the award of the first two LUSVs and to support future program milestones. This includes the creation of the following artifacts: development of requirements and acquisition documentation including a Capability Development Document, Systems Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, Open Systems Architecture Management Plan, Quality Assurance Program Plan, Reliability Maintainability Program Plan, Configuration Management Plan, Software Development Plan, and Program Protection Plan (PPP). ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Accomplishments/Planned Programs Subtotals	0.000	273.327	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603178N/3066: *Large Unmanned Surface Vehicle (LUSV)*	0.000	0.000	238.617	-	238.617	377.200	144.549	198.720	134.948	Continuing	Continuing

Remarks

D. Acquisition Strategy

In FY 2020, the Navy will procure two prototype experimentation vessels as a means to mitigate technical risk and continue to generate lessons learned through testing and experimentation, which will be delivered in FY 2021. In FY 2020, the Navy will award multiple Conceptual Design contracts for a LUSV with reservations in the design to integrate future payloads, which will inform the final Performance Specification. Following in FY 2021, the Navy intends to procure up to two additional prototype experimentation vessels intended to build on the lessons learned through the Overlord project, designed to employ modular payloads and will serve as additional combat systems, C4I, and HM&E test and evaluation platforms as well as be used to further refine CONOPs and TTPs. Also in FY 2021, the Navy will release a RFP solicitation in support of a full and open competition, and will award a DD&C contract for one prototype LUSV with reservations to integrate future payloads, as a step towards delivering a LUSV with the ICS and VLS. In FY 2023, the Navy plans to proceed to serial production of LUSVs with ICS and VLS using SCN appropriations. The FY 2021 President's Budget request plan procures ten vessels throughout the FY 2021 President's Budget request FYDP, two prototype experimentation vessels and one prototype LUSV using FY22 RDTEN funding in Project 3066, then two LUSVs with ICS and VLS yearly in FY 2023 and FY 2024, and three in FY 2025 using SCN. All planned procurements are fully funded in the year of procurement, regardless of appropriation.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LUSV Conceptual Design	C/CPIF	TBD : TBD	0.000	0.000		50.000	Feb 2020	0.000		-		0.000	0.000	50.000	-
OVERLORD Fabrication & System/Payload Integration	C/CPIF	TBD : TBD	0.000	0.000		94.807	Jan 2020	0.000		-		0.000	0.000	94.807	-
LUSV GFE/Long Lead Time Material	C/FFP	TBD : TBD	0.000	0.000		26.000	May 2020	0.000		-		0.000	0.000	26.000	-
LUSV Specification/ Hardware Contract Support	WR	Various : Various	0.000	0.000		6.000	Jan 2020	0.000		-		0.000	0.000	6.000	-
LUSV Combat Systems/ C4I/HM&E Automation Design and Testing	Various	TBD : TBD	0.000	0.000		57.255	Feb 2020	0.000		-		0.000	0.000	57.255	-
Overlord Experimentation	Various	Various : Various	0.000	0.000		18.249	Mar 2020	0.000		-		0.000	0.000	18.249	-
		Subtotal	0.000	0.000		252.311		0.000		-		0.000	0.000	252.311	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SUPSHIP, WF Center Support	WR	Various : Various	0.000	0.000		17.766	Feb 2020	0.000		-		0.000	0.000	17.766	-
LUSV Source Selection	WR	Various : Various	0.000	0.000		1.250	Jan 2020	0.000		-		0.000	0.000	1.250	-
		Subtotal	0.000	0.000		19.016		0.000		-		0.000	0.000	19.016	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	WR	NAVSEA : Washington, DC	0.000	0.000		0.200	Jan 2020	0.000		-		0.000	0.000	0.200	-
Management Services	WR	Various : Various	0.000	0.000		1.800	Jan 2020	0.000		-		0.000	0.000	1.800	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	0.000		2.000		0.000		-		0.000	0.000	2.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		273.327		0.000		-		0.000	0.000	273.327	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3066 / *Large Unmanned Surface Vessel (LUSV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Large Unmanned Surface Vehicle (LUSV)				
Project Moved to Program Element 0603178N: Project Moved to Program Element 0603178N	1	2021	1	2021
Overlord Prototype: Overlord Prototype Construction (options on WHS contract)	2	2020	4	2020
Overlord Prototype: Overlord Experimentation	3	2020	4	2020
Phase 1: Conceptual Design Contract(s): Conceptual Design Contract(s) Award	3	2020	3	2020
Phase 1: Conceptual Design Contract(s): Conceptual Design	3	2020	4	2020
HM&E, C4I, and Combat System Autonomy and Automation: LUSV Prototype Development	2	2020	4	2020
HM&E, C4I, and Combat System Autonomy and Automation: Development from Experimentation & Lessons Learned	3	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	50.413	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.413
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2021 and future funding for Project 3067 were realigned to Program Element 0603178N.

A. Mission Description and Budget Item Justification

In order to accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS), the Unmanned Surface Vessel Enabling Capabilities project includes development, test, and integration of USV technologies; the advancement of Defense Advanced Research Projects Agency (DARPA), Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO), Office of Naval Research (ONR) and Industry USV efforts for associated technologies and the development and fabrication of payloads for Large Unmanned Surface Vessels (LUSVs) and Medium Unmanned Surface Vehicles (MUSVs). USV technology efforts in this project unit support demonstration of mission level autonomy, communications, command and control, navigation compliance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGS), endurance, at sea replenishment, payload feasibility, mission planning and execution for the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) Overlord efforts, and enabling technologies for other USVs in the USV FoS, as applicable.

Modular payloads employed by LUSVs and MUSVs will be developed under this project unit. Payloads will be customized to meet Navy needs and demonstrate useful capability for the Fleet. MUSVs will achieve their mission capability through their employment of modular payloads. LUSVs will augment their organic warfare capabilities with additional modular payloads.

Efforts to develop LUSV organic warfare capability will also be executed under this project. In order to support LUSV future missions, investment in LUSV payload development, payload integration, and Integrated Combat System (ICS) development is required. Investment is also needed to support LUSV payload testing and follow-on operations. Due to the nature of this project, specific applications and detailed plans are available at a higher classification.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	44.613	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Utilize Future Surface Combatant Force (FSCF) Technology Investment Strategy to transition mature products to USVs that increase capabilities to levels required to support Navy warfighting requirements efforts that include					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
developing and integrating innovative payloads onto USVs to improve warfighting capabilities. Utilize FSCF payload investments developed by Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO) to support the acquisition and integration of payload capabilities, development of the Integrated Combat System (ICS) and plans for industry competition for both large and small businesses (i.e., Request for Proposal (RFP) development, SBIR Phase III). Leveraging the Naval Research and Development Enterprise and industry, options will be assessed for the impact to warfighting capabilities. FY 2020 efforts will include technical studies for Elevated Sensor technologies/modalities to provide wide defensive radar coverage and detect/track/identify objects from extended distances. Efforts will also include the development of Elevated Sensor contract(s) to design, develop, and demonstrate a persistent airborne system capable of providing USVs with more time and more battle space to identify potential threats and make critical decisions. Initial requirements derived through market research and studies will drive design efforts of prototype systems of explosive and non-lethal payloads. The payloads will be initially integrated and demonstrated on the Overlord vessels, and developed for integration into other applicable FoS USVs when ready. Develop and deliver an ICS for USVs that will be ready for combined and integrated capabilities, with the ICS infrastructure ready to support any future capabilities. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Support	0.000	5.750	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: In conjunction with the Office of the Chief of Naval Operations (OPNAV), update requirements documents, develop interface control specifications and architecture documentation, develop ship design and top side layout drawings and start development of T&E plans for USV ICS and payloads. Update documentation and continue work on development of common autonomy standards, interfaces, and systems and support modeling/simulation efforts					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and prototype development. Update Common Control System documentation and support testing and design efforts. Operation and maintenance of experimental MUSV and LUSV platforms. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Management Services	0.000	0.050	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Provide execution of the product development and support tasks. Develop acquisition documents to include Systems Engineering Plan (SEP), test and evaluation plan, integrated master schedule, risk evaluations and program cost estimates based on the required capabilities. Oversee transition of payload prototypes and associated experimentation and risk reduction efforts. Coordinate with and across supporting activities (e.g., Program Executive Office (PEO) Integrated Warfare Systems (IWS), PEO Command, Control, Communications, Computers and Intelligence (C4I)), warfare centers, labs, and industry partners to address requirements, manage funding and execute plans for the integration of planned LUSV payloads with the USV ICS. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Accomplishments/Planned Programs Subtotals	0.000	50.413	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603178N/3067: *Unmanned Surface Vehicle Enabling Capabilities*	0.000	0.000	199.123	-	199.123	122.837	192.836	77.854	80.857	Continuing	Continuing

Remarks

D. Acquisition Strategy

USV Enabling Capabilities efforts will accelerate future capability and support steady growth of the Navy's Unmanned Surface Vehicle (USV) Family of Systems (FoS). By leveraging efforts from the Naval Research and Development Enterprise and industry for associated technologies and payloads and integrating them into USVs at the appropriate level of technical maturity, USV capabilities for the Fleet will be increasingly enhanced. Coordination with UxS platforms will eliminate redundant efforts, encourage innovation and improve coordination of unmanned systems across multiple domains. Leveraging SCO-developed standalone capabilities, the plan is to develop these capabilities for the initial LUSVs and then transition those capabilities into the LUSV through incremental development and integration across the funding portfolio. The project will deliver an ICS that will be ready for combined and integrated capabilities with the infrastructure ready to support any future systems, payloads, and capabilities. The Navy will accomplish efforts under USV Enabling Capabilities through existing contract vehicles prepared for SCO and ONR efforts, the USV FoS Indefinite Delivery Indefinite Quantity (IDIQ) Multiple Award Contract (MAC) which will be awarded in FY 2020, the prime contract awarded for MUSV design and fabrication, the prime contract(s) awarded for LUSV Conceptual Design and, later, Detailed Design, and existing contracts for payload fabrication.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Combat Systems (ICS) Integration Development	Various	TBD : TBD	0.000	0.000		38.738	Jan 2020	0.000		-		0.000	0.000	38.738	-
Technical Services	WR	Various : Various	0.000	0.000		1.625	Jan 2020	0.000		-		0.000	0.000	1.625	-
Elevated Sensors	C/CPIF	TBD : TBD	0.000	0.000		0.750	Jan 2020	0.000		-		0.000	0.000	0.750	-
Experimentation	WR	Various : Various	0.000	0.000		3.500	Jan 2020	0.000		-		0.000	0.000	3.500	-
		Subtotal	0.000	0.000		44.613		0.000		-		0.000	0.000	44.613	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomy	Various	Various : Various	0.000	0.000		0.750	Jan 2020	0.000		-		0.000	0.000	0.750	-
Command and Control (C2) Integration	Various	Various : Various	0.000	0.000		1.500	Jan 2020	0.000		-		0.000	0.000	1.500	-
USV Squadron Operations	WR	Various : Various	0.000	0.000		2.500	Jan 2020	0.000		-		0.000	0.000	2.500	-
Delta Req, RFP Dev, Evaluation	WR	Various : Various	0.000	0.000		1.000	Jan 2020	0.000		-		0.000	0.000	1.000	-
RFP Development	WR	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.000	0.000		5.750		0.000		-		0.000	0.000	5.750	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	WR	NAVSEA : Washington, DC	0.000	0.000		0.050	Jan 2020	0.000		-		0.000	0.000	0.050	-
		Subtotal	0.000	0.000		0.050		0.000		-		0.000	0.000	0.050	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		50.413		0.000		-		0.000	0.000	50.413	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3067 / *Unmanned Surface Vehicle Enabling Capabilities*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Unmanned Surface Vessel Enabling Capabilities				
Project Moved to Program Element 0603178N: New PE	1	2021	1	2021
Autonomy: ICD Update: 1	1	2020	1	2020
Autonomy: ICD Update: 2	3	2020	3	2020
Autonomy: Software Integration: 1	2	2020	2	2020
Autonomy: Software Integration: 2	4	2020	4	2020
Command Control (C2): Command and Control (C2)	1	2020	4	2020
Elevated Sensors: Study	1	2020	3	2020
Elevated Sensors: RFP Solicitation Development	2	2020	4	2020
USV Squadron: Maintenance Support	1	2020	4	2020
Experimentation: Planning/Workup: 1	1	2020	2	2020
Experimentation: Experiment: 1	3	2020	3	2020
Experimentation: Data Analysis: 1	4	2020	4	2020
Payload Procurement: RFP Development	2	2020	3	2020
Payload Procurement: RFP Released	3	2020	3	2020
Payload Procurement: Source Selection	4	2020	4	2020
Integrated Combat Systems (ICS): Hardware: Design and Development	1	2020	4	2020
Integrated Combat Systems (ICS): Software: Software Build	2	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*				**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	2.690	23.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.590
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The MUSV project builds on efforts executed in FY 2019 under Project 3428 as well as through the Congressional Add of $42.000 million in Project 9999. Additionally, the project continues to leverage lessons learned through experimentation efforts external to this program element under Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and the Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter projects.

FY 2021 and future funding for Project 3428 were realigned to Program Element 0603178N.

A. Mission Description and Budget Item Justification

As part of the Unmanned Surface Vehicle (USV) Family of Systems (FoS), the Medium Unmanned Surface Vehicle (MUSV) project provides resources for the detail design, fabrication, testing, experimentation and support of the MUSV. The MUSV is defined as having a reconfigurable mission capability which is accomplished via modular payloads with an initial capability to support Battlespace Awareness through supporting Intelligence, Surveillance and Reconnaissance (ISR) and Information Operations (IO) mission areas. Modular payloads may be developed separately by other programs or prototyping efforts and will be further developed and/or integrated into MUSV under the Unmanned Surface Vehicle Enabling Capabilities project unit that supports MUSV and LUSV. MUSVs will provide affordable, high endurance, reconfigurable vehicles able to accommodate various payloads for unmanned missions to augment the Navy's manned surface force.

MUSVs will support the Navy's ability to produce, deploy and disburse ISR/EW capabilities in sufficient quantities and provide/improve distributed situational awareness in maritime Areas of Responsibility (AORs). MUSVs will be designed to be attritable assets if used in a peer or near-peer conflict. MUSVs will initially be capable of semi-autonomous operation, with operators in-the-loop (continuous or near-continuous observation and/or control of operations by remote operators) or on-the-loop (semi-autonomous operations where autonomy is controlling the vessel, but it may prompt the remote human operator for input based on sensory input and autonomy behaviors, or an operator may choose to intervene based on data sent from the MUSV or other sources to the remote operating station). USV Command and Control (C2) will be maintained via the afloat element (i.e., embarked on a United States Navy (USN) combatant/support ship), or via the ashore element (C2 station ashore). MUSV C2, combat and/or weapon system integration will employ tamper proofing and
security controls to prevent disclosure of data and electronic warfare defenses during autonomous operation. MUSVs will employ a Risk Management Framework (RMF) approach with physical, technical and administrative security controls. MUSVs will have hardware and software components to protect classified/sensitive functions. MUSVs will be capable of
weeks-long deployments and trans-oceanic transits, and operate aggregated with Carrier Strike Groups (CSGs) and Surface Action Groups (SAGs), as well as have the ability to deploy independently.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

MUSV leverages efforts external to this project unit accomplished through Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter investments in autonomy, reliability, endurance, command and control, payloads and testing that started in FY 2017 and will continue through FY 2021. In addition, the MUSV C2 concept directly leverages the fleet-ready C2 solution developed for unmanned surface vessels in the OSD SCO Ghost Fleet Overlord LUSV experimentation program. In FY 2020, the Navy is transitioning MDUSV Sea Hunter I to the Surface Development Squadron (SURFDEVRON) under the MUSV project, and will be used for continued experimentation and Fleet learning.

The MUSV will be a key enabler of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to deploy independently or with other MUSVs as well as operate with individual manned combatants or as part of a larger battle group. Potential future missions for MUSV will continue to be explored as the Navy continues to learn through
experimentation with Sea Hunter I and the Ghost Fleet Overlord projects and as MUSV concepts of operation (CONOPs) are developed and refined. Following up on the outcome of the FSCF Analysis of Alternatives (AOA) completed in FY 2019, the Navy will have opportunities in the future to increase the MUSV capability set as technology matures. Fielding of MUSV starting in FY 2022 will provide the Navy increased capability and necessary capacity at lower procurement and sustainment costs, reduced risk to sailors and increased readiness by assuming missions from manned combatants.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Product Development	1.790	16.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Execute DD&F contract for MUSV prototype (contract award described under Congressional Add of $42.000M in Project Unit 9999/C442). Evaluate and approve industry's preliminary and detailed designs for MUSV through Preliminary Design Review (PDR) and Critical Design Review (CDR). Procure materials in support of fabrication. Begin construction of hull and assembly of subcomponents. Begin software modifications to existing autonomy systems to comply with Navy requirements. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Support	0.700	6.200	0.000	0.000	0.000
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: The Navy will transition Sea Hunter I to Commander, Naval Surface Forces / Surface Development Squadron by Q2FY20. The Navy will prepare solicitations for Sea Hunter original equipment manufacturer (OEM) support and the development of training and maintenance documentation in preparation of fleet-based operations and sustainment. The Navy will provide systems engineering, design analysis, hull and assembly oversight, and integration support related to the execution of the DD&F contract. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Title: Management Services	0.200	1.700	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Develop all governing MUSV documentation as required to support advancement of the prototype program. This includes the creation of the following artifacts: System Engineering Plan (SEP), Test and Evaluation Strategy (TES), Life Cycle Support Plan (LCSP), Cybersecurity Strategy, Open Systems Architecture Management Plan, Corrosion Prevention and Control Plan, Weight Control Plan, Quality Assurance Program Plan, Reliability and Maintainability Program Plan, Configuration Management Plan, Software Development Plan and Program Protection Plan (PPP). The Navy will provide program management support related to the execution of the DD&F contract. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project realigned to PE 0603178N from 0603502N in FY 2021.					
Accomplishments/Planned Programs Subtotals	2.690	23.900	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603502N/9999: *Congressional Add*	57.981	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	70.527
• RDTEN/0603178N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	0.000	26.302	-	26.302	29.998	42.994	43.853	44.730	Continuing	Continuing

Remarks

RDT&E/0603502N/9999 - The above funding line accounts for several programs, of which the Medium Unmanned Surface Vehicle program is only a portion.

D. Acquisition Strategy

MUSV has been designated as a Rapid Prototyping Program designation and follows a Middle Tier Acquisition approach per Section 804 of the Fiscal Year (FY) 2016 National Defense Authorization Act (NDAA), as amended in FY 2017 NDAA (codified at 10 U.S.C. sub sec 2302 note). Required capabilities were codified in a Top Level Requirements (TLR) document approved by the OPNAV Director of Surface Warfare in FY 2019. While the project only has two MUSVs funded in the FYDP (one MUSV in FY 2019 and one in FY 2023), the contract structure allows for options to be added should funding become available. Delivery of the initial prototype is planned FY 2022 following completion of initial testing and a Military Utility Assessment (MUA). The prototyping efforts with the FY 2019 MUSV will inform procurement of additional MUSV units and eventual transition to an ACAT program with formalized requirements through a Capability Development Document and procurement funding.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Detailed Design & Construction	TBD	TBD : TBD	0.000	0.000		14.980	Jan 2020	0.000		-		0.000	0.000	14.980	-
Requirements Development	WR	NSWC DD : Dahlgren, VA	0.000	0.250	Dec 2018	0.000		0.000		-		0.000	0.000	0.250	-
Requirements Development	WR	NSWC CD : Bethesda, MD	0.000	0.298	Dec 2018	0.000		0.000		-		0.000	0.000	0.298	-
Requirements Development	WR	SSC PAC : San Diego, CA	0.000	0.240	Dec 2018	0.000		0.000		-		0.000	0.000	0.240	-
Requirements Development	WR	NSWC PD : Philadelphia, PA	0.000	0.345	Dec 2018	0.000		0.000		-		0.000	0.000	0.345	-
Requirements Development	SS/CPFF	JHU APL : Laurel, MD	0.000	0.657	Jan 2019	0.000		0.000		-		0.000	0.000	0.657	-
Technical Services	TBD	TBD : TBD	0.000	0.000		1.020	Jan 2020	0.000		-		0.000	0.000	1.020	-
		Subtotal	0.000	1.790		16.000		0.000		-		0.000	0.000	17.790	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support	WR	Various : Various	0.000	0.000		3.840	Jan 2020	0.000		-		0.000	0.000	3.840	-
Engineering Support	WR	NSWC DD : Dahlgren, VA	0.000	0.230	Dec 2018	0.480	Dec 2019	0.000		-		0.000	0.000	0.710	-
Engineering Support	WR	SSC PAC : San Diego, CA	0.000	0.240	Dec 2018	1.340	Dec 2019	0.000		-		0.000	0.000	1.580	-
Engineering Support	WR	NSWC PD : Philadelphia, PA	0.000	0.150	Dec 2018	0.180	Dec 2019	0.000		-		0.000	0.000	0.330	-
Engineering Support	SS/CPFF	JHU APL : Laurel, MD	0.000	0.080	Jan 2019	0.360	Dec 2019	0.000		-		0.000	0.000	0.440	-
		Subtotal	0.000	0.700		6.200		0.000		-		0.000	0.000	6.900	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPFF	Various : Washington, DC	0.000	0.200	Dec 2018	1.700	Dec 2019	0.000		-		0.000	0.000	1.900	-
		Subtotal	0.000	0.200		1.700		0.000		-		0.000	0.000	1.900	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	2.690		23.900		0.000		-		0.000	0.000	26.590	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 3428 / *Medium Unmanned Surface Vehicle (MUSV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Medium Unmanned Surface Vehicle				
Project Moved to Program Element 0603178N: New PE	1	2021	1	2021
Knowledge Points (KP): Knowledge Point 1	2	2020	2	2020
MUSV #1: Top Level Requirements (TLR) Development	1	2019	3	2019
MUSV #1: Contract Award	2	2020	2	2020
MUSV #1: Detail Design	2	2020	4	2020
MUSV #1: Preliminary Design Review (PDR)	4	2020	4	2020
Fleet Experimentation: Sea Hunter I Experimentation	3	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	12.546	57.981	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	70.527
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

MUSV leverages efforts external to this project unit accomplished through Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) and Office of Naval Research (ONR) Medium Displacement Unmanned Surface Vehicle (MDUSV)/Sea Hunter investments in autonomy, reliability, endurance, command and control, payloads and testing that started in FY 2017 and will continue through FY 2021. Beginning in FY 2019, the Navy will commence transition of MDUSV Sea Hunter I asset to Commander Naval Surface Forces under the MUSV project. In addition, the MUSV C2 concept directly leverages the fleet-ready C2 solution developed for unmanned surface vessels in the OSD SCO Ghost Fleet Overlord LUSV experimentation program.

This project also provides resources for development, improvement and integration of Unmanned Surface Vehicle (USV) Mine Countermeasure (MCM) systems. A description of the major planned programs includes the following:

The Unmanned Influence Sweep System (UISS) utilizes an Unmanned Surface Vehicle (USV) integrated with an Unmanned Surface Sweep System (US3), a magnetic/acoustic sweep system developed to sweep acoustic/magnetic influence mines, which can be deployed from the Littoral Combat Ship (LCS) or a Vessel of Opportunity (VOO).

The Mine Countermeasures Unmanned Surface Vehicle (MCM USV) program leverages the USV from the UISS Program of Record (PoR) and adds a modular mission capability through the addition of multiple payloads. MCM USV w/ AQS-20C integrates the existing AQS-20C minehunting sonar. MCM USV w/ AQS-24B continues the Minehunting efforts. In FY 2019, the MCM USV program began initial design efforts to support integration with a Mine Neutralization capability (Barracuda). Minesweeping payloads will be subsumed by the MCM USV PoR in FY 2020.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Medium Displacement Unmanned Surface Vehicle	40.519	0.000
FY 2019 Accomplishments: Product Development: Generate and release Request for Proposal (RFP), including performance specification, for procurement of MUSV; hold Industry Day; and conduct source selection efforts. Support: PEO USC will coordinate with ONR and advise on development and construction oversight of the Sea Hunter II USV.		

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Management Services: Creation of a MUSV Prototyping Plan. ***FY 2020 Plans:*** Award contract for Detail Design and Fabrication (DD&F) of MUSV prototype.		
Congressional Add: Navy Identified MCM USV Requirement ***FY 2019 Accomplishments:*** Product Development: Complete initial design and software development efforts for craft and payload integration, command and control, and operations. Continue system level testing. Prepare to conduct User Operational Evaluation System (UOES) Employment. Prepare and support design changes for initial Developmental Testing (DT). Conduct technical feasibility studies, trade study analysis, tactics development, requirements definition and USV impact studies for Mine Neutralization (Barracuda) integration with MCM USV. Begin contractor integration testing of MCM USV w/ AQS-24B and MCM USV w/ AQS-20C. Support: Continue program management, engineering and technical support for payload integration and testing efforts. Support testing and User Operational Evaluation System (UOES) efforts for the assessment of system capabilities to determine Military utility. Determine initial spares required for upcoming DT/UOES test events. Management Services: Provide program planning, management and acquisition document updates for the MCM USV program. ***FY 2020 Plans:*** N/A	13.603	0.000
Congressional Add: Navy Identified UISS Requirement ***FY 2019 Accomplishments:*** Product Development: Develop Engineering Change Proposals (ECPs) for EDM and Low Rate Initial Production (LRIP) units in preparation for integration testing and Initial Operational Test and Evaluation (IOT&E). Conduct systems engineering efforts in support of program and test efforts. Complete UISS corrective action period to increase reliability to support a successful Developmental Test (DT) and Operational Assessment (OA). Support: Support engineering, management and logistics efforts for MS C in 2Q FY 2020 and Initial Operational Capability (IOC) in 1Q FY 2021. Prepare for IOT&E. Continue development of Full Rate Production (FRP) documentation to release Request for Proposal (RFP) in early FY 2020. Test and Evaluation: Continue UISS DT and OA in support of MS C decision in 2Q FY 2020. Conduct UISS system level IOT&E in support of FRP decision planned for FY 2020.	3.859	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Management Services: Oversee ongoing contractor efforts. Manage MS C documentation completion. Manage FRP RFP release and proposal evaluation. ***FY 2020 Plans:*** N/A		
Congressional Adds Subtotals	57.981	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTE/0603502N/1234: *Unmanned Surface Vehicle (USV)*	27.703	31.519	19.167	-	19.167	18.929	19.304	19.684	20.073	Continuing	Continuing
• RDTE/0603502N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	2.690	23.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.590
• RDTE/0603178N/3428: *Medium Unmanned Surface Vehicle (MUSV)*	0.000	0.000	26.302	-	26.302	29.998	42.994	43.853	44.730	Continuing	Continuing

Remarks

D. Acquisition Strategy

MUSV will pursue a Rapid Prototyping Program designation and follow a Middle Tier Acquisition approach per Section 804 of the Fiscal Year (FY) 2016 National Defense Authorization Act (NDAA), as amended in FY 2017 NDAA (codified at 10 U.S.C. sub sec 2302 note). Navy required capabilities will be captured in a Top Level Requirements (TLR) document approved by the OPNAV Director of Surface Warfare. A development RFP will be released to industry in FY 2019, containing options for additional USVs contingent on validation of warfighting requirements. A full and open procurement will take place in FY 2019, awarding a single MUSV prototype in FY 2020(Note: Congressional Add of $42.000M in Project Unit 9999/C442). The requirements of the MUSV will allow proposals from both traditional defense and commercial shipyards. Estimated delivery of the initial prototype will be FY 2022. Rapid prototyping efforts with the FY19 MUSV will inform procurement of additional MUSV units and eventual transition to an ACAT program and procurement funding.

UISS requirements are documented in the Unmanned Influence Sweep System (UISS) Capability Production Document (CPD). An Engineering and Manufacturing Development (E&MD) contract was awarded in FY 2014 with options for Low Rate Initial Production (LRIP) in FY 2019.

In FY 2019 and FY 2020, MCM USV is developing a CDD leveraging existing requirements (UISS, AN/AQS-20, MCM MP, etc.). In FY 2021, MCM USV anticipates a Full Rate Production (FRP) decision and will conduct a full and open competition for FRP contract(s).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Product Devlopment	C/CPIF	Textron Systems, Inc. : Hunt Valley, MD	7.663	1.272	Jan 2019	0.000		0.000		-		0.000	0.000	8.935	-
MCM USV: Product Development	C/CPFF	Textron Systems, Inc. : Hunt Valley, MD	0.000	12.300	Mar 2019	0.000		0.000		-		0.000	0.000	12.300	-
MUSV: Product Development	C/FPIF	TBD : TBD	0.000	36.987	Sep 2019	0.000		0.000		-		0.000	0.000	36.987	-
MUSV: Product Development	WR	SSC LANT : Charleston, SC	0.000	0.249	Jan 2019	0.000		0.000		-		0.000	0.000	0.249	-
MUSV: Product Development	WR	NSWC CD : Bethesda, MD	0.000	0.787	Dec 2018	0.000		0.000		-		0.000	0.000	0.787	-
MUSV: Product Development	WR	SSC PAC : San Diego, CA	0.000	1.800	Feb 2019	0.000		0.000		-		0.000	0.000	1.800	-
		Subtotal	7.663	53.395		0.000		0.000		-		0.000	0.000	61.058	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Engineering Support	WR	NUWC N : Newport, RI	0.188	0.100	Jan 2019	0.000		0.000		-		0.000	0.000	0.288	-
UISS: Engineering Support	WR	NSWC PC : Panama City, FL	2.000	0.600	Jan 2019	0.000		0.000		-		0.000	0.000	2.600	-
UISS: Engineering Support	WR	NSWC CD : Bethesda, MD	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
UISS: Integrated Logistics	WR	NSWC PC : Panama City, FL	0.314	0.000		0.000		0.000		-		0.000	0.000	0.314	-
UISS: Integrated Logistics	WR	NSWC CD : Bethesda, MD	0.266	0.000		0.000		0.000		-		0.000	0.000	0.266	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MCM USV: Engineering Support	C/CPFF	Textron Systems, Inc. : Hunt Valley, MD	0.000	1.103	Mar 2019	0.000		0.000		-		0.000	0.000	1.103	-
MUSV: Engineering Support	WR	SSC LANT : Charleston, SC	0.000	0.165	Jan 2019	0.000		0.000		-		0.000	0.000	0.165	-
MUSV: Integrated Logistics	WR	TBD : TBD	0.000	0.080	Aug 2019	0.000		0.000		-		0.000	0.000	0.080	-
		Subtotal	3.268	2.048		0.000		0.000		-		0.000	0.000	5.316	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Test and Evaluation	WR	NSWC PC : Panama City, FL	0.045	0.400	Jan 2019	0.000		0.000		-		0.000	0.000	0.445	-
UISS: Test and Evaluation	WR	NSWC CD : Bethesda, MD	1.300	1.000	Jan 2019	0.000		0.000		-		0.000	0.000	2.300	-
UISS: Test and Evaluation	C/CPFF	Textron Systems, Inc. : Hunt Valley, MD	0.020	0.000		0.000		0.000		-		0.000	0.000	0.020	-
		Subtotal	1.365	1.400		0.000		0.000		-		0.000	0.000	2.765	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UISS: Travel	WR	NAVSEA : Washington, DC	0.040	0.100	Mar 2019	0.000		0.000		-		0.000	0.000	0.140	-
UISS: Management	WR	TBD : TBD	0.210	0.387	Nov 2018	0.000		0.000		-		0.000	0.000	0.597	-
MCM USV: Management	WR	TBD : TBD	0.000	0.200	Mar 2019	0.000		0.000		-		0.000	0.000	0.200	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603502N / *Surface & Shallow Water MCM*	Project (Number/Name) 9999 / *Congressional Adds*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MUSV: Travel	WR	NAVSEA : Washington, DC	0.000	0.151	Mar 2019	0.000		0.000		-		0.000	0.000	0.151	-
MUSV: Management	WR	TBD : TBD	0.000	0.300	Mar 2019	0.000		0.000		-		0.000	0.000	0.300	-
		Subtotal	0.250	1.138		0.000		0.000		-		0.000	0.000	1.388	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	12.546	57.981		0.000		0.000		-		0.000	0.000	70.527	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603502N / *Surface & Shallow Water MCM*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
UISS FY19 Congressional Add (C444): Engineering & Manufacturing Development Phase	1	2019	4	2019
UISS FY19 Congressional Add (C444): DT/OA Testing	1	2019	1	2020
UISS FY19 Congressional Add (C444): Milestone C	2	2020	2	2020
MCM USV FY19 Congressional Add (C443): Craft/Payload Integration	2	2019	2	2020
MCM USV FY19 Congressional Add (C443): In-Water Contractor Testing	3	2019	1	2020
MUSV FY19 Congressional Add (C442): Milestones: Industry RFI	1	2019	1	2019
MUSV FY19 Congressional Add (C442): Milestones: Industry Day	2	2019	2	2019
MUSV FY19 Congressional Add (C442): Milestones: Knowledge Point 1	2	2020	2	2020
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: Government Furnished Equipment (GFE) Procurement	3	2019	4	2020
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: Draft RFP Released	1	2019	1	2019
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: RFP Released	3	2019	3	2019
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: Source Selection	3	2019	1	2020
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: Contract Award	2	2020	2	2020
MUSV FY19 Congressional Add (C442): Prototype Design and Fabrication: Design	2	2020	4	2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	764.061	6.822	7.242	12.816	-	12.816	1.942	0.638	0.000	0.000	0.000	793.521
0225: *Surface Ship Torpedo Defense (SSTD)*	764.061	6.822	7.242	12.816	-	12.816	1.942	0.638	0.000	0.000	0.000	793.521

A. Mission Description and Budget Item Justification

The Surface Ship Torpedo Defense (SSTD) program provides a detect-to-engage layered torpedo defense capability. The funding supports mission readiness for Anti-Torpedo Torpedo Defense System (ATTDS) equipped ships and the sundown effort of ATTDS. The sundown of ATTDS returns the platform back to its original NIXIE configuration during a scheduled availability. In FY21, funding supports four (4) CVNs during their deployment cycles prior to CVN system sundown. The four (4) major efforts that comprise SSTD are the AN/SLQ-25 (NIXIE) system, Torpedo Warning System (TWS), the Countermeasure Anti-Torpedo (CAT) and Acoustic Device Countermeasure (Surface ADC MK2). The CAT program develops a canisterized Anti-Torpedo Torpedo (ATT). The TWS program develops the required torpedo detection, classification and localization (TDCL) ship systems to employ CAT. The TWS and CAT systems make-up the ATTDS.

The ATTDS provides a hard kill torpedo defensive capability on High Value Units (HVU's). The program has developed and fielded five ATTDS Engineering Design Model (EDM) systems on CVNs. Each EDM system is one TWS with a load out of a maximum of eight CATs. Starting in FY20, the ATTDS Program commenced sundown effort to return the five CVNs to their original configuration. The AN/SLQ-25 (NIXIE) is a towed acoustic and non-acoustic countermeasure system. The AN/SLQ-25 program develops countermeasure technologies and capabilities to improve ship survivability against future torpedo threats.

Research and development of new technologies and capabilities developed under the Future Naval Capabilities (FNC), Small Business and Innovative Research (SBIR), and other Research, Development, Test & Evaluation (RDT&E) initiatives are evaluated to determine their effectiveness and impact on improving ship survivability. Evaluations of new and emerging hardware and software in representative acoustic environments, against projected threats using both digital and hardware-in-the-loop simulations. Incorporation of the technology into the appropriate product line upon successful evaluation.
line.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.100	15.800	14.400	-	14.400
Current President's Budget	6.822	7.242	12.816	-	12.816
Total Adjustments	-0.278	-8.558	-1.584	-	-1.584
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-8.558			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.278	0.000			
• Program Adjustments	0.000	0.000	-1.840	-	-1.840
• Rate/Misc Adjustments	0.000	0.000	0.256	-	0.256

Change Summary Explanation

The FY 2021 funding request was reduced by $1.840 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0225: *Surface Ship Torpedo Defense (SSTD)*	764.061	6.822	7.242	12.816	-	12.816	1.942	0.638	0.000	0.000	0.000	793.521
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Countermeasure Anti-Torpedo (CAT) program developed a canisterized Anti-Torpedo Torpedo (ATT). The Torpedo Warning System (TWS) developed the required torpedo detection, classification and localization (TDCL) systems. The Countermeasure TWS and CAT systems make up the Anti-Torpedo Torpedo Defense System (ATTDS). The funding supports mission readiness for Anti-Torpedo Torpedo Defense System (ATTDS) equipped ships and the sundown effort of ATTDS. The sundown of ATTDS returns the platform back to its original NIXIE configuration during a scheduled availability.. In FY21, funding supports four (4) CVNs during their deployment cycles prior to their CVN system sundown.

The ATTDS provides a hard kill torpedo defensive capability on High Value Units (HVU's). The program has developed and fielded five ATTDS Engineering Design Model (EDM) systems on CVNs. Each EDM system consists one TWS with a load out of a maximum of eight CATs. The program delivered its first prototype system in FY13 and has delivered and installed its fifth and final system in FY17. Along with delivering and installing systems on CVN's, the ATTDS Program developed system salvo software through five test events and executed three Quick Reaction Assessment (QRA) tests. CVN Installation and/or removal will occur in FY20 through FY24 during scheduled availabilities.

Research and development of new technologies and capabilities developed under the Future Naval Capabilities (FNC), Small Business and Innovative Research (SBIR), and other Research, Development, Test & Evaluation (RDT&E) initiatives are evaluated to determine their effectiveness and impact on improving ship survivability. Evaluations of new and emerging hardware and software in representative acoustic environments, against projected threats using both digital and hardware-in-the-loop simulations. Incorporation of the technology into the appropriate product line upon successful evaluation.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Countermeasure Anti-Torpedo (CAT)	1.852	2.242	4.769	0.000	4.769
Articles:	-	-	-	-	-
FY 2020 Plans: Start CVN System Sundown plan, with long lead materials and planning. Continued engineering changes on CAT materials and CAT software. Continue fleet support with CAT system loadout prior to CVN development.					
FY 2021 Base Plans: Continue CVN system sundown plan, with NIXIE System Restoration.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Support of deployments for the five (5) CVNs prior to their sundown. Continue fleet support with CAT system loadout for each CVN prior to deployment. Develop future mission capabilities for the ATT. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease is due to supporting four (4) CVNs instead of five (5) during their deployment cycles.					
Title: Torpedo Warning System (TWS)	4.970	5.000	8.047	0.000	8.047
Articles:	-	-	-	-	-
FY 2020 Plans: Start CVN System Sundown plan according to sponsor direction, with long lead materials and planning Continued engineering changes on TWS software where and when required. ***FY 2021 Base Plans:*** Continue CVN system sundown plan, with NIXIE System Restoration. Support of deployments for the five (5) CVNs prior to their sundown. Develop future mission capabilities for the TWS system with the AN/SLQ-25, NIXIE System. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to starting CVN availability work on two CVNs.					
Accomplishments/Planned Programs Subtotals	6.822	7.242	12.816	0.000	12.816

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2213: *Surface Ship Torpedo Def (SSTD)*	4.777	12.439	13.241	-	13.241	13.275	13.438	13.588	5.893	Continuing	Continuing
• WPN/3113: *Surface Ship Torpedo Def (SSTD)*	6.353	5.561	5.811	-	5.811	5.573	5.403	5.498	5.601	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

Remarks

OPN/2213 funds the AN/SLQ-25 System. No ATTDS OPN funding in FY18 and out.
WPN/3113 funds the Surface Acoustic Device Countermeasure, ADC MK2 Mod 6 and Surface ADC Ready Stowage Lockers. No WPN ATTDS funding in FY18 and out.

D. Acquisition Strategy

CAT Program: The Program completed a Systems Requirements Review (SRR) and Preliminary Design Review (PDR) on the Engineering Development Model (EDM) design. ARL Penn State (ARL/PSU) has completed a Technical Data Package (TDP) to support the future system builds. CAT system SALVO Software operational and is currently in fleet use.

TWS Program: ULTRA/3Phoenix developed and produced of five complete sensor sets. Pacific Engineering Incorporated (PEI) and In-Depth Engineering Ready developed the stowage racks and fire control systems respectively. System integration supported fabrication and fielding of the five complete systems. Testing of TWS SALVO software is complete and is currently in fleet use. It is anticipated that ULTRA/3 Phoenix will continue to support the program until sun setting of the systems is complete.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NUWC : Newport, RI	50.331	1.100	Nov 2018	1.500	Nov 2019	6.578	Nov 2020	-		6.578	0.000	59.509	-
Systems Engineering ATT Dev.	C/CPFF	PSU/ARL : State College, PA	305.792	0.822	Dec 2018	0.500	Dec 2019	0.000	Dec 2020	-		0.000	0.000	307.114	-
Systems Engineering	C/CPFF	JHU/APL : Baltimore , MD	1.740	0.000		0.000		0.000		-		0.000	0.000	1.740	-
Systems Engineering Warhead Dev.	WR	NSWC : Indian Head, MD	80.290	0.900	Nov 2018	0.500	Nov 2019	1.500	Nov 2020	-		1.500	0.000	83.190	-
Systems Engineering	WR	NUWC : Keyport,WA	60.631	0.900	Nov 2018	1.242	Nov 2019	2.000	Nov 2020	-		2.000	0.000	64.773	-
Systems Engineering TDCL	C/CPFF	Ultra : Braintree, MA	11.640	0.000		0.000		0.000		-		0.000	0.000	11.640	Continuing
Systems Engineering ATT	WR	ONR : Arlington, VA	1.680	0.000		0.000		0.000		-		0.000	0.000	1.680	-
Systems Engineering TDCL	C/CPFF	AAC : Hauppage, NY	4.480	0.000		0.000		0.000		-		0.000	0.000	4.480	Continuing
Systems Engineering	WR	OPTEVFOR : Norfolk, VA	2.430	0.000		0.000		0.000		-		0.000	0.000	2.430	-
Systems Engineering	C/CPFF	ArgonST : Manassas, VA	0.800	0.000		0.000		0.000		-		0.000	0.000	0.800	Continuing
Systems Engineering TDCL	WR	NSWC : Dahlgren, VA	10.032	0.000		0.000		0.000		-		0.000	0.000	10.032	Continuing
Systems Engineering TDCL	WR	SPAWAR : San Diego, CA	11.118	0.000		0.000		0.000		-		0.000	0.000	11.118	Continuing
Systems Engineering	C/CPFF	UT/ARL : Arlington, TX	0.600	0.000		0.000		0.000		-		0.000	0.000	0.600	Continuing
Systems Engineering	C/CPFF	Alion : Bridgeport, CT	14.858	0.000		0.000		0.000		-		0.000	0.000	14.858	Continuing
Systems Engineering	WR	NUWC DET : Norfolk, VA	41.781	0.000		0.000		0.000		-		0.000	0.000	41.781	-
Systems Development	C/CPFF	3 Phoenix : Fairfax, VA	126.519	1.500	Dec 2018	1.500	Dec 2019	2.000	Nov 2020	-		2.000	0.000	131.519	Continuing
Integrated Logistic Spt	WR	NSWC Crane : Crane, IN	1.113	0.000		0.000		0.000		-		0.000	0.000	1.113	Continuing
Systems Engineering	C/CPFF	PEI : Roca, NE	4.745	0.000		0.000		0.000		-		0.000	0.000	4.745	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	CARDEROCK : Bethesda, MD	1.630	0.000		0.000		0.000		-		0.000	0.000	1.630	-
Systems Engineering	C/CPFF	CGI : Washington, DC	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Systems Engineering	C/BA	Dam Neck : Virginia Beach, VA	0.022	0.000		0.000		0.000		-		0.000	0.000	0.022	-
Systems Engineering	C/BA	NSWC Panama City : Panama City, FL	0.255	0.000		0.000		0.000		-		0.000	0.000	0.255	-
Systems Engineering	C/BA	Devron 26 : Not Specified	0.139	0.000		0.000		0.000		-		0.000	0.000	0.139	-
Systems Engineering	WR	Puget Sounds : Norfolk, VA	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Systems Engineering	WR	NAVAIR (NAWC WD) : Patuxent River, MD	0.140	0.000		0.000		0.000		-		0.000	0.000	0.140	-
Systems Engineering	WR	NORFOLK SHIPYARD : Norfolk, VA	0.150	0.000		0.000		0.000		-		0.000	0.000	0.150	-
Systems Engineering	WR	NORFOLK PLANNING YARD : Norfolk, VA	0.090	0.000		0.000		0.000		-		0.000	0.000	0.090	-
		Subtotal	733.406	5.222		5.242		12.078		-		12.078	0.000	755.948	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Earned Value Mgmt Spt	C/CPAF	Pioneer : Virigina	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Program Management Support	C/FFP	EG&G : Gaithersburg, Md.	2.846	0.000		0.000		0.000		-		0.000	0.000	2.846	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
DAWDF	Various	Not Specified : Not Specified	0.237	0.000		0.000		0.000		-		0.000	0.000	0.237	Continuing
Program Management Support	C/CPAF	Tech-Marine : Washington, DC	9.930	0.000		0.000		0.000		-		0.000	0.000	9.930	Continuing
Travel	Various	PMS 415 : Not Specified	1.244	0.100	Sep 2019	0.100	Sep 2020	0.100	Oct 2020	-		0.100	0.000	1.544	Continuing
Program Management Support	C/CPFF	SPA : Alexandria, VA	0.575	0.000		0.000		0.000		-		0.000	0.000	0.575	Continuing
Program Management Support	C/CPAF	Booz Allen : Washington, DC	15.373	1.500	Feb 2019	1.900	Feb 2020	0.638	Feb 2021	-		0.638	0.000	19.411	-
Program Management Support	C/CPAF	Alion : Washington, DC	0.400	0.000		0.000		0.000		-		0.000	0.000	0.400	-
		Subtotal	30.655	1.600		2.000		0.738		-		0.738	0.000	34.993	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	764.061	6.822		7.242		12.816		-		12.816	0.000	790.941	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603506N / *Surface Ship Torpedo Defense*	**Project (Number/Name)** 0225 / *Surface Ship Torpedo Defense (SSTD)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0225				
CAT - Integration ECP	1	2019	4	2023
TWS - Integration ECP	1	2019	4	2023
SUNDOWN	1	2020	4	2023

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	78.344	5.388	4.997	7.559	-	7.559	7.393	9.654	7.951	5.857	Continuing	Continuing
3216: *Tactical Support Center-Integration*	51.322	4.201	4.295	6.335	-	6.335	6.203	8.568	6.845	4.729	Continuing	Continuing
4005: *In-Service Carrier Systems Development*	27.022	1.187	0.702	1.224	-	1.224	1.190	1.086	1.106	1.128	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Program Element (PE) addresses technology areas associated with Command and Control (C2) of the MH-60R/S Seahawk Helicopter, as well as the development of other technologies and enhancements for Aircraft Carrier-based systems.

PROJECT 3216: The AN/SQQ-34 Aircraft Carrier Tactical Support Center (CV-TSC) program delivers Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) combat capability to the Aircraft Carrier. This Project provides incremental development to deliver frequent capability updates to the Fleet, developing, testing, certifying, and fielding system upgrades and cyber-security patches. The Project maintains interoperability with current and future interfaces; supports mission data exchange; improves track/sensor processing and analysis techniques; improves mission planning; improves data recording, reconstruction, and distribution; improves embedded simulation and training capabilities and implements cyber-security measures to effectively employ overall CVN self-defense capabilities. CV-TSC integrates sensor data from Off-Board Aircraft, Organic Platform Sensors, Minotaur Multi-Sensor Fused Track Data, Link-16 Track Data, Ship Self Defense System (SSDS) Track Data (non-Product Line Architecture (non-PLA) and Product Line Architecture (PLA), Global Command and Control System (GCCS) Over-the-Horizon Track Data, and Environmental and Threat Databases to assess the threat and assist the Tactical Action Officer (TAO) and Composite Warfare Commander (CWC) to effectively employ overall CVN self-defense capabilities. CV-TSC generates real-time ASW/SUW information and recommendations, tactical planning and employment of ASW/SUW assets, ASW/SUW sensor data processing and analysis, and distribution of tactically significant data. Aircraft supported include: MH-60R/S Seahawk, P-8 Poseidon, MQ-4C Triton, and future ASW/SUW systems.

PROJECT 4005: The In-Service Carrier Systems Development Demonstration and Validation Program develops new technology and enhancements to deliver an affordable, robust, operator-friendly automation control environment for Navy Aircraft Carrier shipboard equipment. The program provides the system architecture, requirements/specification development, technology selection, software development (including software baseline), manpower requirements, Total Ownership Costs (TOC), as well as land-based and shipboard testing of new technologies to improve shipboard operations.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	5.440	4.997	5.658	-	5.658
Current President's Budget	5.388	4.997	7.559	-	7.559
Total Adjustments	-0.052	0.000	1.901	-	1.901
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.052	0.000			
• Program Adjustments	0.000	0.000	1.750	-	1.750
• Rate/Misc Adjustments	0.000	0.000	0.151	-	0.151

Change Summary Explanation

FUNDING CHANGES SINCE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:
- FY 2021 net increase of $+1.901M driven by a program adjustment to add and incorporate Minotaur Multi-Sensor Fused Track Data into the Project 3216 CV-TSC development program, as well as the incorporation of general and Navy Working Capital Fund (NWCF) specific rate adjustments against Projects 3216 and 4005.

PROJECT 3216 - FY 2020 TO FY 2021 BUDGET REQUEST INCREASE:
- FY 2020 ($4.295M) to FY 2021 ($6.335M) increase ($+2.040M) primarily driven by the addition and incorporation of Minotaur Multi-Sensor Fused Track Data into the Project 3216 CV-TSC development program beginning in FY 2021. This addition provides increased battlespace awareness and accelerates the find, fix, track capability and Maritime Intelligence Surveillance and Reconnaissance & Targeting (MIS&RT) function in a communications-denied environment.

PROJECT 3216 - SCHEDULE CHANGES SINCE PREVIOUS PRESIDENT'S BUDGET:
- CV-TSC FCR-3 Integrated Shipboard Network System/Consolidated Afloat Network Enterprise System (ISNS/CANES), Platform Information Technology/ Information Assurance (PIT/ATO), Element Certification, and Combat System Test (CST) completion moved from 1Q20 to 3Q20, due to SSDS and combat system test schedule changes, specifically to CVN-70.
- CV-TSC FCR-4 (supports SSDS Non-Product Line Architecture) ISNS/CANES, PIT/ATO, Element Certification, and CST completion moved from 1Q20 to 3Q20, due to SSDS and combat system test schedule changes, specifically to CVN-75.
- CV-TSC FCR-5 development completion extended from 2Q21 to 3Q22, Independent Verification & Validation (IV&V) shifted from 2Q21-4Q21 to 2Q22-4Q22, and ISNS/CANES, PIT/ATO, Element Certification, and CST completion moved from 4Q21 to 4Q22, all due to the addition of Minotaur Multi-Sensor Fused Track Data Phase I integration efforts to the development stroke.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*

- CV-TSC FCR-6 development shifted from 4Q21-1Q23 to 1Q23-3Q24, Independent Verification & Validation (IV&V) shifted from 1Q23-3Q23 to 2Q24-4Q24, and ISNS/CANES, PIT/ATO, Element Certification, and CST completion moved from 3Q23 to 1Q25, all due to the addition of Minotaur Multi-Sensor Fused Track Data Phase II integration efforts to the development stroke.

PROJECT 4005 - FY 2020 TO FY 2021 BUDGET REQUEST INCREASE:
- FY 2020 ($0.702M) to FY 2021 ($1.224M) increase ($+0.522M) is due to an increase in the scope of work for the additive manufacturing and the Weapons Elevator Programmable Logic Controller (PLC) redesign projects.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3216: *Tactical Support Center-Integration*	51.322	4.201	4.295	6.335	-	6.335	6.203	8.568	6.845	4.729	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The AN/SQQ-34 Aircraft Carrier Tactical Support Center (CV-TSC) Project delivers Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) combat capability to the Aircraft Carrier. This Project provides incremental development to deliver frequent capability updates to the Fleet, developing, testing, certifying, and fielding system upgrades and cyber-security patches. The Project maintains interoperability with current and future interfaces; supports mission data exchange; improves track/sensor processing and analysis techniques; improves mission planning; improves data recording, reconstruction, and distribution; improves embedded simulation and training capabilities and implements cyber-security measures to effectively employ overall CVN self-defense capabilities. CV-TSC integrates sensor data from Off-Board Aircraft, Organic Platform Sensors, Minotaur Multi-Sensor Fused Track Data, Link-16 Track Data, Ship Self Defense System (SSDS) Track Data (non-Product Line Architecture (non-PLA) and Product Line Architecture (PLA)), Global Command and Control System (GCCS) Over-the-Horizon Track Data, and Environmental and Threat Databases to assess the threat and assist the Tactical Action Officer (TAO) and Composite Warfare Commander (CWC) to effectively employ overall CVN self-defense capabilities. CV-TSC generates real-time ASW/SUW information and recommendations, tactical planning and employment of ASW/SUW assets, ASW/SUW sensor data processing and analysis, and distribution of tactically significant data. Aircraft supported include: MH-60R/S Seahawk, P-8 Poseidon, MQ-4C Triton, and future ASW/SUW systems.

System development is accomplished through the following initiatives:
1) Maintaining interoperability with the local CVN warfare systems through current and future interfaces;
2) Continuing to support mission data exchange and tactical control with current and future ASW/SUW assets and their mission systems;
3) Improving track and sensor processing and analysis techniques as new track and sensor data becomes available;
4) Improving mission planning support for the ASW/SUW missions conducted from the CVN;
5) Improving data recording, reconstruct, and distribution to meet the decreasing timelines associated with getting tactically significant data to other end users both on and off platform;
6) Improving embedded simulation and training capabilities to enable operator proficiencies; and
7) Implementing cyber security measures.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: CV-TSC Development / Integration / Test / Certification	4.201	4.295	6.335	0.000	6.335
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: CV-TSC's evolutionary acquisition approach to developing, testing, certifying, and fielding system upgrades and cyber-security patches is implemented through a series of phased Fleet Capability Releases (FCRs). ***FY 2020 Plans:*** - Complete Independent Verification and Validation (IV&V) for FCR-3 and FCR-4. - Complete certifications required for fielding, to include Information Assurance (IA) Accreditation, Platform Information Technology (PIT) / Authorization to Operate (ATO), Integrated Shipboard Network System (ISNS) and Consolidated Afloat Network Enterprise System (CANES) Certifications, PEO IWS Element Certification, and Combat System Test (CST) Certification for FCR-3 and FCR-4. - Complete requirements definition phase for FCR-5. - Initiate Technical Insertion-16 (TI-16) Architecture changes specific to CVN-79. - Continue development effort for FCR-5. ***FY 2021 Base Plans:*** - Continue development of FCR-5. - Integrate TI-16 hardware/software baseline specific for CVN-79. - Integrate with Ship Self Defense System (SSDS) Advanced Capability Build-20 (ACB-20) combat system. - Begin Minotaur Integration Phase I. Host Minotaur on CV-TSC, begin Electro-Optical/Infra-Red (EO/IR) sensor integration, and update track interface with SSDS. - Integrate, test, and demonstrate Minotaur Integration Phase I capability. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** - FY 2020 to FY 2021 increase ($+2.040M) is driven by the addition and incorporation of Minotaur Multi-Sensor Fused Track Data into the CV-TSC development program beginning in FY 2021. This addition provides increased battlespace awareness and accelerates the find, fix, track capability and Maritime Intelligence Surveillance and Reconnaissance Targeting (MIS&RT) function in a communications-denied environment.					
Accomplishments/Planned Programs Subtotals	4.201	4.295	6.335	0.000	6.335

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2176: *Undersea Warfare Support Equipment (N98/CV-TSC only)*	0.334	0.343	0.150	-	0.150	4.348	2.371	1.666	0.381	Continuing	Continuing

Remarks

Funding profile represents the Department's CV-TSC portion of the Undersea Warfare (USW) Support Equipment budget (OPN BLI 2176, PE 0204112N).

D. Acquisition Strategy

- CV-TSC utilizes an incremental development approach that aims to deliver frequent capability updates to the Fleet. This approach allows required capability to be delivered to address emerging Fleet needs and provides frequent opportunities to ensure interoperability is synchronized with the Ship Self Defense System (SSDS) Advanced Capability Builds (ACBs). The acquisition strategy places heavy emphasis on the use of open architecture best practices to ensure ease of upgrades and to make developed products available to other platforms.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
CV-TSC Development / Integration	C/CPFF	Adaptive Methods : VA	3.802	0.400	Dec 2018	0.408	Dec 2019	0.712	Dec 2020	-		0.712	Continuing	Continuing	Continuing
CV-TSC Development / Integration	C/CPFF	JHU/APL : MD	0.250	0.000		0.000		0.000		-		0.000	0.000	0.250	-
CV-TSC Development / Integration	WR	NAWC/Pax River : MD	1.115	0.135	Dec 2018	0.138	Dec 2019	0.207	Nov 2020	-		0.207	Continuing	Continuing	Continuing
CV-TSC Development / Integration	WR	NRL : DC	0.325	0.000		0.000		0.000		-		0.000	0.000	0.325	-
CV-TSC Development / Integration	WR	NSWC/Carderock : MD	2.650	0.000		0.000		0.000		-		0.000	0.000	2.650	-
CV-TSC Development / Integration	WR	NSWC/Dahlgren : VA	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	-
CV-TSC Development / Integration	WR	NUWC/Keyport : WA	25.784	2.693	Nov 2018	2.662	Nov 2019	4.287	Nov 2020	-		4.287	Continuing	Continuing	Continuing
CV-TSC Development / Integration	WR	SPAWAR : CA	4.160	0.000		0.000		0.000		-		0.000	0.000	4.160	-
CV-TSC Development / Integration	C/CPFF	VAR* : VAR*	1.383	0.456	Dec 2018	0.556	Jan 2020	0.588	Dec 2020	-		0.588	Continuing	Continuing	Continuing
Boundary Defense Capability Design/ Development	WR	NSWC/Philadelphia : PA	4.046	0.000		0.000		0.000		-		0.000	0.000	4.046	-
Boundary Defense Capability Design/ Development	C/CPFF	VAR* : VAR*	4.495	0.000		0.000		0.000		-		0.000	0.000	4.495	-
		Subtotal	48.110	3.684		3.764		5.794		-		5.794	Continuing	Continuing	N/A

Remarks

* Consists of multiple performing activities with funding for each not greater than $1M per year.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
CV-TSC Test / Certification	WR	NUWC//Keyport : WA	2.330	0.314	Nov 2018	0.324	Nov 2019	0.330	Nov 2020	-		0.330	Continuing	Continuing	Continuing
CV-TSC Test / Certification	WR	NUWC/Newport : RI	0.125	0.000		0.000		0.000		-		0.000	0.000	0.125	-
		Subtotal	2.455	0.314		0.324		0.330		-		0.330	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE Systems : MD	0.411	0.000		0.000		0.000		-		0.000	0.000	0.411	-
Program Management Support - Acquisition, Business & Finance	C/CPFF	CACI : VA	0.055	0.039	Dec 2018	0.040	Jan 2020	0.000		-		0.000	0.000	0.134	-
Program Management Support - Acquisition, Business & Finance	C/CPFF	TBD (CACI Follow On) : TBD	0.000	0.000		0.000		0.041	Dec 2020	-		0.041	Continuing	Continuing	Continuing
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal : VA	0.267	0.144	Dec 2018	0.147	Jan 2020	0.000		-		0.000	0.000	0.558	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	TBD (CGI Federal Follow On) : TBD	0.000	0.000		0.000		0.150	Dec 2020	-		0.150	Continuing	Continuing	Continuing
Program Office Travel	Allot	NAVSEA PEO IWS5 : DC	0.024	0.020	Jan 2019	0.020	Nov 2019	0.020	Dec 2020	-		0.020	Continuing	Continuing	Continuing
		Subtotal	0.757	0.203		0.207		0.211		-		0.211	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603512N / *Carrier Systems Development*	Project (Number/Name) 3216 / *Tactical Support Center-Integration*	

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	51.322	4.201		4.295		6.335		-		6.335	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
CV-TSC Build 8 FCR-3				
CV-TSC Build 8 FCR-3 Development	1	2019	3	2019
CV-TSC Build 8 FCR-3 IV&V	3	2019	1	2020
CV-TSC Build 8 FCR-3 ISNS / CANES Certification	3	2020	3	2020
CV-TSC Build 8 FCR-3 PIT/ATO	3	2020	3	2020
CV-TSC Build 8 FCR-3 Element Certification	3	2020	3	2020
CV-TSC Build 8 FCR-3 CST	3	2020	3	2020
CV-TSC Build 8 FCR-4				
CV-TSC Build 8 FCR-4 Development	1	2019	3	2019
CV-TSC Build 8 FCR-4 IV&V	3	2019	1	2020
CV-TSC Build 8 FCR-4 ISNS / CANES Certification	3	2020	3	2020
CV-TSC Build 8 FCR-4 PIT/ATO	3	2020	3	2020
CV-TSC Build 8 FCR-4 Element Certification	3	2020	3	2020
CV-TSC Build 8 FCR-4 CST	3	2020	3	2020
CV-TSC Build 8 FCR-5 w/Minotaur Integration (Phase I)				
CV-TSC Build 8 FCR-5 Development w/Minotaur Integration (Phase I)	1	2020	3	2022
CV-TSC Build 8 FCR-5 IV&V	2	2022	4	2022
CV-TSC Build 8 FCR-5 ISNS / CANES Certification	4	2022	4	2022
CV-TSC Build 8 FCR-5 PIT/ATO	4	2022	4	2022
CV-TSC Build 8 FCR-5 Element Certification	4	2022	4	2022
CV-TSC Build 8 FCR-5 CST	4	2022	4	2022
CV-TSC Build 8 FCR-6 w/Minotaur Integration (Phase II)				

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 3216 / *Tactical Support Center-Integration*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
CV-TSC Build 8 FCR-6 Development w/Minotaur Integration (Phase II)	1	2023	3	2024
CV-TSC Build 8 FCR-6 IV&V	2	2024	4	2024
CV-TSC Build 8 FCR-6 ISNS / CANES Certification	1	2025	1	2025
CV-TSC Build 8 FCR-6 PIT/ATO	1	2025	1	2025
CV-TSC Build 8 FCR-6 Element Certification	1	2025	1	2025
CV-TSC Build 8 FCR-6 CST	1	2025	1	2025
CV-TSC Build 8 FCR-7				
CV-TSC Build 8 FCR-7 Development	3	2024	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4005: *In-Service Carrier Systems Development*	27.022	1.187	0.702	1.224	-	1.224	1.190	1.086	1.106	1.128	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The In-Service Carrier Systems Demonstration and Validation Program develops new technology and enhancements for 11 nuclear powered Aircraft Carriers with nearly 300 systems onboard each vessel. These systems are a combination of historical and new initiatives that deliver an affordable, robust, operator-friendly automated control environment. In order to deter threats and properly integrate all of the systems, the Demonstration and Validation Program segments the testing and upgrades into four areas: system architecture, requirements/specification development, technology selection, and software development. The Demonstration and Validation Program also focuses on the Total Ownership Costs of each system and any equipment obsolescence issues. Initial technologies include the Uninterruptible Power Supply (UPS) Replacements, the Integrated Condition Assessment System (ICAS), the On-Machine I/O development for Low Pressure Air Plants (LPAP) and LPAP air end redesign. Demonstration technologies include Advanced Damage Control System (ADCS) software improvements, Input / Output Controller (IOC) Replacement, Fleet wireless Personal Digital Assistant (PDA), Weapons Elevator Laser Positioning System (WELPS), Legacy Steering Interface (LSI) upgrades, Passive Countermeasures System (PCMS) alternate measurement capability, additive manufacturing efforts, and Weapons Elevators Programmable Logic Controller (PLC) redesign.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: In-Service Carrier Systems Development	1.187	0.702	1.224	0.000	1.224
Articles:	-	-	-	-	-

FY 2020 Plans:
Fiscal Year 2020 plans include continued support to Aircraft Carrier technologies. Modifications, upgrades and development of systems and software will be ongoing in support of In-Service aircraft carrier modernization initiatives and TOC reduction initiatives as well as addressing equipment obsolescence issues.

FY 2021 Base Plans:
Fiscal Year 2021 plans include continued support to Aircraft Carrier technologies. Modifications, upgrades and development of systems and software will be ongoing in support of In-Service aircraft carrier modernization initiatives and TOC reduction initiatives as well as addressing equipment obsolescence issues.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The increase from FY 2020 to FY 2021 in the amount of $0.522 million, is due to an increase in work for the additive manufacturing and the Weapons Elevator PLC redesign projects.					
Accomplishments/Planned Programs Subtotals	1.187	0.702	1.224	0.000	1.224

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Investigate, demonstrate, and implement available technologies to deliver a robust, operator-friendly automation control environment for Navy Aircraft Carrier shipboard equipment to reduce workload, manpower requirements, and Total Ownership Costs (TOC). Deliver affordable operational upgrades onboard each platform through comparative initiatives and analysis without sacrificing schedule, performance, or requirements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Ship Integration	WR	NAVSEA : Phil	3.590	0.537	Nov 2018	0.227	Nov 2019	0.482	Nov 2020	-		0.482	0.000	4.836	-
Ship Integration	WR	NAVSEA : Dahlgren	0.197	0.000		0.000		0.000		-		0.000	0.000	0.197	-
Ship Integration	WR	NAVSEA : Carderock	0.325	0.100	Nov 2018	0.050	Nov 2019	0.000		-		0.000	0.000	0.475	-
		Subtotal	4.112	0.637		0.277		0.482		-		0.482	0.000	5.508	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development	WR	NAVSEA : Phil	8.386	0.050	Nov 2018	0.050	Nov 2019	0.100	Nov 2020	-		0.100	0.000	8.586	-
Program Management Support	WR	NAVSEA : Phil	3.427	0.100	Nov 2018	0.050	Nov 2019	0.100	Nov 2020	-		0.100	0.000	3.677	-
Training Development	WR	NAVSEA : Phil	1.415	0.050	Nov 2018	0.050	Nov 2019	0.100	Nov 2020	-		0.100	0.000	1.615	-
Integrated Logistics Support	WR	NAVSEA : Phil	1.754	0.085	Nov 2018	0.050	Nov 2019	0.100	Nov 2020	-		0.100	0.000	1.989	-
Software Development	WR	NAVSEA : Dahlgren	0.308	0.000		0.000		0.000		-		0.000	0.000	0.308	-
Program Management Support	WR	NAVSEA : Dahlgren	0.317	0.000		0.000		0.000		-		0.000	0.000	0.317	-
Program Management Support	WR	NAVSEA : Carderock	0.150	0.050	Nov 2018	0.050	Nov 2019	0.037	Nov 2020	-		0.037	0.000	0.287	-
		Subtotal	15.757	0.335		0.250		0.437		-		0.437	0.000	16.779	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	SPAWAR : Atlantic	0.214	0.000		0.000		0.000		-		0.000	0.000	0.214	-
Developmental Test & Evaluation	WR	NAVSEA : Carderock	0.225	0.000		0.000		0.000		-		0.000	0.000	0.225	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAVSEA : Phil	6.445	0.215	Nov 2018	0.175	Nov 2019	0.305	Nov 2020	-		0.305	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NAVSEA : Dahlgren	0.261	0.000		0.000		0.000		-		0.000	0.000	0.261	-
		Subtotal	7.145	0.215		0.175		0.305		-		0.305	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
DAWF	Various	Various : Various	0.008	0.000		0.000		0.000		-		0.000	0.000	0.008	-
		Subtotal	0.008	0.000		0.000		0.000		-		0.000	0.000	0.008	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	27.022	1.187		0.702		1.224		-		1.224	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*

In-Service Carrier Systems Development

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603512N / *Carrier Systems Development*	**Project (Number/Name)** 4005 / *In-Service Carrier Systems Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4005				
C4I Networks performance requirements modeling and analysis: C4I Networks performance requirements modeling and analysis	2	2018	2	2021
Network Data Logger Device: Network Data Logger Device	2	2018	3	2020
Integrated Condition Assessment System SE Improvements: Integrated Condition Assessment System SE Improvements	3	2018	1	2021
Chlorinator/Dechlorinator Reliability Improvements: Chlorinator/Dechlorinator Reliability Improvements	2	2018	2	2021
Portable Navigation/Ship Control Data Analyzer: Portable Navigation/Ship Control Data Analyzer	2	2018	4	2021
CVN78 CL Platform support for Joint Strike Fighter: CVN78 CL Platform support for Joint Strike fighter	1	2018	1	2022
LPAP On-Machine I/O: LPAP On-Machine I/O	1	2018	1	2019
LPAP Air End Redesign: LPAP Air End Redesign	1	2018	4	2021
LPAP Air End Redesign: Modular Refrigeration Unit	1	2018	2	2018
Std Tool Development for In-Service Structural Assessment: Std Tool Development for In-Service Structural Assessment and risk definition	2	2018	4	2019
Additive Manufacturing: Additive Manufacturing	1	2019	4	2025
Weapons Elevator PLC Redesign: Weapons Elevator PLC Redesign	1	2019	1	2024

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603525N / *PILOT FISH*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	140.354	196.648	358.757	-	358.757	401.487	434.104	504.515	565.384	Continuing	Continuing
0428: *Pilot Fish*	0.000	140.354	196.648	358.757	-	358.757	401.487	434.104	504.515	565.384	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	136.533	291.148	281.639	-	281.639
Current President's Budget	140.354	196.648	358.757	-	358.757
Total Adjustments	3.821	-94.500	77.118	-	77.118
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-94.500			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	8.350	0.000			
• SBIR/STTR Transfer	-4.529	0.000			
• Program Adjustments	0.000	0.000	55.175	-	55.175
• Rate/Misc Adjustments	0.000	0.000	21.943	-	21.943

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603527N / *RETRACT LARCH*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	28.653	33.980	12.562	36.500	49.062	12.364	11.851	12.083	12.319	Continuing	Continuing
2690: *Retract Larch*	0.000	28.653	33.980	12.562	36.500	49.062	12.364	11.851	12.083	12.319	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	29.745	11.980	12.682	-	12.682
Current President's Budget	28.653	33.980	12.562	36.500	49.062
Total Adjustments	-1.092	22.000	-0.120	36.500	36.380
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.092	0.000			
• Program Adjustments	0.000	22.000	0.000	22.000	22.000
• Rate/Misc Adjustments	0.000	0.000	-0.120	14.500	14.380

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603536N / *RETRACT JUNIPER*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	109.958	129.163	148.000	-	148.000	139.748	117.611	108.063	101.364	Continuing	Continuing
4016: *Retract Sycamore*	0.000	109.958	129.163	148.000	-	148.000	139.748	117.611	108.063	101.364	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	113.679	129.163	108.092	-	108.092
Current President's Budget	109.958	129.163	148.000	-	148.000
Total Adjustments	-3.721	0.000	39.908	-	39.908
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.721	0.000			
• Program Adjustments	0.000	0.000	17.140	-	17.140
• Rate/Misc Adjustments	0.000	0.000	22.768	-	22.768

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	5.834	0.735	0.689	0.778	-	0.778	0.788	0.785	0.800	0.816	Continuing	Continuing
1830: *RADIAC Development*	5.834	0.735	0.689	0.778	-	0.778	0.788	0.785	0.800	0.816	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mission Description: The Radiation Detection, Indication and Computation (RADIAC) Program is responsible for providing radiation monitoring instruments that detect and measure ionizing radiation. These instruments are used on all Navy, Coast Guard and Military Sealift Command vessels, and at every Navy shore installation, in order to ensure the safety of personnel, continuity of operations in radiological contingencies, and protection of the environment.

Justification: Title 10 of the Code of Federal Regulations, Part 20 (10 CFR 20) requires RADIAC instruments be used to ensure the safety of personnel who work with or who are exposed to radioactive materials in their jobs. Additionally, the Navy's mission requires personnel and ships to have the ability to operate in radiological environments and the ability to identify and interdict radiological Weapons of Mass Destruction (WMD). Navy programs that require RADIAC instruments for Occupational Safety & Health (OSH) under the provisions of 10 CFR 20 include Naval Nuclear Propulsion, Nuclear Weapons, Medical, and Radiological Affairs Support. Non-OSH programs include Radiological Defense, Consequence Management, Training, Technical (RADIAC calibration, shielding evaluation, research, etc.) and Radiological Search (maritime interdiction and radiological search missions to locate or intercept WMD).

This budget item develops, tests and evaluates new, highly reliable, more easily calibrated, easy to care and maintain, light weight and modern RADIAC instruments in order to improve the effectiveness of radiation safety, to make instruments simpler to use, and to reduce life cycle costs. The ultimate goal is to replace old, bulky, costly to maintain and repair, unreliable and obsolete instrumentation with multifunction equipment that can be automatically calibrated at greatly reduced cost.

This budget item also provides for improvement to nuclear weapons intrinsic radiation (gamma and neutron) shielding calculations, mixed field (neutron and gamma) dosimetry, and in neutron measurement. The objective is to develop less costly and more effective integral shielding for better personnel protection and safety. Improvement in personnel dosimetry and neutron measurement is also a major emphasis.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.740	0.689	0.778	-	0.778
Current President's Budget	0.735	0.689	0.778	-	0.778
Total Adjustments	-0.005	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.005	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603542N / *Radiological Control*				Project (Number/Name) 1830 / *RADIAC Development*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
1830: *RADIAC Development*	5.834	0.735	0.689	0.778	-	0.778	0.788	0.785	0.800	0.816	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Mission: The Radiation Detection, Indication and Computation (RADIAC) Program is responsible for providing radiation monitoring instruments that detect and measure radiation in accordance with the provisions of Title 10 of the Code of Federal Regulations (10 CFR 20). These instruments are used on all vessels afloat and at every shore installation in order to ensure the safety of personnel and the environment. RADIACs are also required after an act of terrorism or war that involves nuclear material in order to enable continuation of warfighting ability.

Justification: Many RADIAC instruments and dosimetry systems are decades old and approaching the end of their useful lives. In some cases the equipment and replacement parts are no longer manufactured, making the equipment logistically unsupportable. In other cases increasing failure rates due to age make replacements an economic efficiency
improvement. In all cases a technology refresh will make both economic sense in terms of lowering the total ownership costs, and will also provide increased operational capabilities.

Naval Nuclear Propulsion Program (NNPP): Instruments are developed to support the safe operation and maintenance of nuclear powered vessels and at nuclear maintenance facilities.

Non-NNPP: Instruments are developed to support other than NNPP end users, such as Explosive Ordnance Disposal, Nuclear Weapons, Medical, Industrial Radiography, Radiological Defense and Training.

Visit, Board, Search & Seizure (VBSS): The Navy has been tasked to intercept and board vessels at sea to search for nuclear or radiological materials that could be used for terrorist attacks. These instruments would have different characteristics than those used for NNPP and non-NNPP purposes and prototypes must be developed and/or tested and evaluated.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Primary Dosimetry	0.015	0.070	0.174	0.000	0.174
Articles:	50	50	-	-	-
Description: The need for primary dosimetry is inherent due to the Navy's operation of nuclear reactors and their emission of ionizing radiation. Title 10 CFR 20.1502 states "Each licensee shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits." A primary dosimeter must pass accreditation proficiency testing, allowing the reading obtained					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
to become a part of an individual's permanent health record. This permanent record is used to protect the individual radiation worker's health, and also the Navy from future liability. The Navy's current primary device is the DT-702/PD, a passive Thermo Luminescence Dosimeter (TLD). Existing TLDs and newer technologies, such as Optically Stimulated Luminescence (OSL), must be continually researched to determine on-going performance parameters, cost to field and cost to maintain, since the current system is approaching the end of its useful life and must be replaced by 2030. A passive device does not provide a display of the dose being received, which can be important in certain circumstances. The dosimeter instead must be sent to a facility with a special reader to recover the dose, which is then entered in the individual's medical records. An active device displays the dose digitally in real time, providing immediate feedback in high risk scenarios. Newer passive-active systems can do both. ***FY 2020 Plans:*** NSWCCD procured 50 neutron sensitive BeO (Beryllium oxide) dosimeters in a continuation of testing of new technologies for primary dosimetry applications as a replacement for the Navy's current passive DT-702/PD system. The 50 BeO dosimeters were sent to Pacific Northwest National Laboratory for proficiency testing of Category V (Neutron/Photon) Mixtures. A final report with the results has been provided to NAVSEA 04ND. The objective was to see how well these dosimeters would perform relative to the specifications of the National Voluntary Laboratory Accreditation Program that Navy primary dosimeters must meet. NSWCCD established a Cooperative Research And Development Agreements (CRADA) with Mirion Technologies, Inc. to further test, evaluate and compare new passive-active systems as candidates for the replacement of the DT-702/PD. Passive-active has emerged as the preferred technology for a replacement solution. NSWCCD performed multiple tests under this new CRADA and the two that were previously established with Landauer, Inc. and Thermofisher Scientific. ***FY 2021 Base Plans:*** NSWCCD will test and report the results of the three CRADAs established with TFS, Landauer, Inc. and Mirion Technologies, Inc. Additional BeO testing will be performed and a report with the results will be drafted by NSWCCD and submitted to NAVSEA 04ND. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The labor of a second Health Physicist will be added to test and analyze the three CRADA data. The labor of a Test Engineer will be added for the BeO testing.					
Title: Secondary Dosimetry	0.275	0.131	0.266	0.000	0.266
Articles:	1	-	2	-	2
Description: Secondary dosimetry includes the monitoring of doses to the hands, feet and eyes; extremity dosimetry. In some medical and industrial applications, there is a high risk of such local high exposures due to the handling of sources, working close to a high radiation field, or using/cleaning high-energy beta emitters. Because of this, the need to accurately measure extremity dose is of significant importance to the Navy. The legacy system currently used for hands and feet dose measurements is RADSTAR. This is an active system (see the Primary Dosimetry Overall Description task for a discussion of passive and active dosimeters), but it is no longer supported by the vendor and must be replaced. To that end the ED3 system was procured in FY18 and has been tested and a report rendered on its suitability as a replacement. This is another active system, but shortfalls noted were that it currently measures only exposure to the hands, and it is too fragile for industrial-type use. Another active system being considered is the iMUX, which has the advantage of being wireless (the other two require wires that extend from the extremities to a pager-sized device clipped to the belt or worn on the wrist), and is capable of measuring dose at both the hands and feet. Measurement of dose at the eyes is currently extrapolated from the Navy's passive primary dosimeter, the DT-702/PD. Because eyes are subject to development of cataracts with prolonged or high dose exposure to radiation, a more precise and real time measuring device is being sought in the systems being evaluated. ***FY 2020 Plans:*** NSWCCD began the testing process of Mirion Technologies, Inc. extremity dosimeter system (iMUX). ***FY 2021 Base Plans:*** NSWCCD to complete testing of iMUX and report results to NAVSEA 04ND. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** NSWCCD to procure an upgrade of the ED3 system. The upgrade will consist of ruggedized components and two additional probes for dose measurement at the eyes.					
Title: Visit, Board, Search & Seizure	0.015	0.063	0.063	0.000	0.063
Articles:	-	5	-	-	-
Description: The Visit, Board, Search & Seizure (VBSS) mission of the Navy is the requirement to board ships and be able to detect and identify potential radiological or nuclear Weapons of Mass Destruction (WMD). Such a sensitive mission requires leading edge technology and capabilities to ensure success. The AN/PDX-1 RADIAC Set was fielded in response to a Joint Urgent Operational Needs Statement to meet this requirement. It contains three instruments that serve different purposes: (1) a Handheld Radiation Monitor (HRM)that searches for radiological materials; (2) a Radioisotope Identifier (RID) that identifies the type of radiological material located; and (3) a Personal Radiation Detector (PRD) that displays the radiological dose the VBSS team members may be receiving so that they can be aware if they are being exposed to dangerous levels of radioactivity during the mission. Current technology dictates that the sensitivity of the detectors is directly proportional to the size of the detector element; i.e., the larger the detector, the more sensitive and capable it is. However, in VBSS there must be a tradeoff between size/weight and capability, since it is difficult and hazardous for boarding parties to carry a backpack-sized detector, along with their weapons and other gear, up a rope ladder to board a vessel on the high seas. This will be a continuing effort to find smaller, lighter instruments with enhanced sensitivity, reach-back capability, and other enhancements to provide the Navy the best and most cost effective equipment possible for this mission. ***FY 2020 Plans:*** NSWCCD procured one RID and two each of PRDs and HRMs. ***FY 2021 Base Plans:*** NSWCCD to test the five units acquired in FY20. In addition, the Navy Explosive Ordnance Disposal program has asked that their current RID be replaced with one more capable and less costly to maintain. Those requirements will be compared with VBSS requirements to find one unit to meet all Navy needs and upgrade both programs simultaneously. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A					
Title: Radiological Detection System	0.265	0.150	0.000	0.000	0.000
Articles:	10	-	-	-	-
Description: The Radiological Detection System (RDS) is a survey meter and its associated probes (alpha, beta, gamma, and neutron) used in a wide variety of applications, and the necessary ancillary equipment such as cases, cables and technical manuals. This type of survey meter system is the single most prevalent RADIAC instrument in the Navy inventory, utilized for every Navy end use but predominantly in the Naval Nuclear Propulsion Program (NNPP) and Radiological Defense (RD) end uses. The Joint Product Leader in Radiological Nuclear Defense(JPdl-RND) is currently developing the RDS for use by all the Services. This joint effort will lower the procurement cost for all and just as significantly, for the first time enable joint interoperability in the Radiological Defense arena. The Navy's current version of this instrument is the IM-260/PD Multi-Function RADIAC (MFR), which is 30 years old and nearing the end of its useful life. Army and Marine Corps use the AN/PDR-75 system and the Air Force the ADM-300, which are both also decades old and obsolete. The NNPP end use is unique amongst the Services, since only the Navy operates nuclear reactors, and while the RDS solution should prove to be sufficient for all the Services for most of their respective applications, Navy must test and evaluate the proposed RDS to ensure the performance and specifications of a Joint solution will be sufficient to meet the requirements of the NNPP application. ***FY 2020 Plans:*** NSWCCD developed the RDS Test Plan (TP). The TP was approved by NAVSEA 04ND. First Article RDS sets were tested at NSWCCD, in accordance with the approved TP. NSWCCD submitted a technical submittal detailing the results of First Article RDS testing. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Testing will be completed in 2020 and LRIP procurement will begin.					
Title: Laboratory Test Equipment	0.165	0.275	0.275	0.000	0.275
Articles:	1	2	2	-	2

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Laboratory Test Equipment are used in laboratories to test and evaluate radiation detectors and dosimetry devices. The primary end users will be NSWCCD and NDC. The beta irradiators will be used throughout the development and procurement of the Navy's new primary dosimetry system to evaluate system performance. Handheld radiation detection equipment from the Radiological Detection System (RDS) can also be evaluated using the beta irradiators. The upgraded Ortec equipment will be used to analyze the new accident dosimeter after exposure to a criticality event. ***FY 2020 Plans:*** NSWCCD procured the upgrade of an existing ORTEC Spectroscopy system along with associated software which will be utilized in the testing and evaluation of the new accident dosimeter system. In addition, NSWCCD has acceptance tested the Maintenance & Calibration system for the IM-276/PD and the beta irradiator that were acquired under previously awarded effort. NSWCCD procured a low activity (10 mCi) Cs-137 source for the GC-60 irradiator. The new source has been installed and used to test multiple RADIACs at low exposure rates without the need to add attenuators. ***FY 2021 Base Plans:*** NSWCCD will acceptance test the upgraded ORTEC system to evaluate accident dosimetry. NSWCCD will develop protocols and standard operating procedures for the beta irradiator. NSWCCD will procure the replacement of the RDT&E computers used to control the GC-60 and X-80 Irradiators in order to upgrade memory space and the operating system from Windows XP to the required Windows 10. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	0.735	0.689	0.778	0.000	0.778

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 2920: *RADIAC*	8.175	6.450	10.335	-	10.335	9.306	9.263	9.389	9.847	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

Remarks

D. Acquisition Strategy

Development efforts are focused on evaluation, modification (as required to meet operational requirements) and adaptation of commercial-off-the-shelf (COTS) technology in order to minimize total ownership costs. To the maximum extent possible new contracts are targeted for fixed price efforts to control development cost.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation	WR	NSWCCD : West Bethesda, MD	4.915	0.087	Jan 2019	0.421	Nov 2019	0.568	Oct 2020	-		0.568	Continuing	Continuing	Continuing
Primary Dosimetry	C/FFP	NSWCCD : West Bethesda, MD	0.315	0.003	Mar 2019	0.000		0.000		-		0.000	0.000	0.318	0.288
Secondary Dosimetry	C/FFP	NSWCCD : West Bethesda, MD	0.438	0.250	Nov 2019	0.003	Mar 2020	0.125	Mar 2021	-		0.125	0.000	0.816	0.162
VBSS	C/FFP	NSWCCD : West Bethesda, MD	0.166	0.000		0.063	Aug 2020	0.000		-		0.000	0.000	0.229	0.246
Radiological Detection System	C/FFP	NSWCCD : West Bethesda, MD	0.000	0.230	Sep 2019	0.000		0.000		-		0.000	0.000	0.230	0.063
Laboratory Test Equipment	C/FFP	NSWCCD : West Bethesda, MD	0.000	0.165	Mar 2019	0.202	Mar 2020	0.085	Mar 2021	-		0.085	0.000	0.452	-
		Subtotal	5.834	0.735		0.689		0.778		-		0.778	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.834	0.735		0.689		0.778		-		0.778	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Primary Dosimetry				
Test & Evaluation: Landauer Verifii Dosimeter System Test & Report	1	2020	2	2021
Test & Evaluation: Neutron BeO Dosimeter Proficiency Test & Report at PNNL	3	2020	4	2020
Test & Evaluation: Supplemental Test & Report of Neutron BeO Dosimeter	1	2021	4	2021
Test & Evaluation: Landauer CRADA Test & Report	4	2021	3	2023
Test & Evaluation: Thermo CRADA Test & Report	4	2021	3	2023
Test & Evaluation: Mirion CRADA Test & Report	4	2021	3	2023
Cooperative Research and Development Agreements: Establish CRADA With Landauer	4	2019	4	2019
Cooperative Research and Development Agreements: Establish CRADA With Thermo Fisher Scientific	4	2019	4	2019
Cooperative Research and Development Agreements: Establish CRADA With Mirion	2	2020	2	2020
Contract Events: Procure Neutron BeO Dosimeter Articles	2	2020	2	2020
Secondary Dosimetry				
Test & Evaluation: Test & Report on iMUX Extremity Dosimeter System	2	2019	2	2020
Test & Evaluation: Test & Report on ED3 Extremity Dosimeter System	2	2022	4	2022
Test & Evaluation: ED3 Probees Test & Report	1	2023	4	2023
Contract Events: Procure Maintenance & Calibration System (MAC) and Technical Data Package	2	2019	2	2019
Contract Events: Procure Extremity Dosimeter (ED3) Articles	2	2021	2	2021
Contract Events: Procure Extremity Dosimeter (ED3) Probe Articles	2	2022	2	2022
Radiological Detection System				
Test & Evaluation: Test to Meet Navy Specifications for Nuclear Propulsion Program	2	2020	4	2020
Contract Events: Procure Test Units	4	2019	4	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603542N / *Radiological Control*	**Project (Number/Name)** 1830 / *RADIAC Development*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Procurement: LRIP Procurement	4	2020	4	2020
Visit, Board, Search & Seizure				
Test & Evaluation: Test & Report on PRD and HRM Batch 1	1	2019	4	2019
Test & Evaluation: Test & Report on RID Batch 2	1	2021	4	2021
Test & Evaluation: Test & Report on PRD Batch 2	2	2021	1	2022
Test & Evaluation: Test & Report on HRM Batch 2	3	2021	2	2022
Test & Evaluation: Test & Report on RID Batch 3	1	2023	4	2023
Test & Evaluation: Test & Report on PRD Batch 3	4	2023	3	2024
Test & Evaluation: Test & Report on HRM Batch 3	3	2024	2	2025
Contract Events: Procure RID, PRD & HRM Articles Batch 2	3	2020	3	2020
Contract Events: Procure RID, PRD & HRM Articles Batch 3	3	2022	3	2022
Laboratory Test Equipment				
Test & Evaluation: Acceptance Testing of MAC	1	2020	2	2020
Contract Events: Procure Beta Irradiator	4	2019	4	2019
Contract Events: Procure ORTEC Upgrade	3	2020	3	2020
Contract Events: Procure Cs-137 Source	4	2020	4	2020
Procurement: Procurement of MAC	3	2021	3	2021

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	187.992	1.078	1.137	1.161	-	1.161	1.183	1.209	1.233	1.258	Continuing	Continuing
1704: *Undersea Warfare*	187.992	1.078	1.137	1.161	-	1.161	1.183	1.209	1.233	1.258	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this Program Element (PE) is to pursue the development of technologies with the goal of improving Anti-Submarine Warfare (ASW) effectiveness to the point of rendering the enemy submarine irrelevant against U.S. and coalition forces. The Rest-of-the-World (ROW) continues to produce quieter, more lethal submarine technologies. Adaptable commercial technologies are readily available to the ROW navies. These trends increase the threats to U.S. surface combatants, thus requiring a focused effort to identify the most promising ASW technologies through a process of discovery, assessment, experimentation, and analysis. Studies, experiments, and/or technology developments under this PE will seek to improve the ability of surface combatants to detect, classify, localize, and track submerged contacts and detect and defend against modern torpedoes. To achieve these objectives, it is essential to develop new ASW technologies. The products from these efforts will be provided to the Advanced Capability Build (ACB) program supporting the continuing improvement of the AN/SQQ-89A(V)15 Surface Ship ASW Combat System.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	1.122	1.137	1.157	-	1.157
Current President's Budget	1.078	1.137	1.161	-	1.161
Total Adjustments	-0.044	0.000	0.004	-	0.004
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.044	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.004	-	0.004

Change Summary Explanation

FUNDING CHANGES SINCE PREVIOUS PRESIDENT'S BUDGET:
- FY 2019 decrease of $-0.044M reflects Small Business Innovative Research (SBIR) transfer.
- FY 2021 increase of $+0.004M reflects general and Navy Working Capital Fund (NWCF) specific rate adjustments.

FY 2020 TO FY 2021 BUDGET REQUEST INCREASE:
- FY 2020 ($1.137M) to FY 2021 ($1.161M) increase ($+0.024M) is in line with inflation associated with the RDT&EN appropriation.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1704: *Undersea Warfare*	187.992	1.078	1.137	1.161	-	1.161	1.183	1.209	1.233	1.258	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The objective of this Project is to pursue the development of technologies with the goal of improving Anti-Submarine Warfare (ASW) effectiveness to the point of rendering the enemy submarine irrelevant against U.S. and coalition forces. The Rest-of-the-World (ROW) continues to produce quieter, more lethal submarine technologies. Adaptable commercial technologies are readily available to the ROW navies. These trends increase the threats to U.S. surface combatants, thus requiring a focused effort to identify the most promising ASW technologies through a process of discovery, assessment, experimentation, and analysis. Studies, experiments, and/or technology developments under this PE will seek to improve the ability of surface combatants to detect, classify, localize, and track submerged contacts and detect and defend against modern torpedoes. To achieve these objectives, it is essential to develop new ASW technologies. The products from these efforts will be provided to the Advanced Capability Build (ACB) program supporting the continuing improvement of the AN/SQQ-89A(V)15 Surface Ship ASW Combat System.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: ASW Concept Development/Studies	1.078	1.137	1.161	0.000	1.161
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue development efforts supporting color-map improvements for Torpedo Defense (TD) and Anti-Submarine Warfare (ASW), and development of a statistical model of Continuous Active Sonar (CAS) as compared to Pulsed Active Sonar (PAS) waveform performance to provide testable hypotheses for any data collection. - Continue developing Passive Augmented Doppler Matched Active Processing (DMAP), which associates active TD clusters with passive tracks to provide earlier and single-ping classifications. - Submit technology to Step 3 for laboratory testing and eventual delivery for operational use via ACB-21 on the AN/SQQ-89A(V)15 Surface Ship Anti-Submarine Warfare (ASW) Combat System.					
FY 2021 Base Plans: - Transition development items from FY 2019 and FY 2020 via Advanced Capability Build (ACB)-21 to the AN/SQQ-89A(V)15 Surface Ship ASW Combat System production program for fielding. - Award new development contract via Broad Agency Announcement (BAA) solicitation process in support of AN/SQQ-89A(V)15 Surface Ship ASW Combat System Fleet requirements. - Continue development of new capabilities focused on ASW and TD improvements.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase from FY 2020 to FY 2021 ($+0.024M) is in line with inflation associated with the RDT&EN appropriation.					
Accomplishments/Planned Programs Subtotals	1.078	1.137	1.161	0.000	1.161

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0205620N/1916: *Surface ASW System Improvement*	25.478	29.572	29.348	-	29.348	29.849	30.441	31.046	31.666	Continuing	Continuing
• OPN/2136: *AN/SQQ-89 Surf ASW Cmbt Sys*	114.344	121.966	128.664	-	128.664	135.722	138.306	139.602	141.452	Continuing	Continuing

Remarks

D. Acquisition Strategy

- Use competitively awarded contracts from Broad Agency Announcement (BAA) solicitations. Successful technologies are transitioned to the AN/SQQ-89A(V)15 Surface Ship Anti-Submarine Warfare (ASW) Combat System Advanced Capability Build (ACB) development program funded under PE 0205620N Project 1916 for integration and test. Technologies are delivered every two years to the AN/SQQ-89A(V)15 Surface Ship ASW Combat System production program via the ACB spiral development process (ACB-19, ACB-21, etc.).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ASW Concept Development/Studies	C/CPFF	AAC : NY	2.201	0.000		0.000		0.000		-		0.000	0.000	2.201	-
ASW Concept Development/Studies	C/CPFF	Adaptive Methods : VA	3.788	0.000		0.000		0.000		-		0.000	0.000	3.788	-
ASW Concept Development/Studies	C/CPFF	Alion Sciences : VA	8.749	0.000		0.000		0.000		-		0.000	0.000	8.749	-
ASW Concept Development/Studies	C/CPFF	Applied Physical Sciences : CT	1.150	0.301	Dec 2018	0.307	Jan 2020	0.313	Dec 2020	-		0.313	Continuing	Continuing	Continuing
ASW Concept Development/Studies	C/CPFF	In-Depth Engineering : VA	3.635	0.000		0.000		0.000		-		0.000	0.000	3.635	-
ASW Concept Development/Studies	C/CPFF	JHU/APL : MD	28.068	0.000		0.000		0.000		-		0.000	0.000	28.068	-
ASW Concept Development/Studies	C/CPFF	L-3 Communications : VA	3.000	0.000		0.000		0.000		-		0.000	0.000	3.000	-
ASW Concept Development/Studies	C/CPFF	Lockheed Martin - ISS : NY	7.110	0.000		0.000		0.000		-		0.000	0.000	7.110	-
ASW Concept Development/Studies	WR	NAVWAR : CA	0.277	0.000		0.000		0.000		-		0.000	0.000	0.277	-
ASW Concept Development/Studies	WR	NAWC/Pax River : MD	2.400	0.000		0.000		0.000		-		0.000	0.000	2.400	-
ASW Concept Development/Studies	WR	NFESC/PH : CA	5.350	0.000		0.000		0.000		-		0.000	0.000	5.350	-
ASW Concept Development/Studies	C/CPFF	Northrop Grumman : VA	4.684	0.000		0.000		0.000		-		0.000	0.000	4.684	-
ASW Concept Development/Studies	WR	NRL : DC	3.037	0.000		0.000		0.000		-		0.000	0.000	3.037	-
ASW Concept Development/Studies	WR	NSMA : VA	0.907	0.000		0.000		0.000		-		0.000	0.000	0.907	-
ASW Concept Development/Studies	WR	NSWC/Carderock : MD	4.373	0.000		0.000		0.000		-		0.000	0.000	4.373	-
ASW Concept Development/Studies	WR	NUWC/Keyport : WA	0.790	0.000		0.000		0.000		-		0.000	0.000	0.790	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ASW Concept Development/Studies	WR	NUWC/Newport : RI	44.870	0.045	Jan 2019	0.045	Jan 2020	0.046	Nov 2020	-		0.046	Continuing	Continuing	Continuing
ASW Concept Development/Studies	MIPR	SSGC : MS	3.253	0.000		0.000		0.000		-		0.000	0.000	3.253	-
ASW Concept Development/Studies	C/CPFF	UT/ARL : TX	6.752	0.000		0.000		0.000		-		0.000	0.000	6.752	-
ASW Concept Development/Studies	C/CPFF	VAR : VAR*	33.671	0.232	Dec 2018	0.275	Jan 2020	0.282	Dec 2020	-		0.282	Continuing	Continuing	Continuing
		Subtotal	168.065	0.578		0.627		0.641		-		0.641	Continuing	Continuing	N/A

Remarks

*Consists of multiple performing activities with funding for each not greater than $1M per year.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ASW Concept Development/Studies - At-Sea Test/Experiment	WR	ONR : VA	5.500	0.000		0.000		0.000		-		0.000	0.000	5.500	-
ASW Concept Development/Studies - Enhanced Data Collection	C/CPFF	JHU/APL : MD	4.462	0.000		0.000		0.000		-		0.000	0.000	4.462	-
ASW Concept Development/Studies - Enhanced Data Collection	C/CPFF	UT/ARL : TX	2.000	0.000		0.000		0.000		-		0.000	0.000	2.000	-
		Subtotal	11.962	0.000		0.000		0.000		-		0.000	0.000	11.962	N/A

Remarks

*Consists of multiple performing activities with funding for each not greater than $1M per year.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support - Acquisition, Business & Finance	C/CPAF	EG&G : VA	2.050	0.000		0.000		0.000		-		0.000	0.000	2.050	-
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE Systems : MD	4.824	0.000		0.000		0.000		-		0.000	0.000	4.824	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal* : VA	0.741	0.500	Dec 2018	0.510	Jan 2020	0.000		-		0.000	0.000	1.751	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	TBD (CGI Federal Follow On) : TBD	0.000	0.000		0.000		0.520	Dec 2020	-		0.520	Continuing	Continuing	Continuing
Program Ofice Travel	Allot	NAVSEA PEO IWS 5 : DC	0.350	0.000		0.000		0.000		-		0.000	0.000	0.350	-
		Subtotal	7.965	0.500		0.510		0.520		-		0.520	Continuing	Continuing	N/A

Remarks

*In addition to program office support, CGI Federal provides technical planning, systems engineering, and test support. CGI Federal also provides Subject Matter Experts (SMEs) as members of AN/SQQ-89 Surface Ship Anti-Submarine Warfare (ASW) Combat System Advanced Capability Build (ACB) technical Peer Review Working Groups and Integrated Product Teams (IPTs) in support of designing and refining candidate technologies for inclusion into ACB deliveries.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	187.992	1.078		1.137		1.161		-		1.161	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603553N / *Surface ASW*	**Project (Number/Name)** 1704 / *Undersea Warfare*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 1704.L24				
Broad Agency Announcement (BAA) Awards: BAA Award - 2019	2	2019	2	2019
Broad Agency Announcement (BAA) Awards: BAA Award - 2021	2	2021	2	2021
Broad Agency Announcement (BAA) Awards: BAA Award - 2023	2	2023	2	2023
Broad Agency Announcement (BAA) Awards: BAA Award - 2025	2	2025	2	2025
Technology Development and Analysis: Technology Development and Analysis	1	2019	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,121.718	103.267	115.717	185.356	-	185.356	153.975	170.801	182.010	185.635	Continuing	Continuing
0223: *Sub Combat System Improvement (ADV)*	566.242	44.640	51.151	55.418	-	55.418	56.795	58.797	59.851	61.026	Continuing	Continuing
2033: *Adv Submarine Systems Development*	533.664	29.894	34.282	33.580	-	33.580	27.291	23.389	23.851	24.331	Continuing	Continuing
2096: *Payload Delivery Development*	8.538	10.969	10.801	17.975	-	17.975	12.362	13.636	10.289	10.495	Continuing	Continuing
3391: *SSN/SSGN Survivability Program*	8.203	8.116	9.483	11.511	-	11.511	12.008	11.544	12.795	13.051	Continuing	Continuing
9710: *Advanced Submarine Technology Development*	0.000	0.000	0.000	66.872	-	66.872	45.519	63.435	75.224	76.732	Continuing	Continuing
9999: *Congressional Adds*	5.071	9.648	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.719

Note

Project 9710 was previously funded in FY 2019 under Program Element 0604250D8Z (Advanced Innovative Technologies) Project 250 (Advanced Innovative Technologies). This is a Navy new start.

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $1.160 million to account for the availability of prior year execution balances.

This Program Element (PE) supports innovative research and development in submarine Hull, Mechanical and Electrical (HM&E) and combat systems technologies and the subsequent evaluation, demonstration, and validation for submarine platforms. It will increase the submarine technology base and provide subsystem design options not currently feasible. The PE also supports programs transitioning from Science and Technology (S&T), Defense Advanced Research Projects Agency (DARPA), Independent Research & Development (IR&D), and Small Business Innovation Research (SBIR) projects.

SUMMARY OF MAJOR BUDGET REQUEST CHANGES IN THIS PE FROM FY 2020 TO FY 2021 (NET INCREASE OF $+69.639M):
- PROJECT 0223 increase from FY 2020 to FY 2021 ($+4.267M) was driven by the following: 1) The realignment of responsibilities, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW) with resulting products incorporated directly into the Advanced Processing Build (APB) development program. 2) The increased effort to begin the transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework.

- PROJECT 2033 net decrease from FY 2020 to FY 2021 ($-0.702M) is the result of Large Scale Vehicle (LSV-2) Recapitalization planned program funding increase and under execution reduction.
- PROJECT 2096 increase from FY 2020 to FY 2021 ($+7.174M) reflects increased effort required to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of the Payload Handling System (PHS) in the VIRGINIA Class Block VI Technical Baseline.
- PROJECT 3391 increase from FY 2020 to FY 2021 ($+2.028M) was required for Advanced Signature Management/Countermeasures development (classified).
- PROJECT 9710 increase from FY 2020 to FY 2021 ($+66,872) was driven by the deferral of the start of this Project from FY 2020 to FY 2021.
- PROJECT 9999 decrease from FY 2020 to FY 2021 ($-10.0M) reflects the Congressionally directed add for 'Small Business Technology Insertion' in FY 2020.

DESCRIPTION/JUSTIFICATION BY PROJECT:

PROJECT 0223: The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project researches, develops, and tests new sonar, combat system, imaging, and electronic warfare software and develops, tests, and prototypes new sonar arrays for Program Executive Office Submarine (PEO SUB) programs, delivering approximately thirty (30) new capabilities every other year. This Project supports Navy Submarine Acoustic Superiority and Technology Insertion Initiatives through the application of advanced development and testing of sensors and sensor processing systems supporting tactical control systems improvements. Improvements are supportive of 'A Cooperative Strategy for 21st Century Sea Power and the Chief of Naval Operations (CNO) Design for Maintaining Maritime Superiority'; addressing all components to include Strengthen Naval Power At and From Sea, Achieve High Velocity Learning, Strengthen Our Navy Team for the Future, and Expand and Strengthen Our Network of Partners. This Project addresses threats posed by China, Russia, Iran, Korea and Terrorism (CRIKT), improved lethality of U.S. Submarine Forces and 3rd Offset Capabilities in the Unmanned and Automated Systems domains.

Project 0223 is comprised of four (4) major efforts: Advanced Processing Builds (APB), Flank Array Demonstration (FAD), Advanced Sensors, and Large Vertical Array (LVA).

APB develops, tests and transitions capabilities for:
- APB Acoustics, transitioning to AN/BQQ-10
- APB Tactical Control, transitioning to AN/BYG-1
- APB Imaging, transitioning to AN/BVY-1
- APB Electronic Warfare (EW), transitioning to AN/BLQ-10

Flank Array Demonstration (FAD) conducts testing and analysis on the existing Large Vertical Array (LVA) and supports maintenance and correction of identified problems on the array.

Advanced Sensors develops new technologies for Hull Mounted and Towed Arrays. Hull Mounted improvements support submarine applications only. Towed array improvements are shared to support surface and surveillance applications.

Large Vertical Array (LVA) leverages demonstrated FAD developments to conduct critical testing and analysis needed to improve array performance and develop sensor employment tactics. It will introduce new electronic hardware and new software applications to enhance array and signal processing performance. These improvements will be incorporated in future LVA builds for VIRGINIA class SSNs and OHIO and COLUMBIA classes of SSBNs.

PROJECT 2033: Advanced Submarine Systems Development (ASSD) is a non-acquisition program that develops/matures and tests advanced technologies for successful integration into current and future submarine classes, lowering the technical/cost risks of integrating new technologies prior to acquisition, and speeding the delivery of capability and lethality into the Fleet. ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies, and future naval concepts from the Science & Technology (S&T) and Research and Development (R&D) communities through the development, maturation, and integration of technology projects to operational submarine platforms for assessment, testing, and evaluation. Once projects have proven their maturity and promise through at-sea demonstration, they are formally transitioned into acquisition Programs Of Record (PORs). Additionally, ASSD operates and maintains R&D infrastructure assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

Project 2033 is comprised of three budget categories: Strategic Capability Infrastructure, Long Range R&D Investment,and Rapid Technology Development.

The major developmental efforts include:

Strategic Capability Infrastructure
- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)

Long Range R&D Investment
- Precision Submarine Maneuvering and Control
- Advanced Material Propeller (AMP) Technology
- Advanced SSN Technologies
- Next Generation Thrust (future propulsor/shafting technologies)
- Advanced Hull Treatments

Rapid Technology Development
- Innovation Technology Transfer

PROJECT 2096: Payload Delivery Development, consists of the Payload Handling System (PHS).

Payload Delivery Development is a non-acquisition program used for the integration of large deployable and retrievable payloads with submarines. RDT&EN funding will be used to design, manufacture, and field a prototype payload launch and recovery system utilized with submarine large ocean interfaces to accommodate large diameter payloads and offboard systems. The project enables launch and recovery of these systems from submarines. This will provide the Submarine Force with the capability to launch and recover large payloads and offboard systems of various configurations in support of critical Undersea Warfare (USW) missions, providing battle space awareness and extending war-fighting reach in support of Subsea and Seabed Warfare (SSW) mission objectives. This capability has been identified

as a key enabler for the following critical USW mission areas: Intelligence, Surveillance, and Reconnaissance (ISR), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW), Naval Special Warfare (NSW), Mine Warfare, Subsea and Seabed Warfare (SSW), Counter- Autonomous Underwater Vehicle (AUV) Warfare, Electromagnetic Maneuver Warfare (EMMW), Deception, and Non-Lethal Sea Control. This capability is paramount to winning the great power competition emerging between world powers and maintaining dominance in the undersea domain. In addition to technology development, the program will support engineering and integration of new and existing technologies to enable rapid prototyping and fielding of future payload capabilities for VIRGINIA Class (VACL) Payload Modules (Block V and VI) and will be in coordination with the Tactical Submarine Evolution Plan (TSEP) objectives for VACL Block VII and/or SSNx. The prototype system capability will also provide immediate solutions to urgent war-fighter needs. Experimentation will be conducted with the Fleet (i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.), enabling an agile environment through at-sea demonstrations, which will provide Fleet and acquisition stakeholders with relevant payload employment data to inform Concepts of Operations (CONOPs) and fielding decisions.

- FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

PROJECT 3391: In 2013, OPNAV N97 established SSN/SSGN Survivability Program (S3P) as a separate project area within ASSD to assure SSN/SSGN survivability and the ability of submarines to complete their joint warfighting missions even if covert mobility is compromised. FY 2018 is the first year of S3P execution as Project 3391 under ASSD with level funding across the FYDP. PBR 19 proposes technology projects that would help pace world-wide technology advances and red investments so as to track and assess US undersea superiority technology insertion plans and their impact on SSN/SSGN survivability.

PROJECT 9710: Details of the project are classified SECRET and are submitted to Congress in the classified budget justification books.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	105.809	148.756	166.138	-	166.138
Current President's Budget	103.267	115.717	185.356	-	185.356
Total Adjustments	-2.542	-33.039	19.218	-	19.218
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-43.039			
• Congressional Rescissions	-	-			
• Congressional Adds	-	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.542	0.000			
• Program Adjustments	0.000	0.000	19.125	-	19.125
• Rate/Misc Adjustments	0.000	0.000	0.093	-	0.093

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Small Business Technology Insertion*	0.000	10.000
Congressional Add: *Littoral Water Threats*	4.824	0.000
Congressional Add: *Lightweight Composite Research*	4.824	0.000
Congressional Add Subtotals for Project: 9999	9.648	10.000
Congressional Add Totals for all Projects	9.648	10.000

Change Summary Explanation

FUNDING CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:
- FY 2019 net decrease of $-2.542M reflects the Small Business Innovative Research (SBIR) transfer.
- FY 2020 net decrease of $-33.039M included Congressionally directed program adjustments as follows: $-0.575M to Project 2033 for contract delays; $-3.135M to Project 2096 for material purchases growth early to need; $-0.640M to Project 3391 for project delays; $-38.689 to Project 9710 for unjustified new start and lack of acquisition strategies; $+10.000M to Project C308 for small business technology insertion.
- FY 2021 net increase of $+19.218M included: $+1.130M increase to Project 0223 for the initiation of Interactive Multi-sensor Analysis Training (IMAT) software development starting in FY 2021; $+6.999M increase to Project 2033 for Large Scale Vehicle-2 Recapitalization; $+5.626M increase to Project 2096 for Payload Handling System (PHS); $+6.530M increase to Project 9710 to complete Project 1 production design schedule; and a $-1.160M offset to Project 2033 to account for the availability of prior year execution balances.

INFORMATION AT THE PROJECT LEVEL:

PROJECT 0223:

FUNDING: The FY 2020 ($51.151M) to FY 2021 ($55.418M) budget increase ($+4.267M) was driven by the addition of $+1.130M to realign the responsibility and funding, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office; $+0.500M for additional Large Vertical Array (LVA) development efforts; $+0.140M for additional Advanced Sensor development efforts; $+2.872M for additional Advanced Processing Build (APB) development efforts; and a decrease of $-0.375M for Flank Array Demonstration (FAD). Details on each Project 0223 program's budget increase/decrease from FY 2020 to FY 2021 are as follows:

APB - FY 2020 to FY 2021 increase ($+4.002M) is comprised of two factors:

1) $+1.130M driven by the realignment of responsibility and funding, starting in FY 2021, for the development of software from the UWDC to the NAVSEA Undersea Systems Program Office. The Navy determined that this development effort was best managed by the NAVSEA Undersea Systems Program Office due to its close alignment with other tactical aids, analysis, and training products developed under its APB program. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW). IMAT products will be incorporated into the APB program.

2) $+2.872M driven by the requirement to fully transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework. Program Executive Office for Submarines (PEO SUB) has begun a transition to CI/CD DevSecOps for Submarine Warfare Federated Tactical Systems (SWFTS) as has the APB program.

FAD - FY 2020 to FY 2021 decrease ($-0.375M) is in accordance with original program plans. Efforts cease after FY 2020 with the development/capabilities transitioned to the future LVA development efforts.

Advanced Sensors - FY 2020 to FY 2021 increase ($+0.140M) is in line with inflation associated with the RDT&EN appropriation.

LVA - FY 2020 to FY 2021 increase ($+0.500M) is consistent with program plans. The LVA development program is required to pace the threat of evolutionary quieting of adversary submarines. At-sea testing and analyses in FY 2020 will inform a ramp-up in FY 2021 and beyond to develop sensor and processing hardware improvements, and signal processing and tactics for each planned submarine platform.

SCHEDULE CHANGES:
- APB-19 At-Sea Test and Transition to PEO SUB Production Programs events accelerated one quarter each (from 3Q20 to 2Q20 and 4Q20 to 3Q20 respectively) due to new streamlined approach to Step-3 testing.
- APB-21 At-Sea Test and Transition to PEO SUB Production Programs events accelerated one year each (from 3Q22 to 3Q21 and 4Q22 to 4Q21 respectively) due to the transition to a more agile process (CI/CD DevSecOps) approach to software development and delivery for APB.
- APB-23 At-Sea Test and Transition to PEO SUB Production Programs events accelerated approximately one year each (from 3Q24 to 2Q23 and 4Q24 to 3Q23 respectively) due to the transition to a more agile process (CI/CD DevSecOps) approach to software development and delivery for APB.

PROJECT 2096:

FY 2020 funding profile received a Congressional Mark- ($3.135M)
FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

PROJECT 3391:

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*

S3P top-line resourcing increases to conduct Advanced Signature Management/Countermeasures development.

PROJECT 9710: Details of the project are classified SECRET and are submitted to Congress in the classified budget justification books.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0223: *Sub Combat System Improvement (ADV)*	566.242	44.640	51.151	55.418	-	55.418	56.795	58.797	59.851	61.026	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2020 TO FY 2021 BUDGET REQUEST INCREASE: Increase from FY 2020 to FY 2021 ($+4.267M) was driven by the following: 1) The realignment of responsibilities, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW) with resulting products incorporated directly into the Advanced Processing Build (APB) development program. 2) The increased effort to begin the transition, starting in FY 2021, to a Continuous Integration/Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework.

The Submarine Combat System Improvement (Advanced) (Non-ACAT) Project addresses technology challenges to improve tactical control in littoral and open ocean environments for a variety of operational missions including peacetime engagement, surveillance, battle space preparation, deterrence, regional sea denial, precision strike, task group support, and ground warfare support. These technologies, developed by Navy technology bases, the private sector, Office of Naval Research (ONR), Future Naval Capabilities (FNC), and Defense Advanced Research Projects Agency (DARPA) are then transitioned. Prototype hardware/software systems are developed to demonstrate technologically promising system concepts in laboratory and at-sea submarine environments. The Advanced Sensor development program develops and tests new sensors and demonstrates large array configurations. Current efforts are directed at Towed Array sensor technologies, telemetry, and architecture, to improve reliability and performance while decreasing program life cycle costs. For large array configurations, Conformal Acoustic Velocity Sonar (CAVES), Wide Aperture Array (WAA), Large Vertical Aperture (LVA) and Large Flank Array (LFA) technologies are also being pursued. The focus of sensor processing technology efforts through the Advanced Processing Build (APB) program will address improvements in imaging, tactical control, Electronic Warfare (EW) and acoustics, including detection, localization, classification, ranging, tracking, situational awareness, tactical decision aids, command decision support tools and displays and other functions essential to mission success. APB will also develop capabilities related to Unmanned Aerial and Undersea Vehicles and automated technologies specific to China, Russia, Iran, Korea and Terrorism (CRIKT). Technologies and/or capabilities developed under this Project will be shared, as applicable to reduce costs and optimize reuse, with development programs for surface ship sonar, Advanced Capability Build (ACB) and surveillance platforms, Advanced Surveillance Build (ASB). ACB and APB are managed under a common development process titled AxB. While each platform retains its uniqueness and focus in functional domains essential to mission success, a premium is placed on development of common capabilities and modular architecture technologies to maximize commonality and cost effectiveness.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Processing Build (APB)	39.515	41.776	45.778	0.000	45.778
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Advanced Processing Builds (APBs) adhere to a four Step process: Step-1: Algorithm/technology assessment by peer review panels of Subject Matter Experts (SME) to down-select technologies and assist developers with technical guidance. Step-2: Algorithm/technology testing with open and closed data sets to further down-select and refine capabilities prior to integration and testing. Step-3: Land-based system-level testing stimulated by the Submarine Multi-Mission Team Trainer (SMMTT), in a realistic tactical environment. Step-4: At-sea testing on an operational submarine. APB requirements are generated by the Submarine Tactical Requirements Group (STRG), a group of senior post command officers chaired by the Flag Officer, Director of Undersea Warfare Development Center (UWDC). Requirements are vetted by COMSUBPAC and COMSUBFOR, then provided as direction by the Chief of Naval Operations (CNO), OPNAV N97. PEO SUB provides Milestone Decision Authority (MDA) oversight and approval. Steps 1 and 2 are conducted in a pipeline style, parallel to system integration and production. This makes Steps 1 and 2 independent of any particular Build (e.g APB-17, APB-19) and allows for development of longer lead technologies. The content of a specific APB build (every two years on the odd year) is then determined through a series of discussions with the Fleet/STRG aimed at selecting the most relevant and mature technologies available in the APB pipeline. Integration at the String and System level is performed followed by Steps 3 and 4, as applicable, and transitioned to production. Beginning with APB-21, APB will adopt a Continuous Integration/Continuous Delivery (CI/CD) DevSecOps software development and delivery process in concert with Program Executive Office for Submarines (PEO SUB) and Submarine Warfare Federated Tactical Systems (SWFTS) production and fielding plans. ***FY 2020 Plans:*** - Continue refining candidate capabilities for inclusion in APB-21. - Integrate advanced capabilities through DevSecOps software pipeline in coordination with production program offices. - Conduct Step-3 land-based testing of APB-21. - Conduct Step-4 at-sea test of APB-19. Analyze results to inform improvements, tactics and training. - Continue development and testing new Electronic Warfare (EW) capabilities in a land-based development environment. - Continue development of electronic maneuver warfare capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue development of a Sonar Tactical Decision Aid (STDA) common to submarine, surface, and surveillance applications. Continue to export development products to Surface programs. - Continue studies on the use of Machine Learning and Artificial Intelligence (AI), with emphasis on Deep Learning and Big Data Analytics. Continue collaboration with the Digital Warfare Office and Project Maven to increase expertise and speed of development. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology. - Continue development of automated technologies targeting particular vulnerabilities. - Continue Step-1 and Step-2 development and testing of concepts, algorithms, and technologies in response to Fleet requirements consistent with the multi-year capability development road map developed in FY 2019. - Increase enterprise implementation of classified information exchange network to a larger group. - Update multi-year capability development road map developed in FY 2019.					
FY 2021 Base Plans: - Begin refinement of candidate capabilities for inclusion in APB-23. - Conduct Step-4 at-sea test of APB-21. Analyze results to inform improvements, tactics and training. - Continue studies on the use of Machine Learning and Artificial Intelligence (AI), with emphasis on Deep Learning and Big Data Analytics. Continue collaboration with the Digital Warfare Office and Project Maven to increase expertise and speed of development. Seek system performance improvements and 3rd Offset (automation) capabilities not currently achievable with legacy technology. - Continue Step-1 and Step-2 development and testing of concepts, algorithms, and technologies in response to Fleet requirements consistent with the multi-year capability development road map to be updated in FY 2020. - Implement EW detection improvements against complex signals, and integrate off-hull payloads into the Submarine Warfare Federated Tactical Systems (SWFTS) construct. - Begin integration of Interactive Multi-Sensor Analysis Training (IMAT) software capabilities with APB common Tactical Decision Aids (TDAs). Begin to adapt software architecture to a container-based approach to facilitate rapid updates and sharing with the Surface and Air communities.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: FY 2020 to FY 2021 increase ($+4.002M) is comprised of two factors:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*	

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
1) $+1.130M driven by the realignment of responsibility and funding, starting in FY 2021, for the development of Interactive Multi-Sensor Analysis Training (IMAT) software from the Undersea Warfare Development Center (UWDC) to the NAVSEA Undersea Systems Program Office. The Navy determined that this development effort was best managed by the NAVSEA Undersea Systems Program Office due to its close alignment with other tactical aids, analysis, and training products developed under its APB program. The IMAT program provides performance support and training systems for extremely difficult cognitive tasks involved in Anti-Submarine Warfare (ASW). IMAT products will be incorporated into the APB program. 2) $+2.872M driven by the requirement to fully transition, starting in FY 2021, to a Continuous Integration/ Continuous Delivery (CI/CD) pipeline approach for APB software within a DevSecOps delivery framework. Program Executive Office for Submarines (PEO SUB) has begun a transition to CI/CD DevSecOps for Submarine Warfare Federated Tactical Systems (SWFTS) as has the APB program.					
Title: Flank Array Demonstration (FAD)	1.325	0.375	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: - Provide on-site support for the maintenance, troubleshooting and repair of faulty or failed array inboard/ outboard components. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 decrease ($-0.375M) is in accordance with original program plans. Efforts cease after FY 2020 with the development/capabilities transitioned to the future LVA development efforts.					
Title: Advanced Sensors	3.800	7.000	7.140	0.000	7.140
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete Open Architecture Telemetry (OAT) component development, system architecture, and associated Installation Control Drawings (ICDs).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct array environmental, calibration, and Lake Pend Oreille (LPO) testing of array modules. - Begin procurement and fabrication of a full length OAT array Advanced Development Model (ADM). - Continue development of the High Speed Signal Path. - Continue development of active and passive sensor concepts to support performance requirements for the Bow Conformal Array (BCA). - Complete test panel design and procurement of material. - Initiate detailed design of BCA ADM. ***FY 2021 Base Plans:*** - Complete OAT development, and continue fabrication of OAT ADM array. - Test the active and passive sensor design concept panel for the new BCA and provide detailed design efforts. Additional BCA testing is necessary to validate studies conducted in FY 2019-2020, and to collect data that will be used to improve the acoustic performance of the BCA ADM. - Complete active and passive studies for BCA. Conduct acoustic test tank and environmental panel testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 increase ($+0.140M) is in line with inflation associated with the RDT&EN appropriation.					
Title: Large Vertical Array (LVA)	0.000	2.000	2.500	0.000	2.500
Articles:	-	-	-	-	-
Description: Large Vertical Array (LVA) development is a follow-on effort to the exploratory work conducted under the Flank Array Demonstration (FAD) program. ***FY 2020 Plans:*** - Conduct critical at-sea testing events for LVA2 and SSN 790 and analyze at-sea test results. This testing/ analysis is necessary to integrate enhanced signal processing capability for LVAs and to collect data that will be used to improve LVA tactical performance. These processing upgrades are directly applicable to improving the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines. ***FY 2021 Base Plans:*** - Continue with the conduct of at-sea testing events for LVA2 and SSN 790 and analyze at-sea test results.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 0223 / *Sub Combat System Improvement (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Provide on-site support for the maintenance, troubleshooting, and repair of faulty or failed array inboard/ outboard components. Document troubleshooting and repair findings for evaluation by engineering team and provide findings/recommendations to the forward fit and backfit LVA production programs for Virginia, Ohio, and Columbia Class Submarines. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 increase ($+0.500M) is consistent with program plans. The LVA development program is required to pace the threat of evolutionary quieting of adversary submarines. At-sea testing and analyses in FY 2020 will inform a ramp-up in FY 2021 and beyond to develop sensor and processing hardware improvements, and signal processing and tactics for each planned submarine platform.					
Accomplishments/Planned Programs Subtotals	44.640	51.151	55.418	0.000	55.418

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0205620N: *Surface ASW Cmbt Sys Integr*	25.478	29.572	29.348	-	29.348	29.849	30.441	31.046	31.666	Continuing	Continuing

Remarks

D. Acquisition Strategy

Use competitively awarded contracts from Broad Agency Announcement (BAA) solicitations and Small Business Innovative Research (SBIR) initiatives. Integration to fielded systems performed under contracts awarded by the recipient production program within PEO SUB. Advanced Processing Builds (APBs) adhere to a four-step process and are tested in a laboratory and at-sea on an operational submarine. Performance metrics are established for each build and documented in a Measurement and Analysis Plan.

APB Four-Step Process:
Step-1: Algorithm/technology assessment by peer review panels of Subject Matter Experts (SME) to down-select technologies and assist developers with technical guidance.
Step-2: Algorithm/technology testing with open and closed data sets to further down-select and refine capabilities prior to integration and testing.
Step-3: Land-based system-level testing stimulated by the Submarine Multi-Mission Team Trainer (SMMTT), in a realistic tactical environment.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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Step-4: At-sea testing on an operational submarine.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPFF	Adaptive Methods : VA	1.725	0.050	Dec 2018	0.300	Dec 2019	0.324	Dec 2020	-		0.324	Continuing	Continuing	Continuing
Product Development	C/CPFF	Alion Sciences : VA	3.267	0.000		0.000		0.000		-		0.000	0.000	3.267	Continuing
Product Development	C/CPFF	Arete : CA	0.550	0.000		0.000		0.000		-		0.000	0.000	0.550	-
Product Development	C/CPFF	Chesapeake Science (L-3) : MD	7.551	0.000		0.000		0.000		-		0.000	0.000	7.551	Continuing
Product Development	C/CPFF	Electric Boat : ME	1.855	0.125	Feb 2019	0.000		0.000		-		0.000	0.000	1.980	Continuing
Product Development	C/CPFF	General Dynamics : VA	24.829	1.811	Dec 2018	1.992	Dec 2019	2.151	Dec 2020	-		2.151	Continuing	Continuing	Continuing
Product Development	C/CPFF	GA Tech Research Institute : GA	3.076	0.080	May 2019	0.385	Dec 2019	0.416	Dec 2020	-		0.416	Continuing	Continuing	Continuing
Product Development	C/CPFF	In Depth Engineering : VA	7.085	0.350	Dec 2018	0.950	Jan 2020	1.026	Dec 2020	-		1.026	Continuing	Continuing	Continuing
Product Development	C/CPFF	JHU/APL : MD	111.461	5.983	Dec 2018	10.500	Dec 2019	11.340	Dec 2020	-		11.340	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : VA	80.324	10.235	Dec 2018	9.419	Oct 2019	10.173	Dec 2020	-		10.173	Continuing	Continuing	Continuing
Product Development	C/CPFF	Lockheed Martin : NY	10.064	0.000		0.000		0.000		-		0.000	0.000	10.064	Continuing
Product Development	C/CPFF	Metron : VA	8.938	1.300	Dec 2018	0.750	Jan 2020	0.810	Dec 2020	-		0.810	Continuing	Continuing	Continuing
Product Development	C/CPAF	NSMA : VA	13.094	0.650	Jan 2019	0.650	Feb 2020	0.702	Jan 2021	-		0.702	Continuing	Continuing	Continuing
Product Development	WR	NSWC/Carderock : MD	31.842	2.492	Nov 2018	2.585	Oct 2019	2.792	Nov 2020	-		2.792	Continuing	Continuing	Continuing
Product Development	WR	NUWC/Newport : RI	106.425	9.176	Nov 2018	9.360	Oct 2019	10.020	Nov 2020	-		10.020	Continuing	Continuing	Continuing
Product Development	WR	ONI : DC	2.295	0.000		0.000		0.000		-		0.000	0.000	2.295	Continuing
Product Development	WR	ONR : VA	2.725	0.000		0.000		0.000		-		0.000	0.000	2.725	Continuing
Product Development	C/CPFF	Progeny : VA	8.552	0.244	Dec 2018	0.650	Jan 2020	0.702	Dec 2020	-		0.702	Continuing	Continuing	Continuing
Product Development	C/CPFF	PSU/ARL : PA	10.680	1.133	Dec 2018	0.650	Jan 2020	0.702	Dec 2020	-		0.702	Continuing	Continuing	Continuing
Product Development	C/CPFF	SAIC : VA	3.555	0.000		0.000		0.000		-		0.000	0.000	3.555	Continuing
Product Development	C/CPFF	Sedna Digital : VA	15.400	1.884	Dec 2018	2.000	Nov 2019	2.160	Dec 2020	-		2.160	Continuing	Continuing	Continuing
Product Development	WR	SSC/San Diego : CA	1.963	0.000		0.000		0.000		-		0.000	0.000	1.963	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	U.S. Army Research Lab : MD	1.700	0.000		0.000		0.000		-		0.000	0.000	1.700	Continuing
Product Development	MIPR	U.S. Army/MITRE : NJ	4.595	0.000		0.000		0.000		-		0.000	0.000	4.595	Continuing
Product Development	MIPR	U.S. Hanscom AFB/ MIT Lincoln Labs : MA	21.778	1.820	Oct 2018	2.556	Dec 2019	2.760	Dec 2020	-		2.760	Continuing	Continuing	Continuing
Product Development	C/CPFF	UT/ARL : TX	31.931	1.946	Dec 2018	1.985	Jan 2020	2.144	Dec 2020	-		2.144	Continuing	Continuing	Continuing
Product Development	C/CPFF	VAR : VAR*	27.743	3.611	Dec 2018	4.635	Dec 2019	5.376	Dec 2020	-		5.376	Continuing	Continuing	Continuing
		Subtotal	545.003	42.890		49.367		53.598		-		53.598	Continuing	Continuing	N/A

Remarks

* Consists of multiple performing activities with funding for each not greater than $1M per year.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support - Acquisition, Business & Finance	C/CPFF	EG&G (URS) : VA	4.291	0.000		0.000		0.000		-		0.000	0.000	4.291	Continuing
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE Systems : MD	12.665	0.000		0.000		0.000		-		0.000	0.000	12.665	Continuing
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	CGI Federal* : VA	3.400	1.692	Nov 2018	1.726	Jan 2020	0.000		-		0.000	0.000	6.818	-
Program Management Support - Systems Engineering and Technical Assistance (SETA)	C/CPFF	TBD (CGI Federal Follow On)* : TBD	0.000	0.000		0.000		1.761	Dec 2020	-		1.761	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Office Travel	Allot	NAVSEA PEO IWS5 : DC	0.883	0.058	Nov 2018	0.058	Jan 2020	0.059	Nov 2020	-		0.059	Continuing	Continuing	Continuing
		Subtotal	21.239	1.750		1.784		1.820		-		1.820	Continuing	Continuing	N/A

Remarks

*In addition to program office support, CGI Federal provides technical planning, systems engineering, and test support. CGI Federal also provides Subject Matter Experts (SMEs) as members of AN/SQQ-89 Surface Ship Undersea Warfare (USW) Combat System Advanced Capability Build (ACB) technical Peer Review Working Groups and Integrated Product Teams (IPTs) in support of designing and refining candidate technologies for inclusion into ACB deliveries.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	566.242	44.640		51.151		55.418		-		55.418	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0223				
Advanced Processing Build (APB): APB Development Pipeline	1	2019	4	2025
APB-19: At-Sea Test	2	2020	2	2020
APB-19: Transition to PEO SUB Production Programs	3	2020	3	2020
APB-21: At-Sea Test	3	2021	3	2021
APB-21: Transition to PEO SUB Production Programs	4	2021	4	2021
APB-23: At-Sea Test	2	2023	2	2023
APB-23: Transition to PEO SUB Production Programs	3	2023	3	2023
APB-25: At-Sea Test	2	2025	2	2025
APB-25: Transition to PEO SUB Production Programs	3	2025	3	2025
Flank Array Demonstration (FAD): Test Conduct	1	2019	4	2019
Flank Array Demonstration (FAD): Test Analysis	1	2019	4	2019
Flank Array Demonstration (FAD): Maintenance	1	2020	4	2020
Advanced Sensors: Develop Array Technologies	1	2019	4	2025
Advanced Sensors: Build / Test Prototype Arrays	1	2019	4	2025
Advanced Sensors: Bow Conformal Assessments / Concept Designs	1	2019	4	2021
Large Vertical Array (LVA): Test Planning, Conduct and Analysis	1	2020	4	2022
Large Vertical Array (LVA): Sensor Design	1	2023	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
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COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2033: *Adv Submarine Systems Development*	533.664	29.894	34.282	33.580	-	33.580	27.291	23.389	23.851	24.331	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Advanced Submarine Systems Development (ASSD) is a non-acquisition program that develops/matures and tests advanced technologies for successful integration into current and future submarine classes, lowering the technical/cost risks of integrating new technologies prior to acquisition, and speeding the delivery of capability and lethality into the Fleet. ASSD transitions Hull, Mechanical, and Electrical (HM&E) technologies, and future naval concepts from the Science & Technology (S&T) and Research and Development (R&D) communities through the development, maturation, and integration of technology projects to operational submarine platforms for assessment, testing, and evaluation. Once projects have proven their maturity and promise through at-sea demonstration, they are formally transitioned into acquisition Programs Of Record (PORs). Additionally, ASSD operates and maintains R&D infrastructure assets that are critical to the long-term design, assessment and construction of modern, stealthy submarine platforms.

Project 2033 is comprised of three programmatic budget categories: Strategic Capability R&D Infrastructure, Long Range R&D Investment, and Rapid Technology Development. Strategic infrastructure investments maintain and operate critical, one-of-a-kind submarine R&D assets that enable the design and manufacture of the stealthiest submarines in the world, without the requirement to develop and test at full scale, which is inordinately expensive and risky. Long-range R&D investment is the maturation and prototyping at full scale of long-range (5-10 years) technologies, to enable their readiness for incorporation into existing and future submarines. The objective is to achieve high technology readiness (TRL-7) of the targeted technology so that it can be incorporated into the baseline submarine design during the detailed design contract award. Rapid Technology Development projects are efforts designed to rapidly mature higher TRL capabilities and field the particular technology project capability within an 18-30 month window, from program start to submarine at-sea demonstration. Also included in this category are innovative technology transition projects, seedling efforts (<$800K/year) which assess new technology candidates and keep the submarine/ USW technology pipeline primed. All SUB073/ASSD projects are determined by senior USW leadership and N97 sponsor direction.

The Program works with Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Office of Secretary of Defense (OSD), Office of Naval Research (ONR), and Defense Advanced Research Projects Agency (DARPA) organizations to identify and mature technology candidates for integration into current/future submarine classes to provide new/transformational capabilities, while achieving total-ownership cost reductions. Experimentation and demonstration are also conducted in a joint warfighting context with other services, (i.e. Marine Corps, Army, Air Force), to enable early assessment of a new technology's warfighting capabilities, and to inform the Fleet and acquisition community on smarter technology-selection decisions. This Program also supports cooperative R&D through Information/Data Exchange Agreements (IEA/ DEA) and joint Project Arrangements (PA) with Allies such as the United Kingdom and Australia, as well as other international partners, which target core technology maturation, future submarine component concept designs, etc.
Major technology developmental efforts within this budget submission include:

Strategic Capability R&D Infrastructure (at ARD Bayview, ID)

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- Large Scale Vehicle (LSV)
- Intermediate Scale Measurement System (ISMS)
- Large Scale Vehicle Recapitalization

Long Range R&D
- Advanced Hull Treatments
- Next Generation Thrust (future propulsor/shafting technologies)
- Advanced Material Propeller
- Advanced SSN Technologies
- Precision Submarine Maneuvering and Control
- Advanced Signature Management

Rapid Technology Development
- Innovative Technology Transfer

Overall, FY21 funding level reflects a minor decrease in overall budget from FY20. Funding within the Strategic Capability Infrastructure pillar decreased slightly due to the planned funding ramp for the LSV Electric Drive recapitalization project, while funding within the Long Range R&D pillar increased proportionally based upon planned project ramp ups. Noteworthy programmatic budget changes in this year's budget exhibits include: (1) LSV-2 Electric Drive recapitalization completes component level build and test, and begins system level integration and testing; (2)
Advanced Hull Treatments completes a prototype installation aboard a VA class and commences the installation process for follow-on VA class demonstration; (3) Next Generation Thrust conducts a large scale demonstration of a multi-material, Integrated Shaft and Propulsor on LSV-2 and continues modeling and analysis in support of Next Generation Propulsor design development; (4) Advanced Material Propeller project conducts a full-scale sea trial aboard an international partner submarine, followed by a data analysis phase; (5) Investments continue on studies, small-scale analysis and technology maturation efforts in support of Advanced SSN Technology development/maturation; (6) The Precision Submarine Maneuvering and Control (PSMC) project continues Concept Development /Refinement phase to identify technologies to improve submarine low speed maneuvering in support of emerging missions/payloads; (7) Advanced Signature Management project will remain in ASSD (2033) for continuity of technology development.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Strategic Capability R&D Infrastructure	17.164	22.796	21.269	0.000	21.269
Articles:	-	-	-	-	-
Description: Sustains Navy R&D capability for continued operations of the Large Scale Vehicle and Intermediate Scale Measurement System (ISMS) test facility in support of VIRGINIA and COLUMBIA Class Programs, numerous other smaller programs, and future submarine technology development. These facilities are a critical enabler supporting the conduct of large-scale model experiments and focus on evaluating the stealth, control, affordability, and operational effectiveness of new submarine technologies. The technology					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
validation provided by the model experiments has provided significant cost and schedule savings by allowing prototyping at scale, vice with first-of-hull assets. ***FY 2020 Plans:*** LSV: Support advanced acoustic array hardware and systems maintenance. Replace LSV-2 propulsion battery. Conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data systems and all required shore support systems. Support ship and system alterations to safely conduct COLUMBIA signature and propulsor trials. Complete critical COLUMBIA propulsor R&D trials. Finish design and testing and begin selected procurements of hardware for LSV-2 electric drive replacement. Begin LSV-2 recapitalization process: Initiate procurements for shipset of modernized electric drive module components (inverters and converters). Complete system design for Electronic Drive Control Electronics (EDCE) tech refresh and conduct supporting procurement and manufacturing. Conduct component design and initiate procurement for electric drive shaft bearing, flex coupling, and slip ring data transmission system tech refresh. Continue planning for systems integration and testing. Develop new LSV 2 propulsion battery system, using COTs architecture. Conduct system design, testing, and long lead time material procurement. ISMS: Continue ongoing system refurbishment and replacement on ISMS. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue support of structural acoustics, target strength and radiated noise measurements in support of COLUMBIA, ONR, and other fleet needs. Begin refurbishment of Experimental Support Platform (ESP) Barge. ***FY 2021 Base Plans:*** LSV: Support advanced acoustic array hardware and systems maintenance, conduct LSV-2 core ship systems maintenance, maintain crew qualification, ensure compliance with all LSVSAFE and general regulations, maintain and operate acoustic data systems and all required shore support systems. Conduct triannual LSV Independent Assessment audit.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Support ship and system alterations to safely conduct composite shaft trials. Continue LSV-2 recapitalization process: Complete first-article testing of drive components and continue procurements for shipset (inverters and converters). Complete system design for Electronic Drive Control Electronics (EDCE) tech refresh, complete and approve software updates, assemble system and prepare for testing. Define and design shaft, bearing, and data transmission upgrades. Complete propulsion battery system, assembly, testing and installation. ISMS: Continue ongoing system refurbishment and replacement on ISMS. Operate and maintain ISMS acoustic test range underwater and shore-based facilities. Continue support of structural acoustics, target strength and radiated noise measurements in support of PMS 397, ONR, and other fleet needs. Complete refurbishment of Experimental Support Platform (ESP) Barge restoring capability to ISMS range for full maintenance, repair, and test support. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The overall decrease from FY20 to FY21 is the result of planned LSV2 Recapitalization funding phasing. LSV2 Recapitalization is a discrete project within Strategic Capability Infrastructure and will phase out upon completion, leaving the Strategic Capability Infrastructure budget in its typical long-term range.					
Title: Long Range R&D	8.144	11.214	11.950	0.000	11.950
Articles:	-	-	-	-	-
Description: Develop advanced technologies and tools to increase current and future submarine capabilities, lower acquisition and life-cycle costs, and enhance survivability. Develop technologies and materials that facilitate new and enhanced existing warfighting concepts. The program currently supports development of advanced submarine hull coatings for improved acoustic performance, maintainability, and cost with the objective of near- term implementation on VA and COLUMBIA Class platforms, as well as future submarine classes. The budget line continues to develop technologies for					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
alternative propulsion/propulsor designs to enhance submarine performance, maneuverability and stealth while reducing submarine acquisition costs. Lastly, this long-range R&D continues to develop and demonstrate technologies for future submarines in areas of hull and platform technologies, propulsors, propellers, corrosion control, ship control, electric actuation, sensors, survivability, and other systems which increase near-term capability and provide cost reduction for in-service and future submarine classes. ***FY 2020 Plans:*** ADVANCED HULL TREATMENTS. Support installation and subsequent operational testing of advanced hull treatment on a VA class submarine (VCS Hull A). Complete the industrialization of ONR advanced treatment and perform testing necessary to increase TRL. Complete OPALT package and install a small ONR advanced treatment test patch on a VA class submarine (VCS Hull B) to proof installation procedures and test adhesiveness and durability of the treatment material. Complete OPALT package and order material for a larger ONR advanced treatment patch installation on a VA Class submarine (VCS Hull C) that will be sized to allow performance testing. ADVANCED SIGNATURE MANAGEMENT (ASM): ASM Prototype: Continue FY19 system and concept development work on ASM demonstrator. Demonstrate the interoperability / compatibility of existing SM systems. Complete shore based modeling and system testing of prototype system and initiate formal Technical Data Package development for TEMPALT. Project Arrangements: Continue shore-based testing/modeling and collaborative planning for deferred Partner measurement trials. NEXT GENERATION THRUST. Further develop most promising NGT concepts and continue design tool improvement initiatives. Complete fatigue validation and final assembly of composite shaft assembly for LSV-2 demonstration in FY21. AMP. Instrument and install full-scale AMP propeller on partner submarine in preparation for at-sea trial/data collection.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP) and conduct studies to assess potential impacts on platform capability. Identify enabling technologies and platform integration barriers. Initiate development on critical, long-lead technologies/materials.					
PRECISION SUBMARINE MANEUVERING AND CONTROL (PSMC). Continue development of PSMC concepts and evaluations of supporting technology requirements. Initiate concept designs. Conduct initial modeling predictions in support of performance characterization, and follow-up model updates. Incorporate insights from advanced Submarine Control project and associated water-born barge demo conducted in FY19.					
FY 2021 Base Plans: ADVANCED HULL TREATMENT. Conduct assessment of installation procedures, adhesion and durability following sea trial on VCS Hull B. Install two large ONR advanced hull treatment patches (one on each side) of a VA class submarine (VCS Hull C) undergoing an availability in Portsmouth Naval Shipyard.					
ADVANCED SIGNATURE MANAGEMENT (ASM): ASM Prototype: Develop initial ASM Concept of Operation (CONOP)/procedural guidance. Complete development and review of Technical Data Package Development for ASM TEMPALT in support of FY22 at-sea system demonstration. Project Arrangements: Continue data analysis on shore-based testing/modeling results. Continue collaborative planning for deferred Partner UEM Measurement Trials in FY22.					
NEXT GENERATION THRUST. Conduct initial demonstration of Integrated Shafting and Propulsor (IS&P) assembly on LSV-2. Initiate follow-up "Generation 2" IS&P design of composite shaft concept. Begin concept design for a full-scale (SSN) demo of an IS&P assembly. Continue development of most promising NGT concepts and continue tool design improvement initiatives in support of New SSN propulsion technology development.					
AMP. Conduct Sea Trial. Conduct follow-on destructive testing and analysis of full-scale propeller data per follow-on Project Arrangement.					
ADVANCED SSN TECHNOLOGIES. Continue assessment of new technologies for future submarines in support of the Tactical Submarine Evolution Plan (TSEP) and continue studies to assess potential impacts on platform					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
capability. Continue studies on enabling technologies and platform integration barriers. Continue development on critical, long-lead technologies/materials. PRECISION SUBMARINE MANEUVERING AND CONTROL Conduct refinement of PSMC concepts, and complete evaluations of supporting technology requirements. Initiate component design and initial testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increases in the Long Term R&D budget are due to project investments for next-generation thrust/propulsor and advanced submarine technology work.					
Title: Rapid Technology Development	4.586	0.272	0.361	0.000	0.361
Articles:	-	-	-	-	-
Description: Conducts Navy and joint demonstrations of advanced technologies and payloads to assess the operational value of the technologies/systems under consideration, and speed transition of operational capabilities. Objective is to develop, demonstrate, and evaluate technology projects in an 18-30 month period, transitioning successful, high-interest / high-impact systems to the acquisition community and subsequently the fleet. ***FY 2020 Plans:*** INNOVATIVE TECHNOLOGY TRANSITION. Continued to leverage products and analysis from Small Business (SBIR/STTR), Independent Research and Development (IR&D), and Foreign Comparative Testing efforts to identify/ develop innovative submarine and USW technology transition project candidates. FY20 planned projects include Shaft Laser Peening (Corrosion Control), and Composite Canister System (Payload flexibility), Towed Array Signal Path Improvement. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Modest increase in the Rapid Technology Development RDT&E budget are due to increased investment in Towed Array Signal Path Improvement.					
Accomplishments/Planned Programs Subtotals	29.894	34.282	33.580	0.000	33.580

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Non-ACAT program with BA4 R&D investment. Projects transition via formal processes to acquisition programs of record for inclusion into existing ship baselines or initiation as new POR capabilities. Concept Formulation (CONFORM) contracts with the only two submarine design/construction shipyards, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries (HII) Newport News Shipbuilding facilitate this process. Use of topic-specific Broad Agency Announcement (BAA) solicitations to advance submarine advanced technology work. Engagement with industry to build vendor base and support development of R&D products for enhanced submarine capability via competitively awarded Small Business Innovation Research (SBIR) and Broad Agency Agreement (BAA) contracts to support advanced Hull Mechanical & Electrical (HM&E) technology and payload systems. For the period from FY 18- FY 20,SUB073 is utilizing three separate Determination and Findings (D&F's); one with Sandia National Labs to design, build, integrate, and test Battery Casualty Detection Systems (BCDS), a second with Oak Ridge National Laboratory (ORNL) to explore advanced transition technologies; and additive manufacturing techniques relevant to submarine applications for the Navy; and a third with Oakridge National Laboratory (ORNL) Y12 to explore advanced manufacturing and metallurgies for submarine propulsors.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/FFP	DRS Technologies : Milwaukee, WI	0.000	1.000	Apr 2019	6.873	Mar 2020	6.870	Feb 2021	-		6.870	0.000	14.743	-
Product Development	C/FFP	Moog : East Aurora, NY	0.900	0.400	Aug 2019	0.000		0.000		-		0.000	0.000	1.300	-
Product Development	C/CPFF	Seeman's Composite, : Gulfport, MS	0.000	0.200	Sep 2019	0.000		0.000		-		0.000	0.000	0.200	-
Product Development	WR	NSWC Crane : Crane, IN	0.440	0.200	Nov 2019	0.000		0.000		-		0.000	0.000	0.640	-
Product Development	C/CPFF	Rolls Royce Marine : Walpole, MA	0.000	0.100	Sep 2019	0.100	Jun 2020	0.102	Jun 2021	-		0.102	0.000	0.302	-
Product Development	WR	NSWC PHILLY : Philly, PA	0.165	0.275	Nov 2019	0.275	Nov 2019	0.281	Nov 2020	-		0.281	Continuing	Continuing	Continuing
Product Development	WR	NRL : Washington, DC	2.707	0.300	Nov 2019	0.000		0.000		-		0.000	0.000	3.007	-
Product Development	SS/CPFF	SupShips : Groton, CT	2.958	0.000		0.000		0.000		-		0.000	0.000	2.958	-
Product Development	SS/CPFF	HII : Newport News, VA	17.064	3.000	Apr 2019	3.150	Apr 2020	1.976	Apr 2021	-		1.976	Continuing	Continuing	Continuing
Product Development	SS/CPFF	EB : Groton, CT	77.686	2.387	Apr 2019	4.605	Apr 2020	5.281	Apr 2021	-		5.281	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Carderock, MD	99.743	2.730	Apr 2019	3.185	Apr 2020	3.221	Apr 2021	-		3.221	Continuing	Continuing	Continuing
Product Development	SS/CPFF	ARL/PSU : State College, PA	9.968	0.585	Apr 2019	0.597	Apr 2020	0.609	Apr 2021	-		0.609	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	24.421	0.250	Apr 2019	0.250	Apr 2020	0.255	Apr 2021	-		0.255	Continuing	Continuing	Continuing
Product Development	Various	Various : Various	36.500	0.296	Apr 2019	0.202	Apr 2020	0.296	Apr 2021	-		0.296	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	78.978	1.830	Mar 2019	0.550	Mar 2020	1.020	Mar 2021	-		1.020	Continuing	Continuing	Continuing
Product Development	WR	ONR : Arlington, VA	10.224	0.000		1.700	May 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Progeny : Manassas VA	0.695	0.000	May 2019	0.000		0.000		-		0.000	0.000	0.695	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	Oakridge Lab : Oakridge, TN	0.000	0.000		0.550	Apr 2020	0.000		-		0.000	0.000	0.550	-
		Subtotal	362.449	13.553		22.037		19.911		-		19.911	Continuing	Continuing	N/A

Remarks

Various/VAR is used to group multiple activities with small funding levels.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	SS/CPFF	Various : Various	16.296	1.350	Mar 2019	1.000	Mar 2020	1.020	Mar 2021	-		1.020	Continuing	Continuing	Continuing
Government Engineering Support	WR	Various : Various	7.570	0.364	Mar 2019	0.371	Mar 2020	0.379	Mar 2021	-		0.379	Continuing	Continuing	Continuing
Travel	WR	NAVSEA HQ : Not Specified	1.205	0.104	Mar 2019	0.106	Mar 2020	0.108	Mar 2021	-		0.108	Continuing	Continuing	Continuing
Acquisition Workforce	Various	Not Specified : Not Specified	0.293	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	0.293	0.293
		Subtotal	25.364	1.818		1.477		1.507		-		1.507	Continuing	Continuing	N/A

Remarks

Various/VAR is used to group multiple activities with small funding levels.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	C/CPFF	GDIT : Bayview, ID	1.600	1.600	May 2019	1.000	Mar 2020	2.000	Nov 2020	-		2.000	0.000	6.200	-
Developmental Test & Evaluation	SS/CPFF	EB : Groton, CT	25.308	5.820	May 2019	4.066	May 2020	4.724	May 2021	-		4.724	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC/PHILLY : PHILLY, PA	9.344	0.240	Dec 2018	0.240	Dec 2019	0.245	Dec 2020	-		0.245	0.000	10.069	9.104
Developmental Test & Evaluation	Various	Various : Various	8.732	0.675	Apr 2019	0.689	Apr 2020	0.703	Apr 2021	-		0.703	0.000	10.799	6.372
Developmental Test & Evaluation	WR	NUWC : Newport, RI	31.165	1.050	Apr 2019	0.500	Apr 2020	0.510	Apr 2021	-		0.510	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	55.258	5.138	Apr 2019	4.273	Apr 2020	3.980	Apr 2021	-		3.980	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	HII : Newport News, VA	5.794	0.000	Oct 2018	0.000	Apr 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Developmental Test & Evaluation	SS/CPFF	JHU/ARL : Laurel, MD	7.805	0.000	Apr 2019	0.000		0.000		-		0.000	0.000	7.805	0.305
Developmental Test & Evaluation	SS/CPFF	ARL/PSU : State College, PA	0.845	0.000	Oct 2018	0.000		0.000		-		0.000	0.000	0.845	0.720
		Subtotal	145.851	14.523		10.768		12.162		-		12.162	Continuing	Continuing	N/A

Remarks

Various/VAR is used to group multiple activities with small funding levels.

GDIT contract supports engineering services/technical support of LSV, ISMS, and associated infrastructure at Acoustic Research Detachment Bayview Idaho. Increase in value due to LSV recapitalization.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	533.664	29.894		34.282		33.580		-		33.580	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2033				
Strategic Capability Infrastructure: ISMS/LSV - ISMS ESP Rebuild	1	2020	4	2020
Strategic Capability Infrastructure: ISMS/LSV - Range fiberoptic replacement	2	2021	2	2021
Strategic Capability Infrastructure: ISMS/LSV - ISMS Tech Refresh	1	2022	4	2025
Strategic Capability Infrastructure: ISMS /LSV - Sustainment, Maintenance,Crew Qualification and Operations	1	2019	4	2025
Strategic Capability Infrastructure: ISMS /LSV - Battery Replacement	1	2022	1	2022
Strategic Capability Infrastructure: LSV Test Schedule - COLUMBIA Signature and Propulsor Trials and Program Assessment	1	2019	4	2020
Strategic Capability Infrastructure: LSV Test Schedule - Integrated Shafting	1	2021	2	2021
Strategic Capability Infrastructure: LSV Test Schedule - VA Block VI	3	2021	4	2021
Strategic Capability Infrastructure: LSV Test Schedule - VA Block VII Test 1 & 2	1	2023	3	2025
Strategic Capability Infrastructure: LSV Test Schedule - Gen 2 IS&P Project Demo	1	2023	2	2023
Strategic Capability Infrastructure: LSV Test Schedule - LSV Steering and Diving Replacement	2	2019	1	2020
Strategic Capability Infrastructure: LSV Test Schedule - SSN(X) Traditional Prop Dev	2	2025	4	2025
Strategic Capability Infrastructure: LSV Recapitalization - Individual Component Risk Reduction work	1	2019	2	2020
Strategic Capability Infrastructure: LSV Recapitalization - Electric Drive Modules First Article Builds and Test	2	2020	1	2022
Strategic Capability Infrastructure: LSV Recapitalization - Electric Drive Full System Build,Install,Testing	2	2021	3	2023
Strategic Capability Infrastructure: LSV Recapitalization - Electronic Drive Control Electronics (EDCE) Refresh	2	2020	3	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Strategic Capability Infrastructure: LSV Recapitalization - Data Collection System Refresh	3	2020	2	2022
Long Range R&D: SADS/IDTS - Gen 2 Tile Damping, Fire/Immersion/Toxicity/off-gas tests	1	2019	4	2019
Long Range R&D: SADS/IDTS -Tile Manufacture and Install	1	2020	3	2020
Long Range R&D: Advanced Submarine Control - (ASC) - Conduct in-water barge test and operational pressure test	1	2019	3	2019
Long Range R&D: Advanced Submarine Control - (ASC) - Complete analysis of pump-jet barge test and technical assessment of direct drive motor design.	3	2019	4	2019
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct Trade Studies and Concept Exploration	1	2019	4	2019
Long Range R&D: Precision Submarine Maneuvering and Control - Conduct concept development,	1	2020	2	2021
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct component detailed design and testing.	3	2021	4	2022
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - TEMPALT Dev	1	2022	2	2023
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Conduct Initial Platform Introductions and testing	1	2023	2	2024
Long Range R&D: Precision Submarine Maneuvering and Control (PSMC) - Follow-on Design and Test	3	2024	4	2024
Long Range R&D: Advanced Material Propeller (AMP) - Redesign manufacture and fatigue test Mod Gen 2 blade	1	2019	4	2019
Long Range R&D: Advanced Material Propeller (AMP) - Manufacture and test Gen 3 blades and hub	1	2019	2	2020
Long Range R&D: Advanced Material Propeller (AMP) - Deliver instrument and install AMP propeller	2	2020	4	2020
Long Range R&D: Advanced Material Propeller (AMP) - At-sea test on partner submarine	1	2021	1	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Material Propeller (AMP) - Post-sea trial data analysis and hardware testing	1	2021	4	2023
Long Range R&D: SSN(X) - Advanced SSN Technologies/TSEP Studies - TSEP concept formulation, analysis, and design	1	2019	4	2025
Long Range R&D: Next Generation Thrust (NGT) -Test Article fabrication and testing	1	2019	4	2020
Long Range R&D: Next Generation Thrust (NGT) - New SSN Propulsor Concept Design (GEN 2)	2	2021	1	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - IS&P Maufacture/Assembly for LSV	2	2019	4	2020
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor I(S&P) - Install/Conduct LSV Demo	1	2023	2	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Gen 2 Manufacturing	1	2022	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Conduct Gen 2 IS&P LSV Demo	1	2023	2	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Full Scale IS&P Concept Design	3	2021	4	2022
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Detailed Design	1	2023	4	2023
Long Range R&D: Next Generation Thrust (NGT) Integrated Shaft & Propulsor (IS&P) - Component Manufacturing & Testing	1	2024	4	2025
Long Range R&D: Next Generation Thrust New SSN Propulsor - Technology and Tool Dev	1	2019	4	2020
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 1)	3	2021	4	2022
Long Range R&D: Next Generation Thrust New SSN Propulsor - New SSN Propulsor Concept Design (Gen 2)	1	2023	4	2025
Long Range R&D: Next Generation Thrust New SSN Propulsor - Revolutionary Propolsor Concept Exploration	3	2019	3	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Hull Treatments - Develop VCS Hull A OPALT work package, conduct advanced procurement and material staging.	2	2019	2	2019
Long Range R&D: Advanced Hull Treatments - Treatment Installation and PSA	1	2019	4	2020
Long Range R&D: Advanced Hull Treatments VA Class	1	2021	2	2021
Long Range R&D: Advanced Hull Treatments - Follow-on Analysis	3	2021	1	2023
Long Range R&D: Transition Test Patch (VCS HULL B) - OPALT TPD	1	2019	3	2019
Long Range R&D: Transition Test Patch (VCS HULL B) - VA Class EDSRA/DMP	4	2019	3	2021
Long Range R&D: FNC/ManTech - Coating Dev, Down Select - Test	1	2019	4	2019
Long Range R&D: FNC/ManTech - ManTech Treatment Fabrication	1	2020	4	2020
Long Range R&D: FNC/ManTech - 2nd Gen Treatment Testing and Industrialization	1	2023	4	2023
Long Range R&D: FNC/ManTech - VA Class Hull	1	2024	4	2024
Long Range R&D: Transition Test Patch (VCS HULL C) -OPALT TDP	2	2019	3	2020
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class EDSRA/DMP	2	2021	1	2023
Long Range R&D: Transition Test Patch (VCS HULL C) - VA Class Sea Based Testing	3	2023	3	2023
Long Range R&D: Transition Test Patch (VCS HULL C) - Transition to VA Class	4	2023	4	2023
Long Range R&D: Advanced Signature Management -Concept Development, Modeling and Test Analysis	1	2019	4	2020
Long Range R&D: Advanced Signature Management - CONOP Dev and Sea Trial Planning for Demo	1	2021	3	2022
Long Range R&D: Advanced Signature Management - At Sea Test	4	2022	4	2022
Long Range R&D: Advanced Signature Management - Post Sea Trials Data Analysis and System Spiral Dev	1	2023	4	2025
Long Range R&D: Advanced Signature Management - EM Model Testing/Analysis and Full Scale Test Planning	1	2019	1	2020
Long Range R&D: Advanced Signature Management - Partner UEM Measurement Trial, Planning/Execution	1	2022	4	2022

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2033 / *Adv Submarine Systems Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Long Range R&D: Advanced Signature Management - Post Measurement Trial Data Analysis	1	2023	4	2025
Rapid Technology Development: Innovative Technology Transition - Conduct assessment of technology initiatives, SBIR transition work, STTR, CWP, Foreign Comparative Tests	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2096: *Payload Delivery Development*	8.538	10.969	10.801	17.975	-	17.975	12.362	13.636	10.289	10.495	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

FY 2021 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.

Payload Delivery Development is a program used for the integration of large deployable and retrievable payloads with submarines. RDT&EN funding will be used to develop a prototype payload launch and recovery system utilized with submarine large ocean interfaces to accommodate large diameter payloads and offboard systems. The project enables launch and recovery of these systems from submarines. This will provide the Submarine Force with the capability to launch and recover large payloads and offboard systems of various configurations in support of critical Undersea Warfare (USW) missions, providing battle space awareness and extending war-fighting reach in support of Subsea and Seabed Warfare (SSW) mission objectives. This capability has been identified as a key enabler for the following critical USW mission areas: Intelligence, Surveillance, and Reconnaissance (ISR), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW), Naval Special Warfare (NSW), Mine Warfare, Subsea and Seabed Warfare (SSW), Counter- Autonomous Underwater Vehicle (AUV) Warfare, Electromagnetic Maneuver Warfare (EMMW), Deception, and Non-Lethal Sea Control. This capability is paramount to winning the great power competition emerging between world powers and maintaining dominance in the undersea domain. In addition to technology development, the program will support engineering and integration of new and existing technologies to enable rapid prototyping and fielding of future payload capabilities for VIRGINIA Class (VCS) Payload Modules (Block V and VI) and will be in coordination with the Tactical Submarine Evolution Plan (TSEP) objectives for VCS Block VII and/or SSN(x). The prototype system capability will also provide immediate solutions to urgent war-fighter needs. Experimentation will be conducted with the Fleet (i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.), enabling an agile environment through at-sea demonstrations, which will provide Fleet and acquisition stakeholders with relevant payload employment data to inform Concepts of Operations (CONOPs) and fielding decisions.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Payload Handling System (PHS)	10.969	10.801	17.975	0.000	17.975
Articles:	-	-	-	-	-
Description: PHS includes the development, integration and demonstration of a single prototype "middle-ware" handling system used to deploy and retrieve large undersea vehicles, payloads, and offboard systems from submarines. Funding will be used to design, manufacture, and field a prototype to facilitate the raising, lowering and articulation of payloads into and out of submarine large ocean interfaces (e.g. missile tubes) to increase war fighting capabilities. PHS will initially be integrated and demonstrated on an SSGN platform to foster and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
assess early technology (vertical stowage, launch and recovery capability) integration and operational concept/ employment. Subsequently, PHS includes efforts to transfer the technology and final design to industry for future multi-unit procurement and application on future VIRGINIA Class and other submarines. Payloads currently planned for vertical launch, recovery, and stowage include the U.S. Navy's Family of Unmanned Systems up to large size (e.g. SNAKEHEAD) and future block of Shallow Water Combat Submersibles (SWCS) to support Special Operations Forces (SOF) capabilities. The modularity of hosting these payloads within a tube loaded canister allows for the PHS and/or payload(s) to be swapped out with other payloads (e.g. missiles) while forward deployed dependent upon mission tasking of the submarine. Long lead- time material purchases begin in FY20 and continue into FY21. Planned FY20 efforts include continued detailed analysis and design for subsystem elements, interface control documentation, drawings. Planned FY21 efforts include beginning PHS prototype system manufacturing, commencing test planning development and completion of detailed analysis. ***FY 2020 Plans:*** Continue NRE to conduct Final Design Review (FDR), continue detail design efforts and commence SSGN Temporary Alteration (TEMPALT) package development, execute material purchases. Prototype system manufacturing commences. - Continue the following detailed design efforts: * Refining System Arrangements, Structural and Shock Modeling Analyses, and Interface Control Document * Power Distribution Element (PDE) design completion * Hydraulic System Element (HSE) design completion * Control & Monitoring Element (CME) design completion * Payload Handling Element (PHE) design completion * System Schematic and Diagram Development - Continue VIRGINIA Class build-to-print Technical Data Package (TDP) development - Continue Peculiar Support Equipment (PSE) design development					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Commence Long Lead Time and Other Material Sourcing and Purchasing for Hydraulic Actuators (15 to 18 month lead times) - Commence SSGN Temporary Alteration (TEMPALT) package development - Commence contract planning to support Payload Canister manufacturing - Commence contract planning for Single-Stage Hydraulic Actuators - Award contract for Multi-Stage Hydraulic Actuator					
FY 2021 Base Plans: PHS Prototype System manufacturing continues to include payload canister steel fabrication and weldments. PSE fabrication will be completed and commence along with identification of component level testing requirements to support system assembly. - Commence development and submit SSGN TEMPALT package - Commence prototype fabrication - Commence prototype material purchases - Continue VIRGINIA Class build-to-print Technical Data Package (TDP) development - Commence Peculiar Support Equipment (PSE) Design - Commence PSE material purchases - Commence PSE fabrication - Commence Final Design Review (FDR) - Award Payload Canister Manufacturing contract - Award contract for Single- Stage Hydraulic Actuators - Commence Test Plan Development - Continue SSGN Temporary Alteration (TEMPALT) package development - Continue Long Lead Time and other material sourcing and purchasing for miscellaneous components - Conduct Fabrication Readiness Review (FRR)					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 funding profile is increased to support material purchases and prototype system fabrication efforts. Additionally, this profile supports delivery of a build-to-print Technical Data Package (TDP) for inclusion of PHS in the VIRGINIA Class Block VI Technical Baseline.					
Accomplishments/Planned Programs Subtotals	10.969	10.801	17.975	0.000	17.975

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Project will transition to VIRGINIA Class as part of the Block VI technical baseline. PHS capability will be included as part of block VI ship deliveries. Block V ships will be backfitted with PHS capability post-delivery starting with SSN-806.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development (1)	WR	NUWC NPT : Newport, RI	0.805	1.166	Oct 2018	1.266	Oct 2019	2.134	Oct 2020	-		2.134	Continuing	Continuing	Continuing
Product Development	WR	NSWC PD : Philadelphia, PA	2.540	4.625	Oct 2018	5.235	Oct 2019	4.408	Oct 2020	-		4.408	Continuing	Continuing	Continuing
Product Development (1)	WR	NUWC KPT : Keyport, WA	2.065	2.742	Oct 2018	2.129	Oct 2019	5.587	Oct 2020	-		5.587	Continuing	Continuing	Continuing
Product Development (1)	WR	PSNS : Bremerton, WA	0.666	1.144	Oct 2018	1.621	Oct 2019	5.449	Oct 2020	-		5.449	Continuing	Continuing	Continuing
Product Development	WR	NSWC CD : West Bethesda, MD	0.439	0.875	Oct 2018	0.045	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	NRL : Washington, DC	0.255	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	FFRDC	ARL/PSU : Arlington, VA	0.285	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	NSWC DD : Dahlgren, VA	0.026	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	C/CPFF	DIUx : Mountain View, CA	0.050	0.000	Nov 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	PNSY : Portsmouth, NH	0.597	0.000	Oct 2018	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	7.728	10.552		10.296		17.578		-		17.578	Continuing	Continuing	N/A

Remarks

(1) Increased funding for Product Development in FY21 is for PHS Prototype System manufacturing.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	NAVSEA HQ : Washington DC	0.087	0.045	Oct 2018	0.046	Oct 2019	0.047	Oct 2020	-		0.047	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Management Services	C/CPAF	NTT Data : McLean, VA	0.723	0.372	Dec 2018	0.459	Dec 2019	0.350	Dec 2020	-		0.350	Continuing	Continuing	Continuing
Need Item Text	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.810	0.417		0.505		0.397		-		0.397	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.538	10.969		10.801		17.975		-		17.975	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Payload Handling System (PHS)				
PHS Milestones: Preliminary Design	1	2019	3	2019
PHS Milestones: Initial Design Review	3	2019	3	2019
PHS Milestones: Detailed Design	4	2019	3	2020
PHS Milestones: Final Design Review	1	2021	1	2021
PHS Milestones: Drawing Development (DWG)	1	2021	3	2021
PHS Milestones: PSE Design Complete	3	2022	3	2022
PHS Milestones: Long Lead Time Material Buys	2	2020	1	2022
PHS Milestones: VIRGINIA Class Build to Print TDP Ready	2	2022	2	2022
PHS Milestones: Fabrication Readiness Review	4	2021	4	2021
PHS Milestones: Fabrication	4	2021	1	2023
PHS Milestones: Assembly	2	2023	4	2023
PHS Milestones: Payload Ready	2	2024	2	2024
PHS Milestones: Test Plan	1	2023	1	2023
PHS Milestones: Prototype Test Review	2	2023	2	2023
PHS Milestones: Testing	3	2023	1	2024
PHS Milestones: Install	3	2024	4	2024
PHS Milestones: Delivery	4	2024	4	2024
PHS Milestones: Maintaining Protoype	3	2025	4	2025
VPM Integration: Block V Tech Baseline Lockdown	1	2019	1	2019
VPM Integration: VIRGINIA Class Build to Print TDP Development	2	2020	2	2020

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 2096 / *Payload Delivery Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
VPM Integration: Group 1 Execution Plan Undersea Dominance Payload Integration (UDPI)	1	2019	2	2023
VPM Integration: Block VI Tech Baseline Lockdown	2	2023	2	2023
VPM Integration: RFP - SSN 806	4	2023	4	2023
VPM Integration: PHS Award (PHS) for SSN 806	3	2024	3	2024
SSGN Integration: TEMPALT Development	3	2020	2	2022
SSGN Integration: TEMPALT Submitted	2	2022	2	2022
SSGN Integration: Ship Mods	3	2022	2	2023
Snakehead LDUUV Plan: Phase 2 Delta Design	3	2020	4	2020
Snakehead LDUUV Plan: RFP	1	2021	1	2021
Snakehead LDUUV Plan: Source Selection	1	2021	4	2021
Snakehead LDUUV Plan: Award	4	2022	4	2022
Snakehead LDUUV Plan: Phase 2 Vehicle Design & Fabrication	1	2022	4	2023
Snakehead LDUUV Plan: Vehicle Delivery	4	2024	4	2024
Snakehead LDUUV Plan: GT/MUA	4	2024	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3391: *SSN/SSGN Survivability Program*	8.203	8.116	9.483	11.511	-	11.511	12.008	11.544	12.795	13.051	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In 2013, OPNAV N97 established SSN/SSGN Survivability Program (S3P) as a separate project area within ASSD to assure SSN/SSGN survivability and the ability of submarines to complete their joint warfighting missions even if covert mobility is compromised. The budget increases in FY20 and FY21 add signature countermeasures to the S3P portfolio allowing S3P to address documented gaps in survivability on current submarines.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SSN/SSGN Survivability Program	8.116	9.483	11.511	0.000	11.511
Articles:	-	-	-	-	-

Description: The details of project activities are SECRET or higher. The SSN/SSGN Survivability Program (S3P) provides Director, Undersea Warfare Division (OPNAV N97) with qualitative and quantitative analysis of potential SSN and SSGN submarine vulnerabilities based on technology threats and operational requirements and recommends countermeasure concepts to mitigate these potential vulnerabilities. S3P informs the entire $10B submarine portfolio with validated analysis which informs risk to submarine survivability and stealth in contested environments. This analysis also informs methods by which stealth can be regained once compromised to execute missions such as weapons employment. S3P conducts technical analysis validated with at-sea testing. The technical analysis is put into an operational context using data from current submarine operations and Fleet war plans. S3P develops technologies and tools to increase the survivability of submarines by recognizing and mitigating sources of acoustic and non-acoustic vulnerabilities that put a submarine at risk when operating in contested waters and the littorals. S3P supports fleet development of Tactics, Techniques, and Procedures (TTPs) that facilitate new or enhance existing warfighting concepts.

FY 2020 Plans:
- S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment.
- Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- S3P will conduct acoustic, non-acoustic, and non-traditional ASW vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct one (1) at-sea test to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. ***FY 2021 Base Plans:*** - S3P will continue to address gaps in stealth and survivability for the current SSN/SSGN force to include responding to fleet questions on current tactical vulnerabilities and completion of an annual Operational Survivability Assessment. - Continue analytical and technical work on TSEP and future SSN/SSGN survivability design basis. - S3P will conduct emerging threat, acoustic, non-acoustic vulnerability assessment projects, and will conduct sea tests in stealth requirements and countermeasure concepts. - Complete two tactical decision concept projects for current fleet operations. - S3P will conduct two (2) at-sea tests to include foreign partners where available for Advanced Signature Countermeasures development. - Details may be provided in a classified setting. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21, S3P top-line resourcing increases to conduct Advanced Signature Management/Countermeasures development.					
Accomplishments/Planned Programs Subtotals	8.116	9.483	11.511	0.000	11.511

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

S3P is a non-acquisition activity that investigates, prioritizes, and validates SSN/SSGN survivability issues for peacetime and all phases of war. S3P also proposes and directs development and validation of countermeasure concepts. S3P works to ensure alignment between OPNAV, NAVSEA, ONI, and the Fleet on survivability

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

issues. S3P develops recommendations for stealth requirements to OPNAV N97 and provides technical basis for Tactics, Techniques, and Procedures developed by the Undersea Warfighting Development Command (UWDC). S3P operates under OPNAV N97 and Fleet Flag panel (Operations Review Group) oversight. S3P products and metrics are evaluated by the Submarine Operations Group and Operations Review Group. S3P also recommends technical requirements for all matters of submarine survivability to OPNAV N97.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	MIPR	CNA: : Alex, VA	0.562	0.448	Jan 2019	0.500	Jan 2020	0.700	Jan 2021	-		0.700	Continuing	Continuing	Continuing
Product Development	SS/CPFF	MIT-LL : Cambridge, MA	0.200	0.627	Oct 2018	0.600	Oct 2019	0.750	Oct 2020	-		0.750	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Raytheon : Portmouth, RI	0.429	0.229	Dec 2019	0.450	Sep 2020	0.400	Sep 2021	-		0.400	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	2.042	1.737	Jul 2019	1.000	Jul 2020	2.350	Jul 2021	-		2.350	Continuing	Continuing	Continuing
Product Development	SS/CPFF	UT/ARL : Austin, TX	0.367	0.700	Aug 2019	0.800	Aug 2020	0.600	Aug 2021	-		0.600	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	0.900	1.000	Apr 2019	1.000	Apr 2020	1.000	Apr 2021	-		1.000	Continuing	Continuing	Continuing
Product Development	MIPR	NRL : Washington, DC	0.090	0.300	Dec 2018	0.400	Dec 2019	0.750	Dec 2020	-		0.750	Continuing	Continuing	Continuing
Product Development	C/BA	NSMA : Not Specified	0.782	0.900	Dec 2018	0.920	Dec 2019	0.600	Dec 2020	-		0.600	Continuing	Continuing	Continuing
Product Development	SS/CPFF	Sonalysts : Groton, CT	0.050	0.200	Dec 2019	0.350	Sep 2020	1.500	Sep 2021	-		1.500	Continuing	Continuing	Continuing
Product Development	WR	SPAWAR : Charleston, SC	0.050	0.100	Aug 2019	0.050	Aug 2020	0.050	Aug 2021	-		0.050	Continuing	Continuing	Continuing
		Subtotal	5.472	6.241		6.070		8.700		-		8.700	Continuing	Continuing	N/A

Remarks

FY21 increase at APL JHU for conducting Advanced Signature Countermeasures technical development and testing.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel and Corporate	WR	NAVSEA HQ : Not Specified	0.040	0.340	Oct 2018	0.360	Oct 2019	0.040	Oct 2020	-		0.040	Continuing	Continuing	Continuing
		Subtotal	0.040	0.340		0.360		0.040		-		0.040	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC : Carderock, MD	2.371	1.205	Apr 2019	2.713	Apr 2020	2.411	Apr 2021	-		2.411	Continuing	Continuing	Continuing
		Subtotal	2.371	1.205		2.713		2.411		-		2.411	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	SS/CPFF	NSMA : Not Specified	0.320	0.330	Dec 2018	0.340	Dec 2019	0.360	Dec 2020	-		0.360	Continuing	Continuing	Continuing
		Subtotal	0.320	0.330		0.340		0.360		-		0.360	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.203	8.116		9.483		11.511		-		11.511	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 3391 / *SSN/SSGN Survivability Program*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Assessments				
Operational Survivability Assessment	1	2019	4	2024
Acoustic Assessment	1	2019	4	2024
Non-Acoustic Assessment	1	2019	4	2024
Vulnerability Validation				
Vulnerability SEA Test Validation Program (1-2 per year)	1	2019	4	2024
Countermeasures				
Countermeasure Validation (2-3 per year)	1	2019	4	2024
Advanced Submarine Signature Management/Countermeasures				
Sea Test Validation Program (1 per year)	1	2020	4	2024
Signature Vulnerability Assessment (1 per year)	1	2022	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9710: *Advanced Submarine Technology Development*	0.000	0.000	0.000	66.872	-	66.872	45.519	63.435	75.224	76.732	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Project 9710 was previously funded in FY 2019 under Program Element 0604250D8Z (Advanced Innovative Technologies) Project 250 (Advanced Innovative Technologies). This is a Navy new start.

A. Mission Description and Budget Item Justification

Details of this project are classified and are submitted to Congress in the classified budget justification books.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Submarine Technology Development	0.000	0.000	66.872	0.000	66.872
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Details of this project are classified and are submitted to Congress in the classified budget justification books.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	66.872	0.000	66.872

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Classified	Various	N/A : N/A	0.000	0.000		0.000		66.872	Dec 2020	-		66.872	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		66.872		-		66.872	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		66.872		-		66.872	Continuing	Continuing	N/A

Remarks

Details of this project are classified and are submitted to Congress in the classified budget justification books.

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9710																												
Details of this project are classified and are submitted to Congress in the classified budget justification books.	[redacted]																											

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9710 / *Advanced Submarine Technology Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9710				
Details of this project are classified and are submitted to Congress in the classified budget justification books.	1	2019	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603561N / *Advanced Submarine System Development*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	5.071	9.648	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.719
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

LITTORAL WATER THREATS. Environmentally characterize the South Florida Ocean Measurement Facility (SFOMF) underwater test range battlespace, upgrade the sensors and infrastructure, and conduct at least two characterization tests of a Virginia Class Submarine to validate model data.

LIGHTWEIGHT COMPOSITE RESEARCH. Continue to develop and demonstrate composite material technologies for future submarines in areas of non-traditional/ advanced materials for hull and platform technologies, propulsors, propellers, and other systems which increase near-term capability and provide cost reduction for in-service and future submarine classes.

Small Business Technology Insertion: Leverage small business experience, insights and capabilities to identify/validate/mature/insert new technology into the capability development process, which will improve submarine stealth, performance, reliability, lethality and life cycle cost.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Small Business Technology Insertion	0.000	10.000
FY 2019 Accomplishments: N/A		
FY 2020 Plans: Planned areas of technology insertion include: - Advanced Materials: Use of alternative/advanced/multi-materials in new submarine applications via scale model and prototyping projects. - Advanced Energy Systems: Will examine the efficacy, performance and hazards associated with alternate battery chemistries for use in a submarine main storage battery role, and examine new electrical motor/ component technologies for improved capability/reliability. - Advanced Hull Treatments: Will examine the performance and manufacturing readiness of alternative technologies to identify those with the potential to reduce cost, improve stealth and improve hydrodynamic performance. - Advanced Atmospheric Control Systems. Will examine technologies to more effectively monitor and manage atmospheric conditions in a submarine environment. - Stealth: Will examine the availability of new technologies/tools to assess and improve performance.		

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
- SSN Advanced Technologies: Will examine past and current project work conducted under the small business programs on other various technology areas to identify priority candidates for follow-on project work based upon prioritized technology gaps and prior-demonstrated performance.		
Congressional Add: Littoral Water Threats ***FY 2019 Accomplishments:*** Complete 3-D environmental characteristics of the water space and validate models of the operating area. Upgrade SFOMF range infrastructure, including environmental hardware, sensors, data and power cables, and supporting detection/processing algorithms and associated hardware. Update UEM models and develop environmental threat conditions for future submarine designs. Complete analysis of FY18 prototype trial. Perform SFOMF detection array upgrade. Conduct modeling and planning for sea trials on two Virginia Class Submarines. ***FY 2020 Plans:*** Littoral Water Threats-Conduct two deployments and data collections of the water space environmental data collection system. Complete validation of environmental models of the operating areas. Develop a portable magnetic measurement system to be added to the existing environmental system, deploy and test the system in the SFOMF area of operation and in an alternate location. Complete the upgrade of SFOMF sensors and the supporting network.	4.824	0.000
Congressional Add: Lightweight Composite Research ***FY 2019 Accomplishments:*** AMP. Finalize structural acceptance process for the Advanced Material Propeller (AMP), including fatigue testing of Generation 2 composite blades in partner country, data analysis, and finite element analysis. Complete the structural certification and planning for AMP sea trials, obtain approval from cognizant technical authorities that AMP is acceptable for trial, and provide partner country with supporting documentation package. NEXT GEN THRUST. Continue design studies and plan small and/or large scale testing of innovative, advanced material propulsor and shafting technologies. Complete detailed design of a composite shaft. Begin test article fabrication, testing, and composite shaft manufacture. Continue evaluation and design of a next generation propulsor concept utilizing new/non-traditional materials. NEW COMPOSITE APPLICATIONS. Conduct composite material design and demonstration feasibility studies to explore and validate new applications of composite materials on submarines. ***FY 2020 Plans:*** N/A	4.824	0.000
Congressional Adds Subtotals	9.648	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	Various	NSWC/CD, : Bethesda, MD	2.375	3.906	Dec 2019	1.500	Apr 2020	0.000		-		0.000	0.000	7.781	-
Product Development	Various	NOVA Southeastern University, : Ft. Lauderdale, FL	2.350	1.300	Dec 2019	0.000		0.000		-		0.000	0.000	3.650	-
Product Development	Various	SPA, : Washington, DC	0.000	0.294	Dec 2019	0.000		0.000		-		0.000	0.000	0.294	-
Product Development	Various	ARL/PSU, : State College, PA	0.000	0.746	Dec 2019	0.000		0.000		-		0.000	0.000	0.746	-
Product Development	Various	SCI, : Gulf Port, MS	0.000	2.436	Dec 2019	0.000		0.000		-		0.000	0.000	2.436	-
Product Development	TBD	Small Business A, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business B, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business C, : TBD	0.000	0.000		0.100	Apr 2020	0.000		-		0.000	0.000	0.100	-
Product Development	TBD	Small Business D, : TBD	0.000	0.000		0.200	Apr 2020	0.000		-		0.000	0.000	0.200	-
Product Development	TBD	Small Business E, : TBD	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	TBD	Small Business F, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business G, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business H, : TBD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
Product Development	TBD	Small Business I, : TBD	0.000	0.000		0.750	May 2020	0.000		-		0.000	0.000	0.750	-
Product Development	TBD	Small Business J, : TBD	0.000	0.000		1.000	May 2020	0.000		-		0.000	0.000	1.000	-
Product Development	TBD	Small Business K, : TBD	0.000	0.000		1.000	May 2020	0.000		-		0.000	0.000	1.000	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	TBD	Small Business L, : TBD	0.000	0.000		2.000	May 2020	0.000		-		0.000	0.000	2.000	-
		Subtotal	4.725	8.682		8.500		0.000		-		0.000	0.000	21.907	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	Various	NTT, : Washington, DC	0.100	0.100	Dec 2019	0.000		0.000		-		0.000	0.000	0.200	-
Product Development	Various	Contractor Support, : Various	0.196	0.192	Jan 2019	0.200	Apr 2020	0.000		-		0.000	0.000	0.588	-
Product Development	Various	Gov Engineering, : Various	0.050	0.050	Jan 2019	0.100	Apr 2020	0.000		-		0.000	0.000	0.200	-
Product Development	WR	NSWC/CD, : Bethesda, MD	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	WR	NSWC/Crane, : Crane, IN	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
Product Development	SS/CPFF	Electric Boat, : Groton, CT	0.000	0.000		0.250	Apr 2020	0.000		-		0.000	0.000	0.250	-
		Subtotal	0.346	0.342		1.050		0.000		-		0.000	0.000	1.738	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	NTT : Washington, DC	0.000	0.100	Dec 2019	0.000		0.000		-		0.000	0.000	0.100	-
Contractor Engineering Support	Various	Various : Various	0.000	0.196	Jan 2019	0.250	Apr 2020	0.000		-		0.000	0.000	0.446	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	Gov Engineering : Various	0.000	0.328	Jan 2019	0.200	Apr 2020	0.000		-		0.000	0.000	0.528	-
		Subtotal	0.000	0.624		0.450		0.000		-		0.000	0.000	1.074	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.071	9.648		10.000		0.000		-		0.000	0.000	24.719	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603561N / *Advanced Submarine System Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Littoral Water Threats: Test RangeSensor and Infrastructure upgrades	3	2019	4	2020
Littoral Water Threats: Test Planning, Execution and Analysis	4	2019	4	2020
Littoral Water Threats: Environmental/UEM Modeling and Characterization	1	2019	2	2019
Lightweight Composite Research: AMP: Complete structural certification process, assemble and test AMP Gen 3 blades and hub	1	2019	4	2019
Lightweight Composite Research: AMP: Deliver and install AMP propeller and supporting documentation to partner country	4	2019	3	2020
Lightweight Composite Research: AMP: At-sea test of AMP on partner submarine	4	2020	4	2020
Lightweight Composite Research: Next Gen Thrust: Complete Test Article design, fabrication and testing	1	2019	3	2020
Lightweight Composite Research: Next Gen Thrust: Complete design for Integrated Shaft and Propulsor	1	2019	3	2019
Lightweight Composite Research: Next Gen Thrust: Manufacture/assemble Integrated Shaft and Propulsor	4	2019	3	2020
Lightweight Composite Research: new Composite Applications: Conduct composite material design and demonstration feasibility studies	1	2019	4	2020
Small Business Technology Insertion: Advanced Materials	2	2020	2	2021
Small Business Technology Insertion: Advanced Energy Systems	2	2020	2	2021
Small Business Technology Insertion: Advanced Hull Treatments	2	2020	2	2021
Small Business Technology Insertion: Advanced Atmospheric Control Systems	2	2020	2	2021
Small Business Technology Insertion: Stealth	2	2020	2	2021
Small Business Technology Insertion: SSN Advanced Technologies	2	2020	2	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	95.621	12.180	11.192	10.528	-	10.528	14.291	11.926	12.157	12.398	Continuing	Continuing
0770: *Adv Sub Supp Equip Prog*	25.413	4.264	4.557	4.773	-	4.773	4.810	4.890	4.980	5.077	Continuing	Continuing
1739: *Submarine Arctic W/F Development*	70.208	5.022	6.635	5.755	-	5.755	9.481	7.036	7.177	7.321	Continuing	Continuing
9999: *Congressional Adds*	0.000	2.894	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.894

A. Mission Description and Budget Item Justification

This Program Element (PE) addresses advanced submarine technology areas in support of the Navy's strategic objective of Assured Access and Combat Credibility. All projects funded in this PE are non-Acquisition Category (ACAT) programs.

PROJECT 0770 - The Advanced Submarine Support Equipment Program (ASSEP) objective is to improve submarine operational effectiveness through the development and implementation of advanced Research and Development (R&D). In order to provide improved operational effectiveness, R&D efforts are focused on advanced Imaging development and advanced Electronic Warfare (EW) support development. A continuing need exists to improve these capabilities in view of the advancements in potential imaging counter-detection, the need to support specialized missions, and the increasingly dense and sophisticated electronic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Ongoing developments in 360-degree imaging systems and electro-optic infra-red (EO/IR) vulnerability signature reduction technologies are supporting these needs.

PROJECT 1739 - The Submarine Arctic Warfare Development Project is aligned to Commander, Undersea Warfighting Development Center (UWDC), Detachment Arctic Submarine Laboratory (ASL). This Project provides the U.S. Navy Submarine Force (SUBFOR) a cadre of trained Arctic Operation Specialists (AOS) and an inventory of unique Arctic sensors that are installed to optimize submarine safety during under-ice operations. AOS personnel assigned from ASL embark on submarines that deploy to the Arctic, cold water and iceberg regions, and marginal ice zones (MIZ) in northern latitudes of the Atlantic and Pacific Oceans, and are advisers to the Commanding Officer. ASL is a shore facility at Naval Base Point Loma with the infrastructure capable of supporting personnel and equipment to conduct the submarine Arctic Warfare Development mission. Improvements and life-cycle expenditures to the facility and warehousing are made as necessary to support the mission.

The Submarine Arctic Warfare Development Project, via ASL, responds to the increased threat of naval activity in the Arctic regions while continuously supporting the Navy's strategic objective of Assured Access and Combat Credibility. ASL provides a unique capability that enables the submarine force to satisfy the requirements laid out in the Arctic Maritime Homeland Defense Initial Capabilities Document (ICD). ASL and SUBFOR demonstrate existing Arctic Warfare capabilities and operational and tactical proficiency while developing advanced submarine technology in unique cold water environments, in under-ice conditions, and in ice-covered shallow water regions during a biennial Ice Exercise (ICEX). ICEX places an emphasis on submarine operability and mission capability in the world's harshest maritime environment. Efforts include assessment of combat system effectiveness, weapons testing, use of High Frequency (HF) sonars in Arctic regions, testing of ice-capable submarine structures, and development of class-specific Arctic operational guidelines. Tactical Development (TACDEV) ICEXs are conducted biennially and require up front comprehensive planning and work-up training, as well as post exercise analysis and reporting. ICEXs provide the framework for various submarine test and

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*

evaluation in Arctic regions and at periodic Ice Camps. This program represents DoD's only drifting ice station capability. Emphasis during ICEX is placed on the areas of sonar operability, tactical surveillance, weapon utility, and other submarine support missions. These efforts include the assessment of combat system effectiveness, development of Arctic specific improvements for existing sonar and weapons, development of class-specific Arctic operational guidelines, and testing of ice-capable submarine support structures.

A torpedo firing ICEX occurs every four (4) years (FY2018, FY2022, etc.) in order to meet minimum Fleet requirements of exercise torpedo (EXTORP) firings in the Arctic. A Torpedo Exercise (TORPEX) requires a significantly higher level of logistics, personnel, and infrastructure to account for the recovery and transportation efforts of the EXTORPs.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	12.374	11.192	11.481	-	11.481
Current President's Budget	12.180	11.192	10.528	-	10.528
Total Adjustments	-0.194	0.000	-0.953	-	-0.953
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.194	0.000			
• Program Adjustments	0.000	0.000	-1.000	-	-1.000
• Rate/Misc Adjustments	0.000	0.000	0.047	-	0.047

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Submarine Electronic Warfare Systems*	2.894	0.000
Congressional Add Subtotals for Project: 9999	2.894	0.000
Congressional Add Totals for all Projects	2.894	0.000

Change Summary Explanation

FUNDING CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET AT THE OVERALL PE LEVEL:
- FY 2019 decrease of $-0.194M reflects Small Business Innovative Research (SBIR) transfer.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*

- FY 2021 decrease of $-0.953M reflects realignment of Project 1739 funding ($-1.000M) from FY 2021 to FY 2022 to properly support contract expenditure for the preparation year to conduct torpedo firing exercises and incorporation of general and Navy Working Capital Fund (NWCF) specific rate adjustments ($ +0.047M).

PROJECT 0770 - FY 2020 TO FY 2021 BUDGET REQUEST INCREASE:
- FY 2020 ($4.557M) to FY 2021 ($4.773M) increase ($+0.216M) is in line with the inflation associated with the RDT&EN appropriation.

PROJECT 1739 - FY 2020 to FY 2021 BUDGET REQUEST DECREASE:
- FY 2020 ($6.635M) to FY 2021 ($5.755M) decrease ($-0.880M) is driven by FY 2021 being an ICEX planning year (no major ICEX/Ice Camp events scheduled in FY 2021).

SCHEDULE CHANGES SINCE THE PREVIOUS PRESIDENT'S BUDGET:
PROJECT 0770 - In an effort to reduce the number of individual efforts depicted on the R-4, the schedule for FY 2021 President's Budget Request has since been streamlined to only show the most significant development items. All other efforts previously shown on the FY 2020 President's Budget request R-4, and no longer depicted on the schedule for FY 2021 President's Budget Request, are still planned to occur as previously shown.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0770: *Adv Sub Supp Equip Prog*	25.413	4.264	4.557	4.773	-	4.773	4.810	4.890	4.980	5.077	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

A continuing need exists to improve Imaging and Electronic Warfare (EW) support capabilities in view of the advancements in potential imaging counter detection and the increasingly dense electromagnetic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Improvements are necessary for submarine EW and Imaging to be operationally effective in the following mission areas: Joint Littoral Warfare, Joint Surveillance, Space and Electronic Warfare, Intelligence Collection, Maritime Protection, and Joint Strike. The program is divided into two project categories: Advanced Imaging Project Development and Advanced Electronic Warfare Support Project Development. Both of these categories will allow for the mitigation of visual, radar, and infrared detection of submarine masts, periscopes, and sensors. The evaluation of state-of-the-art technology to implement periscope/mast improvements via EW electromagnetic and electro-optic sensors results in improved capability. Engineering Development Models (EDMs) are developed, evaluated, and validated in the lab and through at-sea testing.

All programs funded in this project are non-Acquisition Category (ACAT) programs. The test articles identified consist of critical components that will be fully developed during Engineering Manufacturing and Development phase into EDMs.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Imaging Project Development	2.518	2.279	2.386	0.000	2.386
Articles:	-	-	-	-	-

FY 2020 Plans:
- Complete Sea Test and Continue Meteorological Sensors Development.
- Complete Low Power Fiber Delivered Laser Range Finder and Transition to Imaging.
- Complete Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres and Transition to Imaging.
- Complete Anti-Reflective Coating Spherical Domes Test and Continue Development.
- Complete Volumetric Atmospheric Modeling Testing and Continue Development.
- Complete Near Ocean Imaging through Atmospheric Turbulence Testing and Continue Development.
- Complete Vulnerability Improvement Testing and Continue Development.
- Start Imaging Buoy Development.
- Continue System for Non-Acoustic Control of Signatures Development.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete Electromagnetic Spectrum Sensor System Simulation & Development for Model-Based Mission Planning Test and Transition to Imaging. ***FY 2021 Base Plans:*** - Complete Meteorological Sensors Development and Transition to Imaging. - Complete Development of Anti-Reflective Coating Spherical Domes and Transition to Imaging. - Complete Development of Volumetric Atmospheric Modeling and Transition to Imaging. - Continue Development of Near Ocean Imaging Through Atmospheric Turbulence. - Continue Development and Testing of Vulnerability Improvement. - Continue Imaging Buoy Development and Testing. - Continue System for Non-Acoustic Control of Signatures Development. - Transition Electromagnetic Spectrum Sensor System Simulation & Development for Model - Based Mission Planning. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** - FY 2020 ($2.279M) to FY 2021 ($2.386M) increase ($+0.107M) is in line with inflation associated with the RDT&EN appropriation.					
Title: Advanced Electronic Warfare (EW) Project Development	1.746	2.278	2.387	0.000	2.387
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete Lab Test and Transition Solid State RADAR Emitter Identification to Electronic Warfare (EW). - Complete Extremely Wideband Digital Receiver Lab Test and Transition to EW. - Continue Tunable Optical Filters for RF Photonic Signal Distributions System Lab Test #2. - Commence Data Transmission using VLC for Undersea Platforms Lab Test. - Commence Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW Lab Test. - Complete Technical Insertion-22 (TI-22) Disposable Buoys Modular Expendable Decoy Buoy Enhancement and Transition to EW. - Complete TI-22 Disposable Buoys Modular Expendable ISR Buoy and Transition to EW. - Complete TI Tethered Buoys Modular Tethered Antennas and RF Over Fiber and Transition to EW. - Complete Micro Adaptive Training Lab Test. - Complete Mast Antenna Coupler Lab Test.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Start RADAR Vulnerability Assessment Tool (RVAT) Development and complete Step 2 and 3 Test. - Start Virginia Class Submarine Direction Finding (VA DF) Improvement Development and complete Step 2 and 3 Test. - Start Low Probability of Intercept (LPI) RADAR improvement and complete Step 2 and 3 Test. ***FY 2021 Base Plans:*** - Transition Solid State RADAR Emitter Identification to EW. - Continue Tunable Optical Filters for Radio Frequency Photonic Signal Distributions System Lab Test. - Complete Data Transmission using Visible Light Comms for Undersea Platforms Lab Test. - Complete Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW. - Complete Micro Adaptive Training and prepare for transition to EW. - Complete Mast Antenna Coupler Lab Test #2 and prepare for transition to EW. - Continue RADAR Vulnerability Assessment Tool Development. - Continue to develop Virginia Class Submarine Direction Finding Improvement Development. - Continue to develop LPI RADAR improvement. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** - FY 2020 ($2.278M) to FY 2021 ($2.387M) increase ($+0.109M) is in line with inflation associated with the RDT&EN appropriation.					
Accomplishments/Planned Programs Subtotals	4.264	4.557	4.773	0.000	4.773

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

- This project is a non-Acquisition Category (ACAT) program.
- This project optimizes technology insertion using a build-test-build approach to support EW and Imaging operational needs. Operational needs have been based on the tactical requirements identified in the Common Submarine Imaging System (CSIS) (CDD# 849-87-11) dated 22 Dec 2011, with an updated CDD approved on 15 Mar 2018, for Submarine Imaging Systems, and the Common Submarine Electronic Warfare System (CSEWS) (CDD# 907-97-16) dated 27 Sep 2016 for the Electronic Warfare Systems. Project efforts develop submarine unique improvements to mast, periscope, and EW electromagnetic spectrum and electro-optic sensors based

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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on emerging technologies that are available from DoD Exploratory Development Programs, industry Independent Research and Development, and other sources. Engineering Development Models (EDMs) will be developed to provide a realistic method of evaluating the improvements, including deployment on submarines for testing.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced Imaging and EW - Systems Engineering	WR	NUWC : RI	24.466	4.236	Nov 2018	1.541	Nov 2019	1.685	Nov 2020	-		1.685	Continuing	Continuing	Continuing
Advanced Imaging and EW - Software and Hardware Development	C/FP	JHU/APL : MD	0.000	0.000	Nov 2018	2.278	Nov 2019	2.325	Nov 2020	-		2.325	Continuing	Continuing	Continuing
Advanced Imaging and EW - Software and Hardware Development	MIPR	MIT/LL : MA	0.590	0.000	Nov 2018	0.710	Nov 2019	0.735	Dec 2020	-		0.735	Continuing	Continuing	Continuing
		Subtotal	25.056	4.236		4.529		4.745		-		4.745	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Office Travel	WR	NAVSEA : DC	0.357	0.028	Nov 2018	0.028	Jan 2020	0.028	Nov 2020	-		0.028	Continuing	Continuing	Continuing
		Subtotal	0.357	0.028		0.028		0.028		-		0.028	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	25.413	4.264		4.557		4.773		-		4.773	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Imaging Advanced Development				
Submarine Meteorological Sensors - Development	1	2019	2	2021
Submarine Meteorological Sensors - Sea Test	4	2020	4	2020
Submarine Meteorological Sensors - Transition to Imaging	2	2021	2	2021
Low Power Fiber Delivered Laser Range Finder - Development	1	2019	1	2020
Low Power Fiber Delivered Laser Range Finder - Lab Test	4	2019	4	2019
Low Power Fiber Delivered Laser Range Finder - Transition to Imaging	1	2020	1	2020
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres - Development	1	2019	1	2020
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres - Lab Test	4	2019	4	2019
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres - Transition to Imaging	1	2020	1	2020
Anti-reflective Coating Spherical Domes - Development	1	2019	1	2021
Anti-reflective Coating Spherical Domes - Lab Test #1	3	2019	3	2019
Anti-reflective Coating Spherical Domes - Lab Test #2	4	2020	4	2020
Anti-reflective Coating Spherical Domes - Transition to Imaging	1	2021	1	2021
Volumetric Atmospheric Modeling (STTR) - Development	1	2019	1	2021
Volumetric Atmospheric Modeling (STTR) - Lab Test #1	3	2019	3	2019
Volumetric Atmospheric Modeling (STTR) - Lab Test #2	4	2020	4	2020
Volumetric Atmospheric Modeling (STTR) - Transition to Imaging	1	2021	1	2021
Near Ocean Imaging though Atmospheric Turbulence - Development	1	2019	1	2022
Near Ocean Imaging though Atmospheric Turbulence - Lab Test	4	2020	4	2020
Near Ocean Imaging though Atmospheric Turbulence - Transition to Imaging	1	2022	1	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Vulnerability Improvement - Development	1	2019	4	2024
Vulnerability Improvement - Lab Test #1	4	2019	4	2019
Vulnerability Improvement - Lab Test #2	4	2020	4	2020
Vulnerability Improvement - Lab Test #3	4	2021	4	2021
Vulnerability Improvement - Lab Test #4	4	2022	4	2022
Vulnerability Improvement - Lab Test #5	4	2023	4	2023
Vulnerability Improvement - Transition to Imaging	4	2024	4	2024
Imaging Buoy - Development	2	2020	3	2022
Imaging Buoy - Lab Test	3	2021	3	2021
Imaging Buoy - Pierside Test	2	2022	2	2022
Imaging Buoy - Transition to Imaging	3	2022	3	2022
SNACS - Development	1	2019	4	2023
SNACS - Jump Start	1	2019	1	2019
SNACS - Transition to ASSEP	1	2022	1	2022
SNACS - Transition to Imaging	4	2023	4	2023
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - Development	1	2019	4	2020
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - PA Lab Testing #1	3	2019	3	2019
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - PA Lab Testing #2	2	2020	2	2020
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - Based Mission Planning - Transition to Imaging	4	2020	4	2020
Next Generation Photonics Development	2	2024	4	2025
Electronic Warfare Advanced Development				
Extremely Wideband Digital Receiver NATO Nunn Project with NAVAIR and Australia Development	1	2019	1	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 0770 / *Adv Sub Supp Equip Prog*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Extremely Wideband Digital Receiver NATO Nunn Project with NAVAIR and Australia Lab Test	4	2019	4	2019
Extremely Wideband Digital Receiver NATO Nunn Project with NAVAIR and Australia Transition to EW	1	2020	1	2020
WB Digitizers - DISARMER Development	1	2019	2	2019
WB Digitizers - DISARMER Lab Test	1	2019	1	2019
WB Digitizers - DISARMER Transition to EW	2	2019	2	2019
TI Multifunctional Apertures Development	1	2019	4	2019
TI Multifunctional Apertures Lab Test	3	2019	3	2019
TI Multifunctional Apertures Transition to EW	4	2019	4	2019
RADAR Vulnerability Assessment Tool Development	1	2020	1	2023
RADAR Vulnerability Assessment Tool Step 2 Test	3	2020	3	2020
RADAR Vulnerability Assessment Tool Step 3 Test	4	2020	4	2020
RADAR Vulnerability Assessment Tool Development Transition to EW	1	2023	1	2023
Virginia Class Submarine Direction Finding Improvement Development	1	2020	1	2023
Virginia Class Submarine Direction Finding Improvement Step 2 Test	3	2020	3	2020
Virginia Class Submarine Direction Finding Improvement Step 3 Test	4	2020	4	2020
Virginia Class Submarine Direction Finding Improvement Transition to EW	1	2023	1	2023
Low Probability of Intercept RADAR Improvement Development	1	2020	1	2023
Low Probability of Intercept RADAR Improvement Step 2 Test	3	2020	3	2020
Low Probability of Intercept RADAR Improvement Step 3 Test	4	2020	4	2020
Low Probability of Intercept RADAR Improvement Test Transition to EW	1	2023	1	2023
Develop Advanced Capabilities for Virginia Class EW	3	2022	4	2025
Develop Advanced Capabilities for Virginia Class EW - Step 2 Test	1	2023	1	2023
Develop Advanced Capabilities for Virginia Class EW - Step 3 Test	2	2023	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 1739 / *Submarine Arctic W/F Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1739: *Submarine Arctic W/F Development*	70.208	5.022	6.635	5.755	-	5.755	9.481	7.036	7.177	7.321	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Submarine Arctic Warfare Development Project is aligned to Commander, Undersea Warfighting Development Center (UWDC), Detachment Arctic Submarine Laboratory (ASL). This Project provides the U.S. Navy Submarine Force (SUBFOR) a cadre of trained Arctic Operation Specialists (AOS) and an inventory of unique Arctic sensors that are installed to optimize submarine safety during under-ice operations. AOS personnel assigned from ASL embark on submarines that deploy to the Arctic, cold water and iceberg regions, and marginal ice zones (MIZ) in northern latitudes of the Atlantic and Pacific Oceans, and are advisers to the Commanding Officer. ASL is a shore facility at Naval Base Point Loma with the infrastructure capable of supporting personnel and equipment to conduct the submarine Arctic Warfare Development mission. Improvements and life-cycle expenditures to the facility and warehousing are made as necessary to support the mission.

The Submarine Arctic Warfare Development Project, via ASL, responds to the increased threat of naval activity in the Arctic regions while continuously supporting the Navy's strategic objective of Assured Access and Combat Credibility. ASL provides a unique capability that enables the submarine force to satisfy the requirements laid out in the Arctic Maritime Homeland Defense Initial Capabilities Document (ICD). ASL and SUBFOR demonstrate existing Arctic Warfare capabilities and operational and tactical proficiency while developing advanced submarine technology in unique cold water environments, in under-ice conditions, and in ice-covered shallow water regions during a biennial Ice Exercise (ICEX). ICEX places an emphasis on submarine operability and mission capability in the world's harshest maritime environment. Efforts include assessment of combat system effectiveness, weapons testing, use of High Frequency (HF) sonars in Arctic regions, testing of ice-capable submarine structures, and development of class-specific Arctic operational guidelines. Tactical Development (TACDEV) ICEXs are conducted biennially and require up front comprehensive planning and work-up training, as well as post exercise analysis and reporting. ICEXs provide the framework for various submarine test and evaluation in Arctic regions and at periodic Ice Camps. This program represents DoD's only drifting ice station capability. Emphasis during ICEX is placed on the areas of sonar operability, tactical surveillance, weapon utility, and other submarine support missions. These efforts include the assessment of combat system effectiveness, development of Arctic specific improvements for existing sonar and weapons, development of class-specific Arctic operational guidelines, and testing of ice-capable submarine support structures. Torpedo ICEXs, occurring every four (4) years (FY 2018, FY 2022, etc.) include a Fleet requirement to conduct exercise torpedo (EXTORP) firings in the Arctic. A Torpedo Exercise (TORPEX) requires a significantly higher level of logistics, personnel, and infrastructure to account for the recovery and transportation efforts of the EXTORPs.

All programs funded in this project are non-Acquisition Category (ACAT) programs.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	5.022	6.635	5.755	0.000	5.755
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 1739 / *Submarine Arctic W/F Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: - Conduct Arctic work-up training, Ice Exercise (ICEX) mission 2020, and Ice Camp 2020. - Conduct ICEX 2020 as a Tactical Development (TACDEV) event. Operate a submarine tracking range for approximately 14 days, conduct complex and coordinated operations from a drifting ice station. Logistically and operationally support submarine and camp operations from a drifting ice station that is re-supplied via contracted commercial rotary and fixed-wing aviation services, via USTRANSCOM, from temporary infrastructure and services on the North Slope of Alaska. - Support Arctic deployments, including inter-Fleet transfers, as required by the SUBFOR Commanders. - Investigate, research, develop, and deploy new systems for Arctic submarine support. - Support testing and tactical development required to improve submarine Arctic operability and warfighting. - Conduct Arctic operations to support ice camp equipment evaluation, systems development and extreme cold weather training, and to also perform drifting sea ice analysis required to improve drifting sea ice camp Arctic operations. ***FY 2021 Base Plans:*** - Conduct Arctic work-up training. - Support Arctic deployments, including inter-Fleet transfers, as required by the SUBFOR Commanders. - Investigate, research, develop, and deploy new systems for Arctic submarine support. - Conduct Arctic operations to support ice camp equipment evaluation, systems development, and extreme cold weather training, and to also perform drifting sea ice analysis required to improve drifting sea ice camp Arctic operations. - Support testing and tactical development required to improve submarine Arctic operability and warfighting. - Initiate planning, logistics support, procurement, and preparation for ICEX mission 2022 and Ice Camp 2022. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** - FY 2020 ($6.635M) to FY 2021 ($5.755M) decrease ($-0.880M) is driven by FY 2021 being an ICEX planning year (no major ICEX/Ice Camp events scheduled in FY 2021).					
Accomplishments/Planned Programs Subtotals	5.022	6.635	5.755	0.000	5.755

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 1739 / *Submarine Arctic W/F Development*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

- This project is a non-Acquisition Category (ACAT) program.
- Use Naval Undersea Warfare Center (NUWC) to provide technical assistance awarded through NAVSEA Reimbursable Work Order.
- Use sole source and competitively awarded contracts through the U.S. Army Corps of Engineers (USACE) Alaska regional office for ICEX Ice Camp logistics, engineering, and operations support.
- Use sole source and competitively awarded contracts through the Fleet Logistics Center (FLC) regional contracting office and Defense Logistics Agency (DLA) for equipment procurement and technical services.
- Use sole source and competitively awarded contracts through the U.S. Transportation Command for ICEX aviation support.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	WR	COMSUBLANT : VA	8.370	2.979	Oct 2018	4.268	Oct 2019	3.500	Nov 2020	-		3.500	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	WR	COMSUBPAC : CA	36.101	0.000		0.000		0.000		-		0.000	0.000	36.101	-
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	WR	NUWC/Keyport : WA	0.468	0.375	Dec 2018	0.149	Oct 2019	0.303	Nov 2020	-		0.303	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	WR	NUWC/Newport : RI	1.795	0.000	Jan 2019	0.121	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	MIPR	USACE : AK	2.715	1.486	Dec 2018	0.150	Nov 2019	1.400	Dec 2020	-		1.400	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	MIPR	USTRANSCOM : IL	1.505	0.065	Dec 2018	1.600	Dec 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	C/CPFF	UT/ARL : TX	1.434	0.010	Feb 2019	0.000		0.100	Jan 2021	-		0.100	Continuing	Continuing	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	C/CPFF	UW/APL : WA	15.827	0.000		0.000		0.000		-		0.000	0.000	15.827	Continuing
Conduct ICEX and Arctic Transit Mission, ICEX	C/CPFF	VAR* : VAR	0.334	0.005	Jan 2019	0.243	Dec 2019	0.246	Dec 2020	-		0.246	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 1739 / *Submarine Arctic W/F Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Workup and Training, Ice Camps															
		Subtotal	68.549	4.920		6.531		5.649		-		5.649	Continuing	Continuing	N/A

Remarks

* Consists of multiple performing activities with funding for each not greater than $1M per year

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support - Acquisition, Business & Finance	C/CPAF	EG&G : VA	0.311	0.000		0.000		0.000		-		0.000	0.000	0.311	-
Program Management Support - Acquisition, Business & Finance	C/CPAF	BAE SYSTEMS : MD	1.088	0.000		0.000		0.000		-		0.000	0.000	1.088	-
Program Management Support - Acquisition, Business & Finance	C/CPIF	TMB : DC	0.220	0.102	Dec 2018	0.000		0.000		-		0.000	0.000	0.322	Continuing
Program Management Support - Acquisition, Business & Finance	C/CPFF	TBD (TMB Follow On) : TBD	0.000	0.000		0.104	Jan 2020	0.106	Dec 2020	-		0.106	Continuing	Continuing	Continuing
Program Office Travel	Allot	NAVSEA PEO IWS 5 : DC	0.040	0.000		0.000		0.000		-		0.000	0.000	0.040	-
		Subtotal	1.659	0.102		0.104		0.106		-		0.106	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	70.208	5.022		6.635		5.755		-		5.755	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 1739 / *Submarine Arctic W/F Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 1739				
ICEX Mission 2020 (TACDEV) Planning/Logistics	1	2019	1	2020
ICEX Mission 2020 (TACDEV)	2	2020	2	2020
ICEX Mission 2020 (TACDEV) Post-ICEX Analysis/Reporting	3	2020	4	2020
ICEX Mission 2022 (TACDEV / TORPEX) Planning/Logistics	1	2021	1	2022
ICEX Mission 2022 (TACDEV / TORPEX)	2	2022	2	2022
ICEX Mission 2022 (TACDEV / TORPEX) Post-ICEX Analysis/Reporting	3	2022	4	2022
ICEX Mission 2024 (TACDEV) Planning/Logistics	1	2023	1	2024
ICEX Mission 2024 (TACDEV)	2	2024	2	2024
ICEX Mission 2024 (TACDEV) Post-ICEX Analysis/Reporting	3	2024	4	2024
ICEX Mission 2026 (TACDEV) Planning/Logistics	1	2025	4	2025
Ice Camp (Arctic Ocean) 2020	1	2020	4	2020
Ice Camp (Arctic Ocean) 2022	1	2022	4	2022
Ice Camp (Arctic Ocean) 2024	1	2024	4	2024
Arctic Workup (At Sea)	1	2019	4	2025
Arctic Training	1	2019	4	2025
Arctic Submarine Deployment as required by the Submarine Type Commander	1	2019	4	2025
Arctic Transit Mission (At Sea)	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	2.894	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.894
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

A continuing need exists to improve Electronic Warfare (EW) capabilities in view of the advancements in potential imaging counter detection and the increasingly dense electromagnetic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Improvements are necessary for submarine EW to be operationally effective in the following mission areas: Joint Littoral Warfare, Joint Surveillance, Space and Electronic Warfare, Intelligence Collection, Maritime Protection, and Joint Strike. The evaluation of state-of-the-art technology to implement periscope/mast improvements via EW electromagnetic results in improved capability. Engineering Development Models (EDMs) are developed, evaluated, and validated in the lab and through at-sea testing.

This project supports development of capability improvements to submarine electronic surveillance measures that are used to detect, classify, localize, and record RADAR and Communications signals. The funding line also supports the specific development of high-speed digital networks and electronic attack demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Advanced Submarine Electronic Warfare Systems	2.894	0.000
FY 2019 Accomplishments: - Developed Field Programmable Gate Array (FPGA) based Peripheral Component Interconnect Express (PCIe) Switch brassboard and PCIe Switch software. - The Ship Countermeasure Warfare Integrated Demonstration (SCWID) effort is being undertaken to demonstrate the effectiveness of the current Georgia Technology Research Institute (GTRI) SCWID Electronic Attack (EA) techniques when interfaced to a platform-specific antenna assembly, while operating in a maritime environment. Develop a prototype to effectively use SCWID EA techniques with submarine representative antennas. ***FY 2020 Plans:*** - Complete and test two engineering development modules of the FPGA based PCIe Switch. - Complete and test a prototype to utilize SCWID EA techniques with submarine representative antennas in a simulated environment.		
Congressional Adds Subtotals	2.894	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDT&E/0603562N/0770: *Adv Sub Supp Equip Prog*	4.264	4.557	4.773	-	4.773	4.810	4.890	4.980	5.077	Continuing	Continuing
• RDTE/0604503N/0775: *Submarine Supt Equip Prog*	24.796	21.235	30.115	-	30.115	31.999	33.379	32.808	33.467	Continuing	Continuing

Remarks

D. Acquisition Strategy

- This project optimizes technology insertion using a build-test-build approach to support EW operational needs. Operational needs have been based on the tactical requirements identified in the Common Submarine Electronic Warfare System (CSEWS) (CDD# 907-97-16) dated 27 Sep 2016 for the Electronic Warfare Systems. Project efforts develop submarine unique improvements to mast, periscope, and EW electromagnetic spectrum and electro-optic sensors based on emerging technologies that are available from DoD Exploratory Development Programs, industry Independent Research and Development, and other sources. Engineering Demonstration Models (EDMs) will be developed to provide a realistic method of evaluating the improvements, including deployment on submarines for testing.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced Submarine EW Systems	C/FFP	GTRI : Atlanta, GA	0.000	0.880	May 2019	0.000		0.000		-		0.000	0.000	0.880	-
Advanced Submarine EW Systems	WR	NUWC : Newport, RI	0.000	1.014	Dec 2018	0.000		0.000		-		0.000	0.000	1.014	-
Advanced Submarine EW Systems	C/FFP	Accipter : Wexford, PA	0.000	1.000	Jun 2019	0.000		0.000		-		0.000	0.000	1.000	-
		Subtotal	0.000	2.894		0.000		0.000		-		0.000	0.000	2.894	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	2.894		0.000		0.000		-		0.000	0.000	2.894	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

Fiscal Year	2019				2020				2021				2022				2023				2024				2025			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
SBIR Topic N121-070: SIGINT Interfaces and Processing Infrastructure for Submarines																												
W31P4Q-18-D-0002: Ship Countermeasure Warfare Integrated Demonstration																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603562N / *Submarine Tactical Warfare Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
SBIR Topic N121-070: SIGINT Interfaces and Processing Infrastructure for Submarines: SBIR Topic N121-070: SIGINT Interfaces and Processing Infrastructure for Submarines	3	2019	2	2020
W31P4Q-18-D-0002: Ship Countermeasure Warfare Integrated Demonstration: W31P4Q-18-D-0002: Ship Countermeasure Warfare Integrated Demonstration	3	2019	2	2020

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	228.811	73.750	96.846	126.396	-	126.396	58.101	52.766	54.358	50.674	Continuing	Continuing
2196: *Design, Tools, Plans and Concepts*	7.088	23.101	33.595	21.520	-	21.520	11.505	10.643	9.659	9.791	Continuing	Continuing
3161: *NAVSEA Tech Authority*	205.776	27.267	34.247	12.205	-	12.205	15.176	11.708	10.471	10.051	Continuing	Continuing
3244: *Cybersecurity Engineering*	0.000	0.000	0.000	17.678	-	17.678	15.468	15.576	23.735	24.209	Continuing	Continuing
3376: *Strategic Sealift*	15.947	6.087	6.004	1.790	-	1.790	4.489	6.533	6.500	6.623	Continuing	Continuing
4037: *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*	0.000	17.295	8.000	13.203	-	13.203	11.463	8.306	3.993	0.000	0.000	62.260
4044: *Next Generation Medium Amphibious Ship*	0.000	0.000	0.000	30.000	-	30.000	0.000	0.000	0.000	0.000	0.000	30.000
4045: *Next Generation Medium Logistics Ship*	0.000	0.000	0.000	30.000	-	30.000	0.000	0.000	0.000	0.000	0.000	30.000
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $12.087 million to account for the availability of prior year execution balances.

Project 2196 - This project provides the foundation for an affordable and mission capable surface ship force. It also supports the next step in the development of a transformed naval force by accomplishing the pre-milestone A (especially pre-concept decision) efforts for all potential surface combatants. These efforts are the required first step in the identification of relevant, effective, and affordable platform requirements for the future force. Additionally the integration of total ship systems, including combat systems, weapons systems and Hull, Mechanical and Electrical (HM&E) systems will be addressed for ships in the pre-milestone A stages of acquisition. Inadequate early planning, requirements definition, and ship concept formulation can result in downstream design, construction and operational problems. A more subtle and severely negative impact of neglecting this early effort is that the "best" concepts and technologies may never even be considered and the greatest potential ship design advances never realized. Designs and technologies must consider how to meet the threat over the life span of the class, which can last nearly a century. This project supports these requirements.

This project funds concept development engineering, mission effectiveness analysis, force architecture analysis, and other analyses for formulation of future surface ship force structure along with development of the platforms, payloads, people and processes required to accomplish these efforts. Advanced ship concept studies, ship and ship systems technology assessments, and the development and upgrade of ship concept design and engineering tools, methods, and criteria are funded in this project.

This project:

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	

(1) Develops alternative surface ship force structure concepts including ships and unmanned surface vehicles.
(2) Evaluates the mission/force capability effectiveness and costs for these alternative surface fleet architectures.
(3) Performs fleet war fighting/mission effectiveness assessment studies.
(4) Identifies future surface ship requirements and characteristics necessary to meet future threats and support mission needs.
(5) Investigates new affordable ship concepts and evaluates technologies necessary to support these concepts.
(6) Provides design methods and automated design tools to develop and evaluate ship concepts.
(7) Supports development of Initial Capabilities Documents (ICD) and analogous early requirements documents for future ships.
(8) Develops and updates a Technology Investment Strategy (TIS) to help guide OPNAVs investments to achieve an effective future fighting force.

These efforts are done to support analysis; mission needs development and technology assessment in support of future fleet concepts and potential ship acquisition programs. These efforts are fundamental to the Navy's formulation of the future fleet requirements. These efforts support and maintain naval ship design and engineering capabilities in the design phase of developing concept design tools, criteria and methods.

Project 3161 - This project is the only R&D effort that provides a coordinated approach to the development of cross platform ship and weapon system designs and technologies "common" to multiple ships and systems. This project directly influences technical standards for design, construction, certification and operation and provides an avenue for innovative solutions and technologies to compete with legacy product requirements and specifications. This project conducts risk reduction of alternative technical architectures, designs and technology solutions that meet Fleet operational and technical requirements at lower cost; and develops engineering capabilities in the areas of design tools, criteria and methods. This project funds a prioritized portfolio of time-sensitive initiatives through the Cross Platform Systems Development (CPSD) Program, supporting NAVSEA Technical Authority and associated risk reduction activity. The areas of exploration for CPSD include Ship Technology Improvements, Fleet Maintenance and Life Cycle Cost Reduction, Advanced Manufacturing and Material Technology, Additive Manufacturing, Digital Framework/Electromagnetic Environment and Development and Unmanned Systems and Cybersecurity. The research products developed by this project directly support and influence both current Fleet requirements and future acquisition programs by providing a range of technically acceptable alternatives and evaluation of emerging technologies. The prototypes, standards/specs, tools and processes and other products developed in this project focus on technical requirements and technologies applicable to multiple ship classes or systems. Products from this project transition directly to early-stage ship design for Ship Preliminary Design and Feasibility Studies, Program Executive Office (PEO) ship acquisition programs, and Systems Engineering Technical Authority (SETA) requirements documentation. Tasks within this project include R&D efforts focused on increasing sustainment technologies and improving performance at reduced cost for current and future naval platforms.

Project 3244 - This effort funds the research, design, development, testing, and installation of Cybersecurity solutions for all installed integrated computer networks to include shipboard Hull Mechanical and Electrical (HM&E), Navigation Systems, Combat Systems, Fire Control, Sonar, Radar, Communications and all other shipboard computerized control systems for all afloat U.S. Navy platforms. Cybersecurity Engineering supports the development of specifications and standards for the Cybersecurity of all Navy Control Systems (NCS).

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*

Project 3376 - Strategic Sealift Research and Development - Develops new concepts and technologies which can be applied to or will enable future strategic sealift, and Seabasing systems. The technologies include ship configuration concepts, equipment to increase cargo handling and cargo loading/unloading rates (including commercial and merchant ship systems), improved man/machine interfaces, improved structural configurations and materials, and Logistics-Over-the-Shore (LOTS) equipment and system improvements. FY2016 and prior years (FY2014 and earlier) efforts were financed under the National Defense Sealift Fund (NDSF) BA 04 Project 3116 Strategic Sealift Research and Development. FY2015, FY2017, and FY2019-FY2024 efforts are financed under this RDT&E,N program element and project (3376).

Project 4037 - This project supports Common Hull Auxiliary Multi-Mission Platform (CHAMP)Design and Total Ship Integration. The CHAMP concept leverages a new approach to requirements generation and shipbuilding to replace aging mission specific designs with a common hull to reduce life cycle costs, leverage tailored payloads, and stabilize the industrial base. Identified missions include: sealift, aviation intermediate maintenance support, medical services, command & control, and submarine tending. Funding will inform requirements definition, early industry engagement and follow-on assessment across CHAMP mission functionality.

Project 4044 - In accordance with the Commandant's Planning Guidance and Chief of Naval Operations, Warfighting Requirements and Capabilities direction in support of the Integrated Naval Force Structure Assessment (INFSA), the Navy will evaluate next generation medium amphibious platform solutions in support of Distributed Maritime Operations (DMO), Littoral Operations in Contested Environment (LOCE), and Expeditionary Advanced Base Operations (EABO) concepts.

Project 4045 - The Navy established the Intra-Theater Small Auxiliary Logistics Platform Task Force in support of the Integrated Naval Force Structure Assessment (INFSA), to evaluate next generation medium platform solutions for logistics mission requirements in support of Distributed Maritime Operations (DMO) and Littoral Operations in Contested Environment (LOCE). This includes a family of vessels with commercial designs tailored for military applications.

Project 9999 (Congressional Add)- Funding provided in the Department of Defense Appropriations Act, 2020 for Advanced Manufacturing of Critical Scale Materials and High-Pressure Cold Spray Systems.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	74.603	81.846	47.514	-	47.514
Current President's Budget	73.750	96.846	126.396	-	126.396
Total Adjustments	-0.853	15.000	78.882	-	78.882
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.650	0.000			
• SBIR/STTR Transfer	-1.503	0.000			
• Program Adjustments	0.000	0.000	78.716	-	78.716
• Rate/Misc Adjustments	0.000	0.000	0.166	-	0.166

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Additive Manufacturing*	0.000	5.000
Congressional Add: *High pressure cold spray system*	0.000	10.000
Congressional Add Subtotals for Project: 9999	0.000	15.000
Congressional Add Totals for all Projects	0.000	15.000

Change Summary Explanation

The FY 2021 funding request was reduced by $12.087 million to account for the availability of prior year execution balances.

The FY 2021 funding request increase supports SABER integration, Common Hull Auxiliary Multi-Mission Platform (CHAMP) design and development of ship specifications, and concept design for medium amphibious and logistics ships. The Cybersecurity Pillar (CPSD F) transferred from Project 3161 to Project 3244 to restructure Cybersecurity efforts into a separate project.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603563N / *Ship Concept Advanced Design*				Project (Number/Name) 2196 / *Design, Tools, Plans and Concepts*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2196: *Design, Tools, Plans and Concepts*	7.088	23.101	33.595	21.520	-	21.520	11.505	10.643	9.659	9.791	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 2196 - This project provides the foundation for an affordable and mission capable surface ship force. It also supports the next step in the development of a transformed naval force by accomplishing the pre-milestone A (especially pre-concept decision) efforts for all potential surface combatants. These efforts are the required first step in the identification of relevant, effective, and affordable platform requirements for the future force. Additionally the integration of total ship systems, including combat systems, weapons systems and Hull, Mechanical and Electrical (HM&E) systems will be addressed for ships in the pre-milestone A stages of acquisition. Inadequate early planning, requirements definition, and ship concept formulation can result in downstream design, construction and operational problems. A subtler and severely negative impact of neglecting this early effort is that the "best" concepts and technologies may never even be considered and the greatest potential ship design advances never realized. Designs and technologies must consider how to meet the threat over the life span of the class, which can last nearly a century. This project supports this requirement.

This project funds concept development engineering, mission effectiveness analysis, force architecture analysis, and other analyses for formulation of future surface ship force structure along with development of the platforms, payloads, people and processes required to accomplish these efforts. Advanced ship concept studies, ship and ship systems technology assessments, and the development and upgrade of ship concept design and engineering tools, methods, and criteria are funded in this project.

This project:
(1) Develops alternative surface ship force structure concepts including ships and unmanned surface vehicles.
(2) Evaluates the mission/force capability effectiveness and costs for these alternative surface fleet architectures.
(3) Performs fleet war fighting/mission effectiveness assessment studies.
(4) Identifies future surface ship requirements and characteristics necessary to meet future threats and support mission needs.
(5) Investigates new affordable ship concepts and evaluates technologies necessary to support these concepts
(6) Provides design methods and automated design tools to develop and evaluate ship concepts.
(7) Supports development of Initial Capabilities Documents (ICD) and analogous early requirements documents for future ships.
(8) Develops and updates a Technology Invest Strategy to help guide OPNAVs investments to achieve an effective future fighting force

These efforts are done to support analysis; mission needs development and technology assessment in support of future fleet concepts and potential ship acquisition programs. These efforts are fundamental to the Navy's formulation of the future fleet requirements. These efforts support and maintain naval ship design and engineering capabilities in the design phase of developing concept design tools, criteria and methods.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Ship Concepts and Mission Need Analysis	1.123	0.494	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Develop ship concepts and perform analysis for potential ships and Force Architectures 5-30 years out in shipbuilding plan. Develop design methods and engineering tools to support the development of ship concepts and forces. ***FY 2020 Plans:*** Continue development of ship and force designs and their evaluations for multi-mission effectiveness and costs. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The $0.494 decrease between FY 2020 and FY 2021 is due to the transition to Future Surface Combatant Force Analysis of Alternatives.					
Title: Future Surface Combatant Studies	21.978	33.101	19.020	0.000	19.020
Articles:	-	-	-	-	-
Description: This effort will lay the analytic foundation for the development of the Future Surface Combatant Force (FSCF). Ships produced from this effort will fill critical gaps in the fleet in the 2045 timeframe created by the decommissioning of CG 47, DDG 51, and LCS 1/2 ships. Unmanned surface vessels concepts and CONOPS will be developed to decouple mission capability from manned force structure. ***FY 2020 Plans:*** Continue development for the Future Surface Combatant Force, including shipyard engagement. Technology integration studies to support various surface combatant platforms required to deliver the Future Surface Combatant Force. Completion of the initial Unmanned Surface Vehicle requirements evaluation and development. Technology Investment Strategy (TIS) that will outline current capability gaps identified in the FY19 FSCF AoA and potential path of investment to fill gaps. The Design Reference Mission (DRM) that defines the baseline operational context will be completed so that current and future surface ship programs can leverage it. Top Level Requirements will be drafted for Large Surface Combatant (LSC) Block II, Small Surface					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Combatant (SSC), Medium USV (MUSV) Block III, Large USV (LUSV) Block III, and Integrated Combat System (ICS). ***FY 2021 Base Plans:*** Continue development of platforms as outlined in the Surface Combatant Evolution Plan (SCEP). Technology integration studies in line with the SCEP and TIS. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Large Surface Combatant is transitioning from a NACT pre-milestone A program to a post milestone A program funded outside of NACT in FY21. This causes a reduction in overall NACT budget priorities.					
Title: Naval Capability Integration Process (NCIP) - From the Sea (FTS)	0.000	0.000	1.000	0.000	1.000
Articles:	-	-	-	-	-
Description: The Naval Capability Integration Process (NCIP) is an annual process analyzing current and future Navy capabilities against future stressing threats providing fully informed quantitative mission and impacts in support of threat based decisions. No longer are effects chains confined to one platform. Effects chains are becoming more complex and fielding them requires coordination and analysis across all Systems Commands (SYSCOMS) and Resource Sponsors. Work is integrated with NCIP-From the Air (FTA) and NCIP- Information Warfare (IW) ensuring alignment of system functions, schedules, and funding in order to field integrated warfighting capabilities. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Continue the annual informed Capabilities-Based Assessments (CBA) such as advanced Naval surface fires and Integrated Air and Missile Defense to identify future capability requirements. Develop metrics to describe the effectiveness of solutions, evaluate current and programmed systems ability to meet capability requirements and determine capability gaps. Expand warfighting gap assessments addressing interaction of mission area kill chain platforms, sensors, and weapons in a system-of-system construct. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase is due to the new NCIP-FTS effort to maintain ongoing integration analysis efforts in order to pace threat capabilities.					
Title: CREATE	0.000	0.000	1.500	0.000	1.500
Articles:	-	-	-	-	-
Description: CREATE Ships efforts maintain Naval architecture industrial base tools utilized as critical enablers of naval ship design. Efforts include High Performing Computing environment tool upkeep and refinements to inform many ship design activities including Rapid Design Integration, Shock & Damage impacts and mitigations, Hydrodynamics design and Structural design utilization. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** FY 2021 plans include development of tools to support future major acquisition programs, specifically including activities on the Integrated Structural Design Environment (ISDE) tooling, and support of high speed computing capabilities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase in funding is to support future surface ship designs and major acquisition programs.					
Accomplishments/Planned Programs Subtotals	23.101	33.595	21.520	0.000	21.520

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0204202N: *DDG-1000*	137.004	111.435	208.448	-	208.448	90.883	30.343	12.076	4.309	Continuing	Continuing
• RDTEN/0603512N: *Carrier Systems Development*	5.388	4.997	7.559	-	7.559	7.393	9.654	7.951	5.857	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603564N: *Ship Preliminary Design/Feasibility*	12.839	22.534	70.270	-	70.270	156.841	158.832	159.542	83.610	Continuing	Continuing
• RDTEN/0604567N: *Ship Contract Design/Live Fire T&E*	69.337	46.809	51.853	-	51.853	57.336	57.082	56.612	46.176	Continuing	Continuing
• RDTEN/0603582N: *Combat System Integration*	15.710	17.251	17.843	-	17.843	17.991	18.353	18.724	18.646	Continuing	Continuing

Remarks

D. Acquisition Strategy

This is a non-acquisition program that develops, evaluates, and validates early stages of total ship concepts and technologies in support of SCN planning and potential future ship acquisition programs. This program also supports development, demonstration, evaluation, and validation of engineering tools, methods, and criteria for those concept designs and assessments.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	C/CPFF	FSCF AoA Various Contractors : Various	0.584	2.677	Feb 2019	1.195	Feb 2020	1.000	Feb 2021	-		1.000	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA NSWC : Various	0.906	1.000	Feb 2019	1.000	Feb 2020	6.800	Nov 2020	-		6.800	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA NSWC DD : Dahlgren, VA	1.662	1.275	Nov 2018	2.000	Nov 2019	4.020	Dec 2020	-		4.020	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA NSWC PD : Philadelphia, PA	0.675	1.250	Nov 2018	0.000	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA NIWC : San Diego, CA	0.172	0.000		2.200	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA JHU APL : Baltimore, MD	0.000	0.000		0.500	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	FSCF AoA NSWC CD : Carderock, MD	0.612	1.918	Oct 2018	1.000	Oct 2019	2.200	Nov 2020	-		2.200	Continuing	Continuing	Continuing
Engineering Development	C/CPFF	FSCF AoA Various Contractors : Various	0.171	7.127	Feb 2019	0.000	Feb 2020	5.000	Nov 2020	-		5.000	Continuing	Continuing	Continuing
Engineering Development	WR	FSCF AoA NSWC CD : Carderock, MD	1.986	1.289	Nov 2018	1.000	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	C/BA	FSCF AoA NSWC : Various	0.000	1.610	Feb 2019	0.100	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	C/CPFF	FSCF AoA Various Contractors : Various	0.029	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Test & Evaluation	C/CPFF	FSCF AoA Various Contractors : Various	0.020	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	FSCF AoA NSWC PD : Philadelphia, PA	0.000	1.900	Nov 2018	0.000	Nov 2019	0.000		-		0.000	0.000	1.900	-
Engineering Development	WR	FSCF AoA NSWC DD : Dahlgren, VA	0.000	2.405	Nov 2018	0.000	Nov 2019	0.000		-		0.000	0.000	2.405	-
Engineering Development	WR	FSCF AoA NAVAIR : Patuxent River, MD	0.196	0.000		0.200	Nov 2019	0.000		-		0.000	0.000	0.396	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	FSCF AoA NUWC : Newport, RI	0.075	0.000		0.400	Nov 2019	0.000		-		0.000	0.000	0.475	-
Systems Engineering	C/CPFF	LSC Pre-PD Various Contractors : Various	0.000	0.000		14.000	Feb 2020	0.000		-		0.000	0.000	14.000	-
Systems Engineering	WR	LSC Pre-PD NSWC : Various	0.000	0.000		3.500	Feb 2020	0.000		-		0.000	0.000	3.500	-
Systems Engineering	WR	LSC Pre-PD NSWC DD : Dahlgren, VA	0.000	0.000		1.800	Nov 2019	0.000		-		0.000	0.000	1.800	-
Systems Engineering	WR	LSC Pre-PD NSWC PD : Philadelphia, PA	0.000	0.000		1.600	Nov 2019	0.000		-		0.000	0.000	1.600	-
Systems Engineering	WR	LSC Pre-PD NIWC : San Diego, CA	0.000	0.000		0.600	Nov 2019	0.000		-		0.000	0.000	0.600	-
Systems Engineering	WR	LSC Pre-PD NSWC CD : Carderock, MD	0.000	0.000		2.500	Oct 2019	0.000		-		0.000	0.000	2.500	-
Systems Engineering	WR	T-AGS(X) NSWC CD : Carderock, MD	0.000	0.650	Mar 2019	0.000		0.000		-		0.000	0.000	0.650	-
Systems Engineering	C/CPFF	NCIP NSMA : Washington DC	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	0.000	1.000	-
Systems Engineering	C/CPFF	CREATE : Washington DC	0.000	0.000		0.000		1.500	Nov 2020	-		1.500	0.000	1.500	-
		Subtotal	7.088	23.101		33.595		21.520		-		21.520	Continuing	Continuing	N/A

Remarks

Changes in Systems Engineering between FY20 and FY21 to support changing program priorities and needs to support continuing and future AoA's and RET's. The Future Surface Combatant Force (FSCF) AOA team will be performing detailed analysis to move from IOVs set out in the FSCF Initial Capabilities Document(ICD) to threshold and objective requirements, and multiple concept formulation teams will be stood up to both develop the workforce as well as to develop concepts in order to shorten the acquisition timeline for future programs.

This funding is essential to:
- Ensure participation in AoA/RET to examine the alternative concepts and feasibility of acquisition strategies
- Prepare required documents for Alternative Systems Reviews (ASR) after the AoA and Navy determines preferred material solution(s)
- Perform operational & technical analysis on preferred material solutions
- Establish program framework and strategies

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
- Prepare required Milestone A documents for preferred material solution(s) - Develop technology development strategy															
		Project Cost Totals	7.088	23.101		33.595		21.520		-		21.520	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 2196 / *Design, Tools, Plans and Concepts*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2196				
Large Surface Combatant: Large Surface Combatant	1	2020	4	2020
Top Level Requests Development: Top Level Requests Development	1	2020	4	2025
Technology Investment Strategy: Technology Investment Strategy	1	2020	4	2025
Design Reference Mission: Design Reference Mission	1	2020	2	2024
FFG(X) Blk II: FFG(X) Blk II	2	2021	3	2021
Small Surface Combatant: Small Surface Combatant	1	2024	4	2024
Large Unmanned Surface Vehicle: Large Unmanned Surface Vehicle	1	2023	4	2023
Medium Unmanned Surface Vehicle: Medium Unmanned Surface Vehicle	1	2023	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
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COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3161: *NAVSEA Tech Authority*	205.776	27.267	34.247	12.205	-	12.205	15.176	11.708	10.471	10.051	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project has been established to support the NAVSEA Tech Authority with the coordination of design and development efforts for cross-platform applicability to result in more affordable, mission-capable, and interoperable surface ship forces including ships that are less expensive to build and operate with reduced manning, reduced support costs, and greater utilization of emerging technology.

NAVSEA Tech Authority efforts under Project 3161, known as the Cross Platform Systems Development (CPSD) Program transition directly to early-stage ship design for Ship Preliminary Design and Feasibility Studies and other Program Executive Office (PEO) ship design programs. While these efforts support concept exploration and mission needs assessment for potential future ship acquisition programs, they also develop cross-program technology solutions and associated Technical Authority products. The CPSD efforts are not direct efforts for specific, authorized shipbuilding programs. This project is the only R&D effort that provides a coordinated, collaborative approach to the development of: cross-platform naval ship and weapon system design, as well as engineering capabilities in the areas of design tools, criteria, and methods. The CPSD project also provides innovative solutions for current Fleet issues involving Technical Authority, such as interoperability issues with new systems or platforms, or broad technology insertion topics.

In FY19, all CPSD Pillars were rebaselined to better address CNO and NAVSEA Chief Engineer (SEA05) technical priorities and shall be comprised of the following functional areas:

CPSD A - Ship Technology Improvements
CPSD B - Fleet Maintenance and Life Cycle Cost Reduction
CPSD C - Additive and Advanced Manufacturing Technology
CPSD D - Digital Framework/Electromagnetic Environment and Development
CPSD E - Unmanned Systems
CPSD F - Cybersecurity

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Ship Technology Improvements (CPSD A)	1.297	2.162	1.328	0.000	1.328
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: This effort funds the analysis of ship system technologies to reduce design and construction costs. This also includes the development of validation tools to certify the safety and mission capability of platform concepts and eventually ships. ***FY 2020 Plans:*** Continue the development of ship construction technology improvements to reduce risk related to alternative technical architectures and designs. The Next Generation Cooling System (NGCS) to support our higher powered systems is a technology that will be improved. The Efficient Thermal Systems will utilize inherent thermal storage to improve and handle integration issues with current thermal management systems. ***FY 2021 Base Plans:*** Continue the development of ship construction technology improvements to reduce risk related to alternative technical architectures and designs. Further research regarding thermal loads will be conducted. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in funding from $2.162 to $1.328 due to Next Generation Cooling System (NGCS) project suite completion and transition to the Policy, Procedures, and Spec Development team within NAVSEA with fleet announcements of updates of how to adequately cool the higher-powered systems on surface ships.					
Title: Fleet Maintenance and Life Cycle Cost Reduction (CPSD B)	0.878	2.493	1.574	0.000	1.574
Articles:	-	-	-	-	-
Description: This effort funds the development of tools, analyses and technologies to reduce fleet life cycle costs, reduce life-cycle failure risk and improved refurbishment cycles. This will allow the Navy to better meet fleet operational and technical requirements and lower cost. ***FY 2020 Plans:*** Develop technologies to reduce in-service costs and technical risk associated with deployed technologies and systems. FY20 shall include a focus on technology improvements to reduce known in-service deficiencies. A suite of Standardized Guidelines for design tools will be researched to establish criteria for determining when					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
a Departure of Specification (DFS) should be written, and develop a passivation procedure for in-situ and pre-installation tubes which are causing significant availability delays in the fleet. ***FY 2021 Base Plans:*** Efforts to develop technologies to reduce in-service costs and technical risk associated with deployed technologies and systems will be conducted. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding decrease from $2.493 to $1.574 due to Passivation Process for Copper Nickel Tubing Project and Corrosion task suite completion and transition to spec updates/development and ultimately the fleet.					
Title: Additive and Advanced Manufacturing Technology (CPSD C)	7.360	8.155	8.399	0.000	8.399
Articles:	-	-	-	-	-
Description: This effort funds the development of additive manufacturing technologies, advanced coating techniques, design and topology optimization, materials selection, characterization and process development. ***FY 2020 Plans:*** FY20 funding continues additive manufacturing (AM) technology RDT&E for metal and polymer components including materials characterization and process development, development of AM design and manufacturing standards, application and technical data package development; determining AM equipment performance requirements in dynamic environments (i.e. shipboard), ship integration requirements for AM equipment, and Navy-specific AM industrial base requirements including digital file transfer and cyber. ***FY 2021 Base Plans:*** FY21 funding continues additive manufacturing (AM) technology RDT&E for metal and polymer components including materials characterization and process development, development of AM design and manufacturing standards, application and technical data package development; determining AM equipment performance requirements in dynamic environments (I.e. shipboard), ship integration requirements for AM equipment, and navy-specific AM industrial base requirements including digital file transfer and cyber. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Funding increase in FY21 for expanded metal additive manufacturing materials testing and process development for multiple AM processes, afloat metal AM RDT&E and digital additive manufacturing efforts.					
Title: Digital Framework/Electromagnetic Environment and Development (CPSD D)	0.405	1.006	0.457	0.000	0.457
Articles:	-	-	-	-	-
Description: Develop an understanding of the wireless electromagnetic environment (EME) on numerous ship classes and the vulnerability of these systems to hacking. ***FY 2020 Plans:*** Continue development of power management wireless capability and distribution technologies. Complete ship display system testing supporting HACK the Machine Event. ***FY 2021 Base Plans:*** Efforts will continue development of power management wireless capability and distribution technologies. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding decrease from $1.006 to $0.457 due to completion of HACK the MACHINE events and transition to test team for reporting, analysis, verification and validation.					
Title: Unmanned Systems (CPSD E)	0.588	0.978	0.447	0.000	0.447
Articles:	-	-	-	-	-
Description: This effort funds the development and advancement of Navy unmanned systems across various platforms. Note: Unmanned system efforts in years prior to FY19 were captured under CPSD Pillar 1.0. ***FY 2020 Plans:*** Continue efforts that support development and rapid and sage deployment of unmanned systems with respect to reliability, maintainability and availability efficiencies, and over-watch capabilities. Provide weapon system alternatives for both large and small scale unmanned platforms. Perform evaluation of multi-scaled vehicles for deployment from various host vessels. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Efforts to focus on further development of quick deployment and maintenance efficiencies. Further research into over-watch capabilities will be conducted. Continued funding is required to provide weapon system alternatives for both large and small scale unmanned platforms. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease from FY 2020 to FY 2021 is result of partnering to complete testing and verification of Reliability, Maintainability, and Availability (RMA) efficiency and RDT&E of the Overwatch tasks.					
Title: Cybersecurity (CPSD F)	16.739	19.453	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This effort funds the research, design, development, testing, and installation of Cybersecurity solutions for all installed integrated computer networks to include shipboard Hull Mechanical and Electrical (HM&E), Navigation Systems, Combat Systems, Fire Control, Sonar, Radar, Communications and all other shipboard computerized control systems for all afloat U.S. Navy platforms. CPSD F supports the development of specifications and standards for the Cybersecurity of all Navy Control Systems (NCS). ***FY 2020 Plans:*** Continue engineering and development efforts to mature numerous cross-platform hardware and software Cybersecurity solutions that will be rapidly deployed on afloat systems to increase ship platforms and ship forces' ability to protect, detect, react to, and recover from Cybersecurity incidents on NCS's in real time. The plan will fund the research and development of situational awareness tools, boundary defense capabilities (to include Government-Off-The-Shelf (GOTS) tool Situational Awareness Boundary Enforcement and Response (SABER)), Cybersecurity-optimized network design, network inspection and detection, and operational indifference to Cybersecurity threats. This effort will continue development of system specifications related to Cybersecurity and development of enterprise standards for Cybersecurity of NCS's. The implementation will be expanded to additional enclaves and classes of ships on a schedule based on ship availability. Lifecycle sustainment requirements of reliability, maintainability, and supportability are tailored and implemented to suit future needs and the constantly evolving Cybersecurity threat landscape across the Navy enterprise. This effort will continue to address Navy Cyber T&E policy and requirements through the development of USS Secure, a distributed					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
system of system cyber test and assessment capability. USS Secure provides full mission assurance cyber risk assessments through vulnerability and resolution testing of operational platforms and systems. ***FY 2021 Base Plans:*** Cybersecurity efforts will transfer to PU 3244 in FY 2021. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The $19.453 decrease in between FY 2020 to FY 2021 is due to transitioning of Cybersecurity efforts from PU 3161 to PU 3244.					
Accomplishments/Planned Programs Subtotals	27.267	34.247	12.205	0.000	12.205

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0204202N: *DDG-1000*	137.004	111.435	208.448	-	208.448	90.883	30.343	12.076	4.309	Continuing	Continuing
• RDTEN/0603512N: *Carrier Systems Development*	5.388	4.997	7.559	-	7.559	7.393	9.654	7.951	5.857	Continuing	Continuing
• RDTEN/0603564N: *Preliminary Design/Feasibility Studies.*	12.839	22.534	70.270	-	70.270	156.841	158.832	159.542	83.610	Continuing	Continuing
• RDTEN/0604567N: *Ship Contcept Design/Live Fire T&E*	69.337	46.809	51.853	-	51.853	57.336	57.082	56.612	46.176	Continuing	Continuing
• RDTEN/0603582N: *Combat System Integration*	15.710	17.251	17.843	-	17.843	17.991	18.353	18.724	18.646	Continuing	Continuing

Remarks

D. Acquisition Strategy

This is a non-acquisition program that develops, evaluates, and validates early stages of total ship concepts and technologies in support of SCN planning and potential future ship acquisition programs. This program also supports development, demonstration, evaluation, and validation of engineering tools, methods, and criteria for those concept designs and assessments. This program provides validated engineering tools, methods, and criteria for ship, and weapon system concept designs and assessments while fostering collaboration and coordination of efforts resulting in more effective use of funding.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	C/CPFF	Various Contractors : Various	18.436	0.000		0.000		0.350	Jan 2021	-		0.350	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC, NUWC, CDSA : Various	62.829	0.000		0.360	Feb 2020	0.900	Nov 2020	-		0.900	Continuing	Continuing	Continuing
Engineering Development	C/CPFF	DRS : Stevensville, MD	3.249	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NSWC, NUWC : Various	53.465	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	WR	NSWC : Various	20.044	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	WR	NIWC : Various	1.922	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Test and Evaluation	WR	NSWC : Various	11.910	0.000		0.000		0.238	Oct 2020	-		0.238	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC DD : Dahlgren, VA	0.600	0.000		0.000		0.140	Nov 2020	-		0.140	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC CD : Carderock, MD	3.280	1.050	Dec 2018	1.878	Nov 2019	0.550	Dec 2020	-		0.550	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC PD : Philadelphia, PA	2.620	0.000		0.700	Nov 2019	0.310	Oct 2020	-		0.310	Continuing	Continuing	Continuing
Systems Engineering	WR	NRL : Washington, D.C.	0.138	0.251	Mar 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	ALION : Wahington, D.C.	0.360	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	CSC : Washington, D.C.	0.900	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	MIPR	Army Research Lab : Aberdeen Proving Ground, MD	0.225	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NUWC Newport : Newport, RI	0.646	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NUWC Keyport : Keyport, WA	0.450	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Development	WR	NSWC Crane : Crane, IN	0.507	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NSWC DD : Dahlgren, VA	1.650	0.500	Dec 2018	0.787	Dec 2019	0.340	Nov 2020	-		0.340	Continuing	Continuing	Continuing
Engineering Development	WR	NSWC CD : Carderock, MD	3.364	1.003	Dec 2018	0.776	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NSWC PD : Philadelphia, PA	0.782	0.500	Nov 2018	0.570	Nov 2019	0.478	Jan 2021	-		0.478	Continuing	Continuing	Continuing
Engineering Development	C/CPFF	CSC : Washington, D.C.	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	C/CPFF	JHU APL : Baltimore, MD	0.600	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	WR	NUWC Keyport : Keyport, WA	0.150	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	WR	NSWC CD : Carderock, MD	0.750	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Demonstration & Evaluation	WR	NSWC PD : Philadelphia, PA	0.375	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	C/CPFF	JHU/APL : Baltimore, MD	6.723	1.500	May 2019	2.150	May 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	C/CPFF	MITRE : McLean, VA	1.108	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	MIPR	PNNL DOE : Richland, WA	0.900	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Development	WR	NSWC Carderock : Carderock, MD	0.000	1.055	Oct 2018	0.000		0.000		-		0.000	0.000	1.055	-
Engineering Development	WR	NUWC Keyport Washington : Keyport, WA	0.000	0.020	Oct 2018	0.000		0.000		-		0.000	0.000	0.020	-
Engineering Development	WR	PHD NSWC : Port Hueneme, CA	0.090	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Development	C/CPFF	Various Contractors : Various	0.000	5.099	Oct 2018	0.000		0.000		-		0.000	0.000	5.099	-
Cybersecurity Technologies	WR	NUWC Keyport : Keyport, WA	0.000	0.350	Dec 2018	0.200	Dec 2019	0.000		-		0.000	0.000	0.550	-
Cybersecurity Technologies	WR	NUWC Newport : Newport, RI	0.000	0.600	Dec 2018	1.706	Dec 2019	0.000		-		0.000	0.000	2.306	-
Cybersecurity Technologies	WR	NSWC Crane : Crane, IN	0.000	0.350	Dec 2018	0.350	Dec 2019	0.000		-		0.000	0.000	0.700	-
Cybersecurity Technologies	WR	NSWC DD : Dahlgren, VA	0.000	7.600	Dec 2018	8.814	Dec 2019	0.000		-		0.000	0.000	16.414	-
Cybersecurity Technologies	WR	NSWC PD : Philadelphia, PA	0.000	2.100	Dec 2018	2.500	Dec 2019	0.000		-		0.000	0.000	4.600	-
Systems Engineering	WR	NSWC IH : Indian Head, MD	0.000	0.000		0.635	Nov 2019	0.000		-		0.000	0.000	0.635	-
Systems Engineering	WR	NUWC Keyport : Keyport, WA	0.000	0.000		0.600	Nov 2019	0.000		-		0.000	0.000	0.600	-
Sys Engineering Additive Manufacturing	WR	NSWC CD : Carderock, MD	0.000	0.000		0.486	Nov 2019	1.850	Nov 2020	-		1.850	0.000	2.336	-
Eng Development Additive Manufacturing	WR	NSWC CD : Carderock, MD	0.000	0.000		2.600	Nov 2019	1.000	Nov 2020	-		1.000	0.000	3.600	-
Sys Engineering Additive Manufacturing	WR	NSWC PD : Philadelphia, PA	0.000	0.000		0.150	Nov 2019	0.700	Nov 2020	-		0.700	0.000	0.850	-
Eng Development Additive Manufacturing	WR	NSWC PD : Philadelphia, PA	0.000	0.000		0.450	Nov 2019	0.100	Nov 2020	-		0.100	0.000	0.550	-
Sys Engineering Additive Manufacturingd Item Text	WR	NUWC Newport : Newport, RI	0.000	0.000		0.300	Oct 2019	0.350	Oct 2020	-		0.350	0.000	0.650	-
Sys Engineering Additive Manufacturingext	WR	NUWC Keyport : Keyport, WA	0.000	0.000		0.150	Oct 2019	0.200	Oct 2020	-		0.200	0.000	0.350	-
Eng Development Additive Manufacturing	WR	NSWC DN : Dam Neck, VA	0.000	0.000		0.150	Nov 2019	0.150	Oct 2020	-		0.150	0.000	0.300	-
Sys Engineering Additive Manufacturing	C/CPFF	JHU APL : Baltimore, MD	0.000	0.000		0.450	Oct 2019	1.152	Oct 2020	-		1.152	0.000	1.602	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3161 / *NAVSEA Tech Authority*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Eng Development Additive Manufacturing	C/CPFF	JHU APL : Baltimore, MD	0.000	0.000		0.350	Oct 2019	0.450	Oct 2020	-		0.450	0.000	0.800	-
Sys Engineering Additive Manufacturing	C/CPFF	PSU ARL : State College, PA	0.000	0.000		0.200	Oct 2019	0.000	Oct 2020	-		0.000	0.000	0.200	-
Eng Development Additive Manufacturing	C/CPFF	PSU ARL : State College, PA	0.000	0.000		0.350	Oct 2019	0.300	Oct 2020	-		0.300	0.000	0.650	-
Sys Engineering Additive Manufacturing	WR	USNA : Annapolis, MD	0.000	0.000		0.100	Oct 2019	0.100	Nov 2020	-		0.100	0.000	0.200	-
Sys Engineering Additive Manufacturing	C/CPFF	Various Contracts : Various	0.000	0.000		0.450	Mar 2020	0.472	Mar 2021	-		0.472	0.000	0.922	-
Eng Development Additive Manufacturing	C/CPFF	Various Contracts : Various	0.000	0.000		1.100	Mar 2020	0.950	Mar 2021	-		0.950	0.000	2.050	-
		Subtotal	198.373	21.978		29.312		11.080		-		11.080	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NUWC Newport : Newport, RI	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC DD : Dahlgren, VA	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC CD : Carderock, MD	0.750	0.500	Dec 2018	0.552	Dec 2019	0.500	Dec 2020	-		0.500	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC PD : Philadelphia, PA	0.425	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	G2OPS : Virginia Beach, VA	0.750	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	JHU/APL : Baltimore, MD	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	WR	NSWC CD : Carderock, MD	0.000	1.489	Dec 2018	1.080	Dec 2019	0.000		-		0.000	0.000	2.569	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3161 / *NAVSEA Tech Authority*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	MIPR	NIWC : Various	0.000	0.250	Dec 2018	0.250	Dec 2019	0.000		-		0.000	0.000	0.500	-
Cybersecurity Technologies	C/CPFF	Various Contractors : Various	0.000	1.500	Jan 2019	1.903	Jan 2020	0.000		-		0.000	0.000	3.403	-
Sys Engineering Additive Manufacturing	WR	NSWC CD : Carderock, MD	0.000	0.000		0.000		0.275	Nov 2020	-		0.275	0.000	0.275	-
Sys Engineering Additive Manufacturing	WR	NSWC PD : Philadelphia, PA	0.000	0.000		0.000		0.275	Nov 2020	-		0.275	0.000	0.275	-
Sys Engineering Additive Manufacturing	C/CPFF	Various Contractors : Various	0.000	0.000		0.000		0.075	Mar 2021	-		0.075	0.000	0.075	-
		Subtotal	2.825	3.739		3.785		1.125		-		1.125	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test Planning & Execution	WR	NSWC DD : Dahlgren, VA	0.060	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	WR	NSWC CD : Carderock, MD	0.950	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	C/CPFF	JHU/APL : Baltimore, MD	0.650	0.500	May 2019	0.500	May 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	WR	NSWC PD : Philadelphia, PA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	1.660	0.500		0.500		0.000		-		0.000	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3161 / *NAVSEA Tech Authority*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PM/Travel	Allot	NAVSEA HQ : Washington, DC	0.799	0.050	Dec 2018	0.150	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
DAWDF	Various	Not Specified : Not Specified	0.145	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	WR	NUWC Newport : Newport, RI	0.096	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	WR	NSWC DD : Dahlgren, VA	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	WR	NSWC CD : Carderock, MD	0.750	0.250	Nov 2018	0.250	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	C/CPFF	CSC : Washington, D.C.	0.315	0.250	Nov 2018	0.250	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	C/FFP	ARDEC : Picatinny Arsenal, NJ	0.300	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Mgmt Spt	MIPR	PNNL DOE : Richland, WA	0.213	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Cybersecurity Technologies	C/CPFF	CSC : Washington, D.C.	0.000	0.250	Dec 2018	0.000		0.000		-		0.000	0.000	0.250	-
Cybersecurity Technologies	C/CPFF	Alion : Washington, D.C.	0.000	0.250	Dec 2018	0.000		0.000		-		0.000	0.000	0.250	-
Cybersecurity Technologies	MIPR	NAVSEA HQ : Washington, D.C.	0.000	0.000		0.000	Dec 2020	0.000		-		0.000	0.000	0.000	-
		Subtotal	2.918	1.050		0.650		0.000		-		0.000	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	205.776	27.267		34.247		12.205		-		12.205	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3161 / *NAVSEA Tech Authority*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3161 / *NAVSEA Tech Authority*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3161				
CPSD A - Ship Technology Improvements:	1	2019	4	2025
CPSD B - Fleet Maintenance and Life Cycle Cost Reduction:	1	2019	4	2025
CPSD C - Additive and Advanced Manufacturing Technology:	1	2019	4	2025
CPSD D - Digital Framework/Electromagnetic Environment and Development:	1	2019	4	2025
CPSD E - Unmanned Systems:	1	2019	4	2025
CPSD F - Cybersecurity:	1	2019	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3244: *Cybersecurity Engineering*	0.000	0.000	0.000	17.678	-	17.678	15.468	15.576	23.735	24.209	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is not a new start. This effort was previously funded under PU 3161, NAVSEA Tech Authority.

A. Mission Description and Budget Item Justification

This effort funds the research, design, development, testing, and installation of Cybersecurity solutions for all installed integrated computer networks to include shipboard Hull Mechanical and Electrical (HM&E), Navigation Systems, Combat Systems, Fire Control, Sonar, Radar, Communications and all other shipboard computerized control systems for all afloat U.S. Navy platforms. Cybersecurity Engineering supports the development of specifications and standards for the Cybersecurity of all Navy Control Systems (NCS).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Cybersecurity	0.000	0.000	17.678	0.000	17.678
Articles:	-	-	-	-	-

FY 2020 Plans:
FY 2020 plans remain in PU 3161 (CPSD F).

FY 2021 Base Plans:
Continue to mature all engineering and development efforts of numerous cross-platform hardware and software Cybersecurity solutions. Continue the rapid deployment on afloat systems to increase ship platforms and ship forces' ability to protect, detect, react to, and recover from Cybersecurity incidents on NCS's in real time. The plan will fund the research and development of situational awareness tools, boundary defense capabilities (to include Government-Off-The-Shelf (GOTS) tool Situational Awareness Boundary Enforcement and Response (SABER)), Cybersecurity-optimized network design, network inspection and detection, and operational robustness to Cybersecurity threats. The systems will be expanded to additional enclaves and classes of ships based on ship schedule availability. Lifecycle sustainment requirements of reliability, maintainability, and supportability are now being matured and executed to suit future needs and the constantly evolving Cybersecurity threat landscape across the Navy Enterprise. This effort will continue to address Navy Cyber T&E policy and requirements through the development of USS Secure, a distributed system of system cyber

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
test and assessment capability. USS Secure provides full mission assurance cyber risk assessments through vulnerability and resolution testing of operational platforms and systems. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This project was funded in FY 2020 under PU 3161, NAVSEA Tech Authority at $19.453M but transitioned into this PU, Cybersecurity Engineering, starting in FY 2021.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	17.678	0.000	17.678

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This is a non-acquisition program that designs, develops, and tests Cybersecurity solutions and technologies in support of control systems for all afloat U.S. Navy platforms. The capabilities are transitioned to acquisition programs for installation and sustainment. This program provides Navy Cyber T&E policy and requirements for acquisition programs.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	C/CPFF	JHU APL : Baltimore, MD	0.000	0.000		0.000		3.500	May 2021	-		3.500	Continuing	Continuing	Continuing
Cybersecurity Technologies	WR	NUWC Newport : Newport, RI	0.000	0.000		0.000		0.750	Dec 2020	-		0.750	0.000	0.750	-
Cybersecurity Technologies	WR	NSWC Crane : Crane, IN	0.000	0.000		0.000		0.200	Dec 2020	-		0.200	0.000	0.200	-
Cybersecurity Technologies	WR	NSWC DD : Dahlgren, VA	0.000	0.000		0.000		6.687	Dec 2020	-		6.687	0.000	6.687	-
Cybersecurity Technologies	WR	NSWC DD : Philadelphia, PA	0.000	0.000		0.000		2.000	Dec 2020	-		2.000	0.000	2.000	-
		Subtotal	0.000	0.000		0.000		13.137		-		13.137	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	WR	NSWC CD : Carderock, MD	0.000	0.000		0.000		0.250	Dec 2020	-		0.250	0.000	0.250	-
Cybersecurity Technologies	MIPR	NIWC : Various	0.000	0.000		0.000		0.250	Dec 2020	-		0.250	0.000	0.250	-
Cybersecurity Technologies	C/CPFF	Various Contractors : Various	0.000	0.000		0.000		2.771	Jan 2021	-		2.771	0.000	2.771	-
		Subtotal	0.000	0.000		0.000		3.271		-		3.271	0.000	3.271	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	C/CPFF	JHU APL : Baltimore, MD	0.000	0.000		0.000		0.500	May 2021	-		0.500	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	WR	NSWC PD : Philadelphia, PA	0.000	0.000		0.000		0.500	Dec 2020	-		0.500	0.000	0.500	-
		Subtotal	0.000	0.000		0.000		1.000		-		1.000	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Cybersecurity Technologies	MIPR	NAVSEA HQ : Washington, DC	0.000	0.000		0.000		0.270	Oct 2020	-		0.270	0.000	0.270	-
		Subtotal	0.000	0.000		0.000		0.270		-		0.270	0.000	0.270	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		17.678		-		17.678	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*

3244	FY2021				FY2022				FY2023				FY2024				FY2025			
Cybersecurity Technologies	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
USS Secure	QPR SERIAL IX	QPR	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX	QPR SERIAL IX
SABER		CVN (3)	LPD (1)	DDG (8)	CVN (3) LPD (1)	LSD (2)	CG (2)	DDG (15)	CVN (1) LHD (1)	LPD (1)	CG (2)	DDG (16)	CVN (2) LHD (2)	LPD (4)	CG (1)	DDG (16)	LHA (1) LHD (1)	LPD (1) LSD (1)	CG (3)	DDG (10)

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3244 / *Cybersecurity Engineering*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3244				
Cybersecurity Engineering: USS Secure	1	2021	4	2025
Cybersecurity Engineering: SABER	1	2021	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3376: *Strategic Sealift*	15.947	6.087	6.004	1.790	-	1.790	4.489	6.533	6.500	6.623	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 3376 - Strategic Sealift Research and Development - Develops new concepts and technologies which can be applied to or will enable future strategic sealift, and Seabasing systems. The technologies include ship configuration concepts, equipment to increase cargo handling and cargo loading/unloading rates (including commercial and merchant ship systems), improved man/machine interfaces, improved structural configurations and materials, and Logistics-Over-the-Shore (LOTS) equipment and system improvements.

Prior Years include: FY16 and prior years (FY2014 and earlier) efforts financed under the National Defense Sealift Fund (NDSF) BA 04 Project 3116 Strategic Sealift Research and Development; FY2015 and FY2017 efforts financed under this program element, RDT&E,N BA04, Project 3376 (Strategic Sealift); and FY2018 efforts financed under RDT&E,N BA 04 Project 9999/C403 (Congressional Adds).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Shipboard Crane Systems/Shipboard Cargo Systems	3.700	2.284	1.249	0.000	1.249
Articles:	-	-	-	-	-
FY 2020 Plans: Continue investigation and demonstration of shipboard crane/cargo system improvements including Vertical Launch System (VLS) Rearming and transfer capabilities. MPS Fleet Crane Enhancement demonstration to be completed. ***FY 2021 Base Plans:*** Continue investigation and demonstration of shipboard crane/cargo system improvements including VLS Rearming and transfer capabilities. VLS rearming scope to include fabrication and testing of intermodal container system for transportation of VLS missile canisters, and implementation of prototype ordnance stowage modifications on selected sealift vessels. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease in FY 2021 is due to the completion of the MPS Fleet Crane Enhancement demonstration.					
Title: Sealift Concept Development	0.702	0.800	0.402	0.000	0.402

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
FY 2020 Plans: Continue providing Sealift Research and Technology development and program guidance and conduct Sealift ship concept development and analysis. This includes interacting with resource sponsors and fleet operators to develop concepts for sealift improvements, conducting feasibility and engineering analysis of concepts, and developing concepts into specific lines of effort, and providing program and technical management of projects. ***FY 2021 Base Plans:*** Continue providing Sealift Research and Technology development and program guidance and conduct Sealift ship concept development and analysis. This includes interacting with resource sponsors and fleet operators to develop concepts for sealift improvements, conducting feasibility and engineering analysis of concepts, and developing concepts into specific lines of effort, and providing program and technical management of projects. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease in FY 2021 is due to the Departments decision to resource other higher priority efforts.					
Title: Lighter/HSV Seabase to Shore Cargo Transfer	0.385	1.520	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Continue development and demonstration of at-sea vehicle transfer capability. FY 2020 plans continue to support the EPF V-22 Interface Project. Increase in FY20 resulted from ramp-up of EPF V-22 Flight Deck Thermal Management project design development and testing to be completed in FY20 and transitioned to PMS 385 for implementation on EPF-13. One-year OSV Employment Analysis and MPS T-AKE C2 Enhancement to be completed in FY20. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The Department divested itself of this effort in FY 2021 as FY 2020 efforts have been completed.					
Title: Advanced Tools	1.300	1.400	0.139	0.000	0.139
Articles:	-	-	-	-	-
FY 2020 Plans: Continue investigation and demonstration of individual and multi-ship motion measurement and prediction included installation on an EPF and supported testing on the EPF and ESD installs from FY19. ***FY 2021 Base Plans:*** Will conduct minor development plan review in preparation for ramp-up of ESB modular medical facility design capability to begin in FY22. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease in FY 2021 is due to the Departments decision to resource other higher priority efforts.					
Accomplishments/Planned Programs Subtotals	6.087	6.004	1.790	0.000	1.790

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable for SEALIFT R&D efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Shipboard Crane Systems/ Shipboard Cargo Systems	WR	Various Contractors : Various	4.761	3.700	Jan 2019	2.284	Jan 2020	1.249	Jan 2021	-		1.249	Continuing	Continuing	Continuing
Sealift Concept Development	WR	Various Contractors : Various	4.825	0.702	Jan 2019	0.800	Jan 2020	0.402	Jan 2021	-		0.402	Continuing	Continuing	Continuing
Lighter/HSV Seabase to Shore Cargo Transfer	WR	Various Contractors : Various	5.471	0.385	Jan 2019	1.520	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Tools	WR	Various : Various	0.890	1.300	Jan 2019	1.400	Jan 2020	0.139	Jan 2021	-		0.139	Continuing	Continuing	Continuing
		Subtotal	15.947	6.087		6.004		1.790		-		1.790	Continuing	Continuing	N/A

Remarks

1. Prior Years column only includes FY2015 (project 3376), FY2017 (project 3376), and FY2018 Congressional Add (project C403) funding as FY2016 and prior years (FY14 and earlier) were funded under NDSF BA 04 Project 3116 Strategic Sealift Research and Development.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	15.947	6.087		6.004		1.790		-		1.790	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*

Note: FY2016 and prior year (FY14 and earlier) efforts were financed under the National Sealift Defense Fund (NDSF) BA 04, Project 3116 (Strategic Sealift Research and Development. FY 2017, FY2018, FY2019 and out-year funds are financed under this program element.

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 3376 / *Strategic Sealift*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3376				
Shipboard Crane Systems/Shipboard Cargo Systems	1	2019	4	2025
VLS Rearming	1	2019	4	2025
AFP Implementation	1	2019	1	2020
AFP Enhancement & Demonstration	1	2020	4	2025
MPS Fleet Crane Enhancement & Demonstration	1	2019	3	2020
ESB Enhanced Boat Launch & Recovery	1	2023	4	2024
Sealift Concept Development	1	2019	4	2025
Lighter/HSV Seabase to Shore Cargo Transfer	1	2019	4	2024
EPF V-22 Interface	1	2019	4	2020
OSV Employment Analysis	1	2020	4	2020
MPS T-AKE C2 Enhancement	1	2020	4	2020
EPF Enhanced Boat Launch & Recovery	1	2023	4	2024
ESD Direct Craft Interface	1	2023	4	2024
ESD Direct Craft Interface Detailed Design	1	2023	4	2023
ESD Direct Craft Interface Installation & Demonstration	4	2023	4	2024
Advanced Tools	1	2019	4	2025
Environmental & Ship Motion Forecasting (ESMF)	3	2019	4	2021
System Testing, Enhancement, Expanded Applications	3	2019	4	2021
Tool Development	1	2022	4	2025
ESB Medical	4	2021	1	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4037 / *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4037: *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*	0.000	17.295	8.000	13.203	-	13.203	11.463	8.306	3.993	0.000	0.000	62.260
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Common Hull Auxiliary Multi-Mission Platform (CHAMP) concept leverages a new approach to requirements generation and shipbuilding to replace aging mission specific designs with a common hull to reduce life cycle costs, leverage tailored payloads, and stabilize the industrial base. Identified CHAMP missions include: Sealift, Aviation Intermediate Maintenance support, Medical Services, Command & Control, and Submarine Tending. Funding will inform requirements definition, early industry engagement and follow-on assessment across CHAMP mission functionality.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: CHAMP Design and Total Ship Integration	17.295	8.000	13.203	0.000	13.203
Articles:	-	-	-	-	-
FY 2020 Plans: Additional options for Design Maturation are planned to be exercised to all four shipyards in Q1FY20. Continue development and obtain approval of the Sealift Capability Development Document (CDD) and provide engineering oversight for Industry Studies and Design Maturation. ***FY 2021 Base Plans:*** Begin the development of the Sealift DD&C RFP solicitation package. Continue Sealift Design Maturation efforts from FY20. Exercise options to all four shipyards for Sealift Preliminary Design. Develop the Submarine Tender CDD. Fund Government Planning Yard activity to design and develop ship specification for the Submarine Tender Nuclear Support Facility. Continue development of the Sealift DD&C RFP solicitation package. Provide engineering oversight for Sealift Design Maturation. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Additional $5.203M increase from FY2020 to FY2021 required to exercise options to four shipyards for Sealift Preliminary Design, fund a Government Planning Yard activity to design and develop ship specification for the Submarine Tender Nuclear Support Facility as well as to develop the Sealift DD&C solicitation package.					
Accomplishments/Planned Programs Subtotals	17.295	8.000	13.203	0.000	13.203

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4037 / *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/5094: *CHAMP Procurement*	0.000	0.000	0.000	-	0.000	0.000	500.000	0.000	0.000	0.000	500.000
• SCN/5010: *AS Submarine Tender*	0.000	0.000	0.000	-	0.000	0.000	0.000	500.000	0.000	0.000	500.000

Remarks

D. Acquisition Strategy

Contracts were awarded to four Shipyards for CHAMP Trade-Off Studies on 29 May 2019. Additional options for CHAMP Design Maturation and Special Studies are planned for FY20. These options will be exercised based on the results of the Trade-Off Studies. These efforts will inform Government requirements definition for future Ship acquisition.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4037 / *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Industry Studies & Design	C/FFP	Various : Various	0.000	11.600	May 2019	7.400	Jan 2020	9.413	Dec 2020	-		9.413	0.000	28.413	-
PM & Engineering Support	Various	Various : Various	0.000	4.695	Oct 2018	0.600	Oct 2019	3.790	Oct 2020	-		3.790	0.000	9.085	-
		Subtotal	0.000	16.295		8.000		13.203		-		13.203	0.000	37.498	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Documentation Development	Various	Various : Various	0.000	1.000	Oct 2018	0.000		0.000		-		0.000	0.000	1.000	-
		Subtotal	0.000	1.000		0.000		0.000		-		0.000	0.000	1.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	17.295		8.000		13.203		-		13.203	0.000	38.498	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4037 / *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4037 / *Common Hull Auxiliary Multi-Mission Platform (CHAMP)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4037				
Program Documentation & Sealift CDD Development	1	2019	1	2019
Design Trade Studies	1	2019	2	2019
Design Trade Studies RFP Release	2	2019	2	2019
Sealift Industry Design Maturation/Special Studies	3	2019	1	2023
Submarine Tender Industry Design Maturation/Special Studies	1	2022	3	2023
Sealift CDD Approval	3	2020	3	2020
Submarine Tender Program Documentation, CDD Development, and Planning Yard Facillity	1	2021	1	2023
Sealift DD&C solicitation package and COR development	1	2021	1	2022
Sealift Milestone B/C	4	2022	4	2022
Sealift RFP Development	3	2021	1	2022
Sealift RFP Release	1	2022	1	2022
Submarine Tender CDD Approval	2	2023	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4044 / *Next Generation Medium Amphibious Ship*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4044: *Next Generation Medium Amphibious Ship*	0.000	0.000	0.000	30.000	-	30.000	0.000	0.000	0.000	0.000	0.000	30.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is a new start.

A. Mission Description and Budget Item Justification

In accordance with the Commandant's Planning Guidance and Chief of Naval Operations, Warfighting Requirements and Capabilities direction in support of the Integrated Naval Force Structure Assessment (INFSA), the Navy will
evaluate next generation medium amphibious platform solutions in support of Distributed Maritime Operations (DMO), Littoral Operations in Contested Environment (LOCE), and Expeditionary Advanced Base Operations (EABO)
concepts.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Next Generation Medium Amphibious Ship	0.000	0.000	30.000	0.000	30.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: FY 2021 funds support concept evaluation/design, industry studies and exploration for a medium lift intra-theater amphibious support vessel. Efforts include requirements development, systems engineering, naval architecture and marine engineering, and operations research analysis. Following completion of the Integrated Naval Force Structure Assessment (INFSA) and as informed by the above efforts, follow-on funding requirements will be established during the Department of Navy's programming process.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4044 / *Next Generation Medium Amphibious Ship*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 funds support concept evaluation, ship configuration development, and industry studies focused primarily on the requirements development, systems engineering, naval architecture and marine engineering, and operations research analysis of Next Generation Medium Amphibious Ships.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	30.000	0.000	30.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This is a non-acquisition program that designs, develops, and tests Distributed Maritime Operations (DMO), Littoral Operations in Contested Environment (LOCE), and Expeditionary Advanced Base Operations (EABO) concepts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4044 / *Next Generation Medium Amphibious Ship*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Industry Studies & Design	TBD	Various : Various	0.000	0.000		0.000		21.500	Jan 2021	-		21.500	0.000	21.500	-
		Subtotal	0.000	0.000		0.000		21.500		-		21.500	0.000	21.500	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PM & Engineering Support	TBD	Various : Various	0.000	0.000		0.000		5.000	Nov 2020	-		5.000	0.000	5.000	-
Special Studies	TBD	Various : Various	0.000	0.000		0.000		2.500	Dec 2020	-		2.500	0.000	2.500	-
		Subtotal	0.000	0.000		0.000		7.500		-		7.500	0.000	7.500	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USG Indicative Design	TBD	Various : Various	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	0.000	1.000	-
		Subtotal	0.000	0.000		0.000		1.000		-		1.000	0.000	1.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		30.000		-		30.000	0.000	30.000	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4044 / *Next Generation Medium Amphibious Ship*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4044 / *Next Generation Medium Amphibious Ship*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4044				
PM & Engineering Support	1	2021	4	2021
USG Indicative Design	1	2021	2	2021
Industry Studies & Design	2	2021	2	2021
Special Studies	2	2021	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4045 / *Next Generation Medium Logistics Ship*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4045: *Next Generation Medium Logistics Ship*	0.000	0.000	0.000	30.000	-	30.000	0.000	0.000	0.000	0.000	0.000	30.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is a new start.

A. Mission Description and Budget Item Justification

The Navy established the Intra-Theater Small Auxiliary Logistics Platform Task Force in support of the Integrated Naval Force Structure Assessment (INFSA), to evaluate next generation medium platform solutions for logistics mission requirements in support of Distributed Maritime Operations (DMO) and Littoral Operations in Contested Environment (LOCE). This includes a family of vessels with commercial designs tailored for military applications.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Next Generation Medium Logistics Ship	0.000	0.000	30.000	0.000	30.000
Articles:	-	-	-	-	-

FY 2020 Plans:
N/A

FY 2021 Base Plans:
FY 2021 funds support concept evaluation, ship configuration development, and industry studies focused primarily on the Refuel, Resupply, and Rearm logistics missions. Efforts include requirements development, systems engineering, naval architecture and marine engineering, and operations research analysis.

Following completion of the Integrated Naval Force Structure Assessment (INFSA) and as informed by the above efforts, follow-on funding requirements will be established during the Department of Navy's programming process.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4045 / *Next Generation Medium Logistics Ship*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 funds support concept evaluation, ship configuration development, and industry studies focused primarily on the requirements development, systems engineering, naval architecture and marine engineering, and operations research analysis of Next Generation Medium Logistics Ships.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	30.000	0.000	30.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This is a non-acquisition program that designs, develops, and tests the Integrated Naval Force Structure Assessment (INFSA), to evaluate next generation medium platform solutions for logistics mission requirements in support of Distributed Maritime Operations (DMO) and Littoral Operations in Contested Environment (LOCE). This includes a family of vessels with commercial designs tailored for military applications.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4045 / *Next Generation Medium Logistics Ship*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Industry Studies & Design	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		21.500	Jan 2021	-		21.500	0.000	21.500	-
		Subtotal	0.000	0.000		0.000		21.500		-		21.500	0.000	21.500	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PM & Engineering Support	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		5.000	Nov 2020	-		5.000	0.000	5.000	-
Special Studies	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		2.500	Dec 2020	-		2.500	0.000	2.500	-
		Subtotal	0.000	0.000		0.000		7.500		-		7.500	0.000	7.500	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
USG Indicative Design	C/BA	Not Specified : Not Specified	0.000	0.000		0.000		1.000	Dec 2020	-		1.000	0.000	1.000	-
		Subtotal	0.000	0.000		0.000		1.000		-		1.000	0.000	1.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		30.000		-		30.000	0.000	30.000	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4045 / *Next Generation Medium Logistics Ship*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 4045 / *Next Generation Medium Logistics Ship*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4045				
PM & Engineering Support	1	2021	4	2021
USG Indicative Design	1	2021	2	2021
Industry Studies & Design	2	2021	4	2021
Special Studies	2	2021	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project C439 - Advanced Manufacturing of Critical Scale Materials-$5M
Funding provided in the Department of Defense Appropriations Act, 2020 to ensure the next generation of submarines incorporates the most cutting edge technologies, the Navy must advance the qualification and certification of Advanced Manufacturing (AM) processes, materials, and components to allow the Navy to integrate AM capabilities into current and future systems and platforms. The committee directs the Secretary of the Navy to report to the committee by December 1, 2019 on what efforts are underway to integrate AM. Further, as part of this report, the committee directs the Navy to include specific information about the testing and qualification of processes, materials, and components required to meet Columbia Class requirements and milestones.

Project C580 - High-Pressure Cold Spray Systems-$10M
Funding provided in the Department of Defense Appropriations Act, 2020 to conduct research, development, and prototyping for high-pressure cold spray systems. Sustainment drives significant lifecycle costs to ships and submarines. The utilization of high-pressure cold spray systems for ship and submarine sustainment, including maintenance and repairs can result in significant efficiencies and cost savings for the Navy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Additive Manufacturing ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Advanced Manufacturing of Critical Scale Materials-$5M To ensure the next generation of submarines incorporates the most cutting edge technologies, the Navy must advance the qualification and certification of Advanced Manufacturing (AM) processes, materials, and components to allow the Navy to integrate AM capabilities into current and future systems and platforms. The committee directs the Secretary of the Navy to report to the committee by December 1, 2019 on what efforts are underway to integrate AM. Further, as part of this report, the committee directs the Navy to include specific information about the testing and qualification of processes, materials, and components required to meet Columbia Class requirements and milestones.	0.000	5.000
Congressional Add: High pressure cold spray system	0.000	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
FY 2019 Accomplishments: N/A ***FY 2020 Plans:*** The Congressional Add for High-Pressure Cold Spray Systems was inadvertently aligned to NAVAIR MH-60 NRE, PE 0702206N as appropriated and lists BSO 24 and N96 as the RS. The Add was moved to NAVSEA BA04 LI 0603563N for execution to match Congressional intent of ships and submarines sustainment. The High-Pressure Cold Spray Systems Congressional Add will conduct research, development, and prototyping for high-pressure cold spray systems. Sustainment drives significant lifecycle costs to ships and submarines. The utilization of high-pressure cold spray systems for ship and submarine sustainment, including maintenance and repairs can result in significant efficiencies and cost savings for the Navy.		
Congressional Adds Subtotals	0.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced Manufacturing of Critical Scale Materials	TBD	Various : Various	0.000	0.000		1.000	May 2020	0.000		-		0.000	0.000	1.000	-
Battery Prototype	TBD	Various : Various	0.000	0.000		1.500	Apr 2020	0.000		-		0.000	0.000	1.500	-
		Subtotal	0.000	0.000		2.500		0.000		-		0.000	0.000	2.500	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	TBD	Various : Various	0.000	0.000		0.500	Jan 2020	0.000		-		0.000	0.000	0.500	-
		Subtotal	0.000	0.000		0.500		0.000		-		0.000	0.000	0.500	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Battery T&E	TBD	Various : Various	0.000	0.000		10.000	Apr 2020	0.000		-		0.000	0.000	10.000	-
Advanced Manufacturing of Critical Scale Materials	TBD	Various : Various	0.000	0.000		2.000	May 2020	0.000		-		0.000	0.000	2.000	-
		Subtotal	0.000	0.000		12.000		0.000		-		0.000	0.000	12.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		15.000		0.000		-		0.000	0.000	15.000	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9999																												
Advanced Manufacturing of Critical Scale Materials																												
High-Pressure Cold Spray Systems																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603563N / *Ship Concept Advanced Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Advanced Manufacturing of Critical Scale Materials	2	2020	4	2020
High-Pressure Cold Spray Systems	2	2020	4	2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	28.413	12.839	22.534	70.270	-	70.270	156.841	158.832	159.542	83.610	Continuing	Continuing
0409: *DDG-51 Flt III Concept Development*	0.000	0.000	0.000	5.545	-	5.545	4.805	4.903	6.101	3.000	Continuing	Continuing
0411: *Future Surface Combatant Concept Development*	0.000	0.000	0.000	46.453	-	46.453	129.472	145.886	143.629	70.601	Continuing	Continuing
3377: *T-ATS Ship Concept Development*	4.584	0.391	0.893	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	5.868
3389: *OPLOG IPT Development*	23.829	12.448	21.641	18.272	-	18.272	22.564	8.043	9.812	10.009	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 180

Note

The FY 2021 funding request was reduced by $1.500 million to account for the availability of prior year execution balances.

Project 3389 prior years includes $11.319M FY2018 funding financed under this PE project 9999/C404 (Congressional add).

Projects 0409 and 0411 are new starts to support the DDG-51 Flight III Test and Evaluation requirements and for development of the Navy's Future Large Surface Combatant.

A. Mission Description and Budget Item Justification

0409 - This project is a new start that provides Test and Evaluation (T&E) requirements for DDG-51 Flight III to meet Initial Operational Capability (IOC) in FY24. T&E will concentrate on verifying integration and interoperability of employed technologies and systems in the DDG-51 FLT III design to achieve the mission capabilities and performance requirements as defined in the DDG-51 Flight III Capability Development Document (CDD). T&E functions will include the evaluation of Critical Technical Parameters (CTP), Measures of Effectiveness (MOE), Measures of Suitability (MOS), and Key Performance Parameters (KPP). Funding planned is for the execution of Developmental Testing (DT), Operational Testing (OT), and Live Fire Test and Evaluation (LFT&E).

0411 - The Navy's Large Surface Combatant (LSC) Program is a new start for a new ship evolutionary acquisition program essential to the Future Surface Combatant Force. The purpose of the program is to initially integrate non-developmental systems into a new hull design that incorporates platform flexibility and growth capabilities to meet projected future Fleet system requirements. Initial LSCs will leverage DDG 51 Flight III combat systems as well as increased flexibility/adaptability features including expanded Space, Weight, Power & Cooling Service Life Allowances (SWaP-C SLA) to allow for more rapid and affordable upgrades in capabilities over the ships' service life and allow for fielding of future high demand electric weapons and sensor systems and computing resources. The ability of the ship's Vertical Launch System to accommodate longer and larger diameter missiles for increased speed and range of weapons, additional capacity for an embarked warfare commander

and staff, support for 360-degree coverage with Directed Energy weapons, and improved signatures with support for additional improvements over time. The new ships will be designed to provide these initial capability increases as well as the growth capacity to support projected future systems requirements. The design will also incorporate flexibility features to quickly back-fit and forward-fit systems to pace known threats and meet future emergent needs through evolutionary block upgrades and modernization.

3389 - Naval Operational Logistics (OPLOG) Integration IPT Development - Develops enabling technologies for future and in-service afloat operational logistics and integrated supply force and combatant logistics requirements; and conducts cooperative initiatives with acquisition programs, program sponsors, engineering managers, the Navy science and technology community and Fleet customers. OPLOG develops integrated, cross-platform (i.e. applicable to more than one ship class/type) operational logistics and energy conservation technologies and capabilities as well as draft acquisition and operations policy ensuring future Naval systems leverage emerging logistic capabilities and technologies to provide operationally effective and energy efficient logistics delivery.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	13.348	69.084	75.480	-	75.480
Current President's Budget	12.839	22.534	70.270	-	70.270
Total Adjustments	-0.509	-46.550	-5.210	-	-5.210
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-46.550			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.509	0.000			
• Program Adjustments	0.000	0.000	-5.210	-	-5.210
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Change Summary Explanation

FY21 Change Explanation -$5.210M

Proj 0409 - Increase $+5.545M for DDG-51 Flight III Test and Evaluation including (DT/OT) to support Initial Operating Capability (IOC) in FY24.

Proj 3389 - Decrease of -4.048M due to $-2.562M for cancellation of OPLOG R&D efforts without a transition plan and by $-1.500M to account for the availability of prior year execution balances.

Proj 0411 - Decrease of $-6.707M due to revised acquisition strategy

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0409 / *DDG-51 Flt III Concept Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0409: *DDG-51 Flt III Concept Development*	0.000	0.000	0.000	5.545	-	5.545	4.805	4.903	6.101	3.000	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 180

Note

This project is a new start.

A. Mission Description and Budget Item Justification

This project provides Test and Evaluation (T&E) requirements for DDG-51 Flight III to meet Initial Operational Capability (IOC) in FY24. T&E will concentrate on verifying integration and interoperability of employed technologies and systems in the DDG-51 FLT III design to achieve the mission capabilities and performance requirements as defined in the DDG-51 Flight III Capability Development Document (CDD). T&E functions will include the evaluation of Critical Technical Parameters (CTP), Measures of Effectiveness (MOE), Measures of Suitability (MOS), and Key Performance Parameters (KPP). Funding planned is for the execution of DT, OT, and LFT&E.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: DDG-51 Flight III Test and Evaluation	0.000	0.000	5.545	0.000	5.545
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: Conduct DDG-51 test planning in support of Development Testing, Operational Testing (DT/OT), including Live Fire Test and Evaluation (LFT&E). Begin Modeling and Simulation (M&S) updates and Verification Validation, and Accreditation (VV&A) planning activities to include Total Mine Simulation System (TMSS), Cruise Missile analysis, Advance Survivability Assessment Program (ASAP), Integrated Recovery Model (IRM), and Navy Enhanced Sierra Mechanics (NESM). DDG-51 FLT III Cyber Security DT Cooperative Vulnerability Identification (CVI) evaluation will also be included in planning events.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0409 / *DDG-51 Flt III Concept Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Establishes funding in FY21 for DDG-51 Flight III T&E efforts.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	5.545	0.000	5.545

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/2122: *DDG-51 Class*	5,878.031	5,809.323	1,388.201	-	1,388.201	3,592.416	2,375.950	4,021.363	1,935.953	3,987.100	112,788.539

Remarks

D. Acquisition Strategy

The DDG-51 class ships use a competitive acquisition strategy using Multi-Year Procurement (MYP) contracts awarded to two shipbuilders in FY 2018.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0409 / *DDG-51 Flt III Concept Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Modeling and Simulation	WR	NRL : Washington, DC	0.000	0.000		0.000		0.459	Oct 2020	-		0.459	Continuing	Continuing	Continuing
Modeling and Simulation	WR	NSWC CD : Bethesda, MD	0.000	0.000		0.000		0.819	Oct 2020	-		0.819	Continuing	Continuing	Continuing
Modeling and Simulation	WR	NSWC : Panama City, FL	0.000	0.000		0.000		0.287	Oct 2020	-		0.287	Continuing	Continuing	Continuing
Modeling and Simulation	Various	T&E Solutions : Various	0.000	0.000		0.000		0.900	Dec 2020	-		0.900	Continuing	Continuing	Continuing
Test and Evaluation	WR	NSWC : Philadephia, PA	0.000	0.000		0.000		0.050	Oct 2020	-		0.050	Continuing	Continuing	Continuing
Test and Evaluation	Various	T&E Solutions : Various	0.000	0.000		0.000		0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
Test and Evaluation	Various	Various : Various	0.000	0.000		0.000		0.965	Nov 2020	-		0.965	Continuing	Continuing	Continuing
LFT&E	Various	T&E Solutions : Various	0.000	0.000		0.000		0.320	Dec 2020	-		0.320	Continuing	Continuing	Continuing
Cyber DT	Various	Various : Various	0.000	0.000		0.000		1.645	Nov 2020	-		1.645	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		5.545		-		5.545	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		5.545		-		5.545	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0409 / *DDG-51 Flt III Concept Development*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0409 / *DDG-51 Flt III Concept Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0409				
Total Mine Simulation System (TMSS) Analysis	1	2021	4	2022
Model Development and CRUISE Missile Analysis	1	2021	4	2024
Advance Survivability Assessment Program (ASAP) Model Update, Runs, and Analysis	1	2021	4	2025
Integrated Recovery Model (IRM) Update and Analysis	1	2021	4	2025
Modeling & Simulation (M&S) Verification Validation, and Accreditation (VV&A)	1	2021	4	2024
Cooperative Vulnerability Identification (CVI)	2	2021	2	2021
Cyber Table Top (CTT) -1	2	2022	2	2022
Total Ship Survivability Test (TSST) Planning	3	2022	4	2024
Damage Scenario Based Engineering Analyses (DSBEA) Runs for Primary/Secondary Damage	1	2023	4	2025
Cyber Table Top (CTT) - 2	1	2023	1	2023
Total Ship Survivability Test (TSST) Execution	1	2025	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0411: *Future Surface Combatant Concept Development*	0.000	0.000	0.000	46.453	-	46.453	129.472	145.886	143.629	70.601	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is a new start.

A. Mission Description and Budget Item Justification

The Navy's Large Surface Combatant (LSC) Program is a new ship evolutionary acquisition program essential to the Future Surface Combatant Force. The purpose of the program is to initially integrate non-developmental systems into a new hull design that incorporates platform flexibility and growth capabilities to meet projected future Fleet system requirements. Initial LSCs will leverage DDG 51 Flight III combat systems as well as increased flexibility/adaptability features including expanded Space, Weight, Power & Cooling, Service Life Allowances (SWaP-C SLA) to allow for more rapid and affordable upgrades in capabilities over the ships' service life and allow for fielding of future high demand electric weapons and sensor systems and computing resources. Additional capabilities of interest that will be evaluated for the initial ship include the ability of the ship's Vertical Launch System to accommodate longer and larger diameter missiles for increased speed and range of weapons, additional capacity for an embarked warfare commander and staff, support for 360-degree coverage with directed Energy weapons, and improved signatures with support for additional improvements over time. The new ships will be designed to provide these initial capability increases as well as the growth capacity to support projected future systems requirements. The design will also incorporate flexibility features to quickly back-fit and forward-fit systems to pace known threats and meet future emergent needs through evolutionary block upgrades and modernization.

Set Based Design will be utilized to narrow subsystem trade space, and develop a draft ship Concept of Operations (CONOPS).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Large Surface Combatant Design Studies and Analysis	0.000	0.000	46.453	0.000	46.453
Articles:	-	-	-	-	-
Description: Prior year LSC efforts were conducted as part of the Future Surface Combatant Force initiative under PE 0603563N/2196 Ship Concept Advanced Design for requirements and concept feasibility studies and under PE 0603573N/2471 Integrated Power Systems for land based test related planning. In FY19 the LSC program released requests for Information (RFI) to the shipbuilding industry and the supplier industry to collect product and process information to support requirements development and concept refinement, as well as solicit input on acquisition and competition strategies that will optimally involve industry in the future design					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
effort. During FY20 the program focused on requirements development and refinement, supported by cost vs. capability analyses, concept feasibility studies and early industry engagement including follow-up on the FY19 RFIs. Acquisition strategy alternatives and impacts were also assessed. Planning and preparations for shoreside testing facilities, primarily the near-term Integrated Power and Energy System Test Facility (ITF) and also the future Land-Based Engineering Site (LBES), were started.					
FY 2020 Plans: N/A					
FY 2021 Base Plans: In FY 2021, the LSC program office will continue the efforts started in FY20, conducting additional cost vs. capability analyses, and concept feasibility studies to support development of a draft Capabilities Development Document (CDD) and draft specifications. A Set Based Design approach will continue to be utilized to narrow subsystem trade space, and develop a draft ship Concept of Operations (CONOPS). Industry engagement will be increased focused on producibility and affordability analyses. Products developed or updated this year will include Integrated Master Schedule, Engineering Management Plan, Initial Ship Baseline (including General Arrangements, Topside arrangements, power and propulsion architecture and Master Equipment List, and Subsystems identification), Requirements Allocation, Preliminary Manning Assessment, Signatures budget, and Systems Engineering Plan. Upon approval of the draft CDD for LSC in Q1FY21, and execution of a successful System Requirements Review in 2QFY21 the Preliminary Design Phase will begin. During FY21 Initial Operational Capability (IOC) of the Integrated Power and Energy System Test Facility (ITF), comprising a digital twin of the ITF, engineering development models and prototypical equipment, will occur to address risks with critical systems. In addition, ITF will support validation of digital engineering models, including, but not limited to, virtual prototyping of a Flexible Bus Node, a component that facilitates protection of the power system busses and provision of power to shipboard equipment. Necessary modifications of the ITF will continue in a phased approach to support testing for LSC.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase from FY20 to FY21 is to transition from concept refinement and requirements development to a Preliminary Design Effort for the LSC. The increase also supports vendor and shipyard involvement in the design team as well as validation of CDD requirements.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	46.453	0.000	46.453

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603563N/2196: *Ship Concept Advanced Design*	23.101	33.595	21.520	-	21.520	11.505	10.643	9.659	9.791	Continuing	Continuing

Remarks

D. Acquisition Strategy

The Navy envisions an evolutionary acquisition strategy for LSC utilizing a flexible, adaptable HM&E design coupled with open architecture mission systems that will allow for affordable block buys utilizing the most up to date mission systems available at the time of acquisition. The initial LSCs will utilize the DDG 51 Flight III Combat System with additional capabilities as described above. The schedule for LSC commences Preliminary Design in FY 2021. Contract Design, with primary objectives of development of an Allocated Baseline and development of a ship specification and selected procurement specifications will follow Preliminary Design with objective of issuance of an RFP for Detail Design and Construction.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Ship Design Engineering Contract	C/CPAF	Various : Various	0.000	0.000		0.000		16.150	Dec 2020	-		16.150	Continuing	Continuing	Continuing
Systems Engineering & Design Integration	WR	Not Specified : Not Specified	0.000	0.000		0.000		3.153	Oct 2020	-		3.153	0.000	3.153	-
Naval Architecture System Development	WR	NSWC Carderock : Carderock, MD	0.000	0.000		0.000		6.200	Oct 2020	-		6.200	0.000	6.200	-
Marine Engineering System Development	WR	NSWC Philadelphia : Philadelphia, PA	0.000	0.000		0.000		2.200	Oct 2020	-		2.200	0.000	2.200	-
Warfare Systems Development	WR	NSWC DD : Dahlgren, VA	0.000	0.000		0.000		1.850	Oct 2020	-		1.850	0.000	1.850	-
Shipboard Systems Development	WR	Other Government Organizations : Various	0.000	0.000		0.000		9.750	Oct 2020	-		9.750	0.000	9.750	-
Land Based Integration and Test	WR	Other Government Organizations : Various	0.000	0.000		0.000		5.150	Oct 2020	-		5.150	0.000	5.150	-
		Subtotal	0.000	0.000		0.000		44.453		-		44.453	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	Various : Various	0.000	0.000		0.000		1.100	Oct 2020	-		1.100	0.000	1.100	-
Design Management and Integration	Various	Various : Various	0.000	0.000		0.000		0.900	Oct 2020	-		0.900	0.000	0.900	-
		Subtotal	0.000	0.000		0.000		2.000		-		2.000	0.000	2.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		46.453		-		46.453	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603564N / *Ship Prel Design & Feasibility Studies*	Project (Number/Name) 0411 / *Future Surface Combatant Concept Development*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 0411 / *Future Surface Combatant Concept Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0411				
Pre Preliminary Design	1	2021	2	2021
System Requirements Review	2	2021	2	2021
Preliminary Design	2	2021	4	2023
System Functional Review	4	2023	4	2023
Contract Design	4	2023	3	2025
Preliminary Design Review	3	2025	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3377 / *T-ATS Ship Concept Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3377: *T-ATS Ship Concept Development*	4.584	0.391	0.893	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	5.868
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Towing, Salvage and Rescue Ships (T-ATS 6 Class) will recapitalize the current Fleet tugs and salvage ships with a common hull that is capable of performing the missions of the retiring T-ATF and T-ARS classes. This project provides Test and Evaluation Phase Developmental Testing (DT) and Operational Testing (OT) requirements per the Test and Evaluation Master Plan (TEMP) schedule.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: T-ATS 6 Class Test & Evaluation (T&E)	0.391	0.893	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Complete the execution of Test and Evaluation (T&E) Phase Developmental Testing (DT) and Operational Testing (OT) per the Test and Evaluation Master Plan (TEMP) schedule. Coordinate efforts with NAVSEA, Military Sealift Command (MSC), PEO Ships, Operational Test and Evaluation Force (OPTEVFOR) , Joint Interoperability Test Command (JITC) and OSD Director of Operational Test & Evaluation (ODT&E). ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** T&E efforts complete in FY 2020. No funding required FY 2021 and out.					
Accomplishments/Planned Programs Subtotals	0.391	0.893	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/5035: *Towing, Salvage, and Rescue Ship (T-ATS)*	80.517	150.282	168.209	-	168.209	80.800	0.000	0.000	0.000	0.000	630.897

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3377 / *T-ATS Ship Concept Development*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

Remarks

D. Acquisition Strategy

Detail Design and Construction (DD&C) was awarded for Lead Hull in March 2018.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3377 / *T-ATS Ship Concept Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support	Various	NAVAIR/NSWC/ NIWC : MD, MD, SC	0.769	0.000		0.000		0.000		-		0.000	0.000	0.769	-
Industry Design Studies	Various	Various : Various	0.679	0.000		0.000		0.000		-		0.000	0.000	0.679	-
		Subtotal	1.448	0.000		0.000		0.000		-		0.000	0.000	1.448	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Milestone Documention Support	C/FFP	CACI : DC	2.041	0.000		0.000		0.000		-		0.000	0.000	2.041	-
RFP and Specification Development	Various	Alion/CACI/NIWC : DC, DC, SC	0.705	0.000		0.000		0.000		-		0.000	0.000	0.705	-
Test & Evaluation Execution	Various	OPTEVFOR, CACI, ALION : VA, DC	0.390	0.300	Jan 2019	0.350	Dec 2019	0.000		-		0.000	0.000	1.040	-
		Subtotal	3.136	0.300		0.350		0.000		-		0.000	0.000	3.786	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Testing/ Operational Testing	C/FFP	Various : Various	0.000	0.091	Jun 2019	0.543	Apr 2020	0.000		-		0.000	0.393	1.027	-
		Subtotal	0.000	0.091		0.543		0.000		-		0.000	0.393	1.027	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	4.584	0.391		0.893		0.000		-		0.000	0.393	6.261	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3377 / *T-ATS Ship Concept Development*

T-ATS Design & Total Ship Integration

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3377 / *T-ATS Ship Concept Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3377				
Deveopmental Testing/Operational Testing	1	2019	3	2020
Initial Operational Capabilities	4	2021	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*				**Project (Number/Name)** 3389 / *OPLOG IPT Development*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3389: *OPLOG IPT Development*	23.829	12.448	21.641	18.272	-	18.272	22.564	8.043	9.812	10.009	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY2016 and prior year efforts were financed under NDSF BA4 PE 0408042N Project 3117 Naval Operational Logistics (OPLOG) Integration. FY2017, FY2019 and forward is financed under this Program Element (Project 3389). FY2018 financed under Congressional add Project 9999/C404 included in prior years shown in this budget.

A. Mission Description and Budget Item Justification

Project 3389 - Develops enabling technologies for future and in-service afloat operational logistics and integrated supply systems; defines integrated combat logistics force and combatant logistics requirements; and conducts cooperative initiatives with acquisition programs, program sponsors, engineering managers, the Navy science and technology community, and Fleet customers. Operational Logistics Integration R&D (OPLOG) develops integrated, cross-platform (i.e. applicable to more than one ship class/type) operational logistics and operational energy conservation technologies and capabilities as well as draft acquisition and operations policy ensuring future Naval systems leverage emerging logistic capabilities and technologies to provide operationally effective and energy efficient logistics delivery.

Though the operational logistics family of systems touches all aspects of Naval presence and power projection, operational logistics capability and system interfaces typically have been left to individual acquisition programs to develop and resolve. Technology development is necessary to mitigate technological and operational risk before ship acquisition programs accept new technologies. This project provides a foundation for the transition and systems development of science & technology initiatives evolving from the Office of Naval Research (ONR) Power & Energy Future Naval Capabilities (FNC), Enterprise and Platform Enablers FNC, Seabasing FNC, and from other enabling Government, industry and academia concepts to the acquisition community. Thus, this project resources continued research and development of appropriate technologies with applicability to multiple acquisition programs and defines and matures performance and interface requirements for those technologies. This project continues to identify, develop, integrate, demonstrate, and transition logistics technologies to improve the cost effectiveness of Fleet at sea logistics delivery through outreach, coordination and collaboration with industry, academia, Fleet, and Enterprise representatives.

This project will continue to develop improved shipboard replenishment, transfer, and handling systems and components as well as asset visibility and standardized packaging technologies. This project includes development of approaches to reduce operation and maintenance costs of, and energy consumption by the logistics Fleet. This integrated suite of developed capabilities will enable multiple ship types to leverage common technologies common across DoD (Joint) and commercial transportation networks providing a more affordable, energy efficient, mission capable force. These capabilities and system-of-systems approach will be applied to concept development of future auxiliary force
architectures.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Systems	8.948	20.391	17.738	0.000	17.738
Articles:	-	-	-	-	-
FY 2020 Plans: Continue advanced refueling system R&D to include: Continue Seabased Petroleum Distribution System (SPDS) scaled prototype development, demonstrations, and test and evaluations; complete Open Ocean Joint Off-Shore Fuel Farm (JOFF) concept development and begin prototype development, test and evaluation; continue modular Consolidated (CONSOL) tanker adapter kit test, evaluation, and demonstrations; and continue Improved Modular Fuel Distribution System (iMFDS) detailed design and prototype development; Complete Expeditionary Advanced Base Operations (EABO) JOFF concept development and begin prototype development. ***FY 2021 Base Plans:*** Research, development, and testing of advanced refueling systems and concepts to include: performing operationally relevant testing of SPDS system and complete detailed design and build for the FY21 scaled prototype. Begin to develop full scale SPDS prototype; Continue to develop the Open Ocean and EABO support JOFF variant development; Continue CONSOL and iMFDS development and testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** A total decrease of $2.653M is result of completion of two JOFF concept developments in FY20 and delaying the SPDS scaled prototype development.					
Title: Logistics Architectures	0.050	0.050	0.050	0.000	0.050
Articles:	-	-	-	-	-
Description: This is annual funding needed by the Center for Naval Analyses (CNA) to maintain the Combat Logistics Force database so OPLOG can utilize the data to support logistics R&D and concept development. ***FY 2020 Plans:*** Center for Naval Analyses (CNA) collects data and maintains the Combat Logistics Force (CLF) database to support ongoing and future analyses. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Center for Naval Analyses (CNA) collects data and maintains the Combat Logistics Force (CLF) database to support ongoing and future analyses. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No increase/decrease of funding.					
Title: Shipboard Energy Conservation (E-STREAM)	3.100	0.800	0.374	0.000	0.374
Articles:	-	-	-	-	-
FY 2020 Plans: Continue data package development for Navy Standard Transmission Replacement (NSTR) and energy initiatives Efficient shipboard Replenishment At Sea (E-RAS). ***FY 2021 Base Plans:*** Continue design data package development for NSTR for transition. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The $426K decrease in the FY21 budget is due to the completion of T&E for RAS and FAS E-STREAM.					
Title: Shipboard Material Transport	0.350	0.400	0.110	0.000	0.110
Articles:	-	-	-	-	-
FY 2020 Plans: Continue development of Lithium Ion Battery storage technologies to enable Combat Logistics Force (CLF) ships to safely transport Li batteries. Build and install First Article on T-AOE / T-AKE. Modify T-AOE and T-AKE vessels for safe Li battery storage. Design containerized storage onboard T-AKR ships with self-contained fire and safety systems. ***FY 2021 Base Plans:*** Identify additional battery storage and maintenance requirements. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** There is a $290K decrease in the FY 2021 budget due to the completion of design in FY 2020.					
Accomplishments/Planned Programs Subtotals	12.448	21.641	18.272	0.000	18.272

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable for OPLOG R&D efforts

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	Various	VARIOUS : Various	5.600	5.000	Jan 2019	9.265	Jan 2020	8.450	Jan 2021	-		8.450	Continuing	Continuing	Continuing
Ancillary Hardware Development	Various	VARIOUS : Various	2.200	1.500	Jan 2019	2.650	Jan 2020	2.287	Jan 2021	-		2.287	Continuing	Continuing	Continuing
Ship Integration	Various	VAROUS : Various	2.100	0.600	Jan 2019	0.850	Jan 2020	0.750	Jan 2021	-		0.750	Continuing	Continuing	Continuing
Ship Suitability	Various	VARIOUS : Various	0.950	0.500	Jan 2019	1.000	Jan 2020	0.850	Jan 2021	-		0.850	Continuing	Continuing	Continuing
System Engineering	Various	VARIOUS : Various	2.250	0.940	Jan 2019	1.750	Jan 2020	1.810	Jan 2021	-		1.810	Continuing	Continuing	Continuing
		Subtotal	13.100	8.540		15.515		14.147		-		14.147	Continuing	Continuing	N/A

Remarks

1. Primary Hardware Development, Ancillary Hardware Development and System Engineering is related to the Advanced Systems Joint Offshore Fuel Farm (JOFF) and SeaBased Petroleum Distribution System (SPDS) prototype development.
2. Award dates reflect initial award of incremental execution.
3. PY includes FY2017 Proj. 3389 and FY2018 Congressional Add Proj. C404

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Suport	Various	VARIOUS : Various	1.700	0.825	Jan 2019	1.100	Jan 2020	0.820	Jan 2021	-		0.820	Continuing	Continuing	Continuing
Software Development	Various	VARIOUS : Various	0.000	0.025	Jan 2019	0.100	Jan 2020	0.025	Jan 2021	-		0.025	Continuing	Continuing	Continuing
Integrated Logistics Support	Various	VARIOUS : Various	0.518	0.300	Jan 2019	0.300	Jan 2020	0.225	Jan 2021	-		0.225	Continuing	Continuing	Continuing
Configuration Management	Various	VARIOUS : Various	1.500	0.400	Jan 2019	1.000	Jan 2020	0.605	Jan 2021	-		0.605	Continuing	Continuing	Continuing
Technical Data	Various	VAROUS : Various	1.150	0.600	Jan 2019	0.725	Jan 2020	0.400	Jan 2021	-		0.400	Continuing	Continuing	Continuing
Studies & Analysis	Various	VARIOUS : Various	0.500	0.135	Jan 2019	0.300	Jan 2020	0.175	Jan 2021	-		0.175	Continuing	Continuing	Continuing
		Subtotal	5.368	2.285		3.525		2.250		-		2.250	Continuing	Continuing	N/A

Remarks

1. Award dates reflect initial award of incremental execution.
2. PY includes FY2017 Proj. 3389 and FY2018 Congressional Add Proj. C404

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	Various	VARIOUS : Various	2.600	0.700	Jan 2019	1.250	Jan 2020	0.825	Jan 2021	-		0.825	Continuing	Continuing	Continuing
Operational Test & Evaluation	Various	VARIOUS : Various	1.750	0.573	Jan 2019	0.951	Jan 2020	0.650	Jan 2021	-		0.650	Continuing	Continuing	Continuing
		Subtotal	4.350	1.273		2.201		1.475		-		1.475	Continuing	Continuing	N/A

Remarks

1. DT&E and OT&E cost are related to prototype test and demonstration for Advanced Systems Joint Offshore Fuel Farm (JOFF) and SeaBased Petroleum Distribution System (SPDS).
2. Award dates reflect initial award of incremental execution.
3. PY includes FY2017 Proj. 3389 and FY2018 Congressional Add Proj. C404

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	Various	VARIOUS : Various	0.411	0.100	Jan 2019	0.150	Jan 2020	0.150	Jan 2021	-		0.150	Continuing	Continuing	Continuing
Government Engineering Support	Various	VARIOUS : Various	0.600	0.250	Jan 2019	0.250	Jan 2020	0.250	Jan 2021	-		0.250	Continuing	Continuing	Continuing
		Subtotal	1.011	0.350		0.400		0.400		-		0.400	Continuing	Continuing	N/A

Remarks

Award dates reflect initial award of incremental execution.
2. PY includes FY2017 Proj. 3389 and FY2018 Congressional Add Proj. C404

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	23.829	12.448		21.641		18.272		-		18.272	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603564N / *Ship Prel Design & Feasibility Studies*	**Project (Number/Name)** 3389 / *OPLOG IPT Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3389				
Advanced Systems	1	2019	1	2025
Logistics Architectures	1	2019	4	2025
Shipboard Energy Conservation (E-STREAM)	1	2019	1	2023
Shipboard Material Transport	1	2019	3	2021

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603570N / *Advanced Nuclear Power Systems*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	256.137	181.652	149.188	-	149.188	130.627	133.058	132.141	123.681	Continuing	Continuing
1258: *Nuclear Technology Development*	0.000	66.037	67.646	69.103	-	69.103	70.485	76.217	77.741	79.296	Continuing	Continuing
3219: *SBSD Nuclear Technology Development*	0.000	190.100	114.006	80.085	-	80.085	60.142	56.841	54.400	44.385	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 444

A. Mission Description and Budget Item Justification

The details of this program element are classified CONFIDENTIAL and are submitted annually to Congress in the classified budget justification books.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	256.137	181.652	149.188	-	149.188
Current President's Budget	256.137	181.652	149.188	-	149.188
Total Adjustments	0.000	0.000	0.000	0.000	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603570N / *Advanced Nuclear Power Systems*	**Project (Number/Name)** 1258 / *Nuclear Technology Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1258: *Nuclear Technology Development*	0.000	66.037	67.646	69.103	-	69.103	70.485	76.217	77.741	79.296	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The details of this program element are classified CONFIDENTIAL and are submitted annually to Congress in the classified budget justification books.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603570N / *Advanced Nuclear Power Systems*				**Project (Number/Name)** 3219 / *SBSD Nuclear Technology Development*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3219: *SBSD Nuclear Technology Development*	0.000	190.100	114.006	80.085	-	80.085	60.142	56.841	54.400	44.385	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 444												

A. Mission Description and Budget Item Justification

The details of this program element are classified CONFIDENTIAL and are submitted annually to Congress in the classified budget justification books.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	244.154	26.272	87.408	38.449	-	38.449	34.179	26.081	24.233	24.710	Continuing	Continuing
2471: *Integrated Power Systems (IPS)*	244.154	21.448	25.408	38.449	-	38.449	34.179	26.081	24.233	24.710	Continuing	Continuing
9999: *Congressional Adds*	0.000	4.824	62.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	66.824

A. Mission Description and Budget Item Justification

The FY 2020 to FY 2021 decrease is due to FY 2020 Congressional Adds for silicon carbide power modules, advanced power electronics integration and surface combatant component-level prototyping. The FY 2020 to FY 2021 increase in PU 2471 funds the design and build of the modular scalable shipboard multi-application Energy Magazine (EM) which enables new pulsed, high power directed energy weapons (lasers) and sensors. FY 2020 competitively awarded contracts to up to two (2) vendors fulfills the need for at least two (2) viable sources of supply for EM with lithium ion batteries, and/or capacitors and or flywheel based energy storage systems and power electronics for shipboard applications. FY 2021 includes resource requirements for characterization and qualification of lithium ion battery based energy storage to safe and reliable shipboard service.

This Program Element (PE) includes the development of advanced surface ship Hull, Mechanical, and Electrical (HM&E) components and systems for all future ships and back-fit ships where appropriate as well as development of Situational Awareness, Boundary Enforcement & Response (SABER) prototype hardware for cybersecurity protections of HM&E systems for applicable surface ships. This PE is managed by PMS 320, the Electric Ships Office, located organizationally within PEO SHIPS, responsible for developing Naval Power and Energy Systems that focus power system integration of Directed Energy (DE) and other high-powered mission systems as well as platform integration and improving energy efficiency of those components and systems. The mission of PMS 320 is to develop and provide smaller, simpler, more affordable and more capable electric power systems for all Navy platforms, focus Navy and industry investments, and reduce total ownership cost. PEO Ships AM manages the SABER hardware development effort.

This PE serves as the bridge between Science and Technology (S&T) and ship platform and mission systems acquisition programs by identifying prospective applications for S&T research, advanced development, and performing additional product development and qualification when necessary to meet platform or mission system requirements.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	27.109	25.408	42.825	-	42.825
Current President's Budget	26.272	87.408	38.449	-	38.449
Total Adjustments	-0.837	62.000	-4.376	-	-4.376
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	62.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.073	0.000			
• SBIR/STTR Transfer	-0.764	0.000			
• Program Adjustments	0.000	0.000	-4.480	-	-4.480
• Rate/Misc Adjustments	0.000	0.000	0.104	-	0.104

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Silicon Carbide Power Modules*	4.824	7.000
Congressional Add: *Advanced power electronics integration*	0.000	5.000
Congressional Add: *Surface combatant component-level prototyping*	0.000	50.000
Congressional Add Subtotals for Project: 9999	4.824	62.000
Congressional Add Totals for all Projects	4.824	62.000

Change Summary Explanation

FY 2020 increase of $62.000M for silicon carbide power modules, advanced power electronics integration and surface combatant component-level prototyping Congressional Adds.

FY 2021 decrease of $4.376M due to -$4.167M reduction to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*				**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2471: *Integrated Power Systems (IPS)*	244.154	21.448	25.408	38.449	-	38.449	34.179	26.081	24.233	24.710	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports the development and transition of Naval Power and Energy Systems including power generation, power conversion, power distribution, energy storage, power utilization and automation and control functions for fully integrated electric propulsion (such as T-AKE -1 class or DDG 1000 class), hybrid electric propulsion (such as LHD 8 and LHA(R) class), as well as legacy mechanical propulsion ships (such as DDG51 class). This project supports optimized integration of Directed Energy (DE) and other high powered mission systems, appropriate component and system controls, integration of components and systems into future and current ships, and providing power and energy system solution alternatives to new and existing platforms. Existing ships' power systems require optimized integration via energy storage and advanced controls techniques to withstand the effects of DE and other high powered mission systems and avoid negative impacts to power generating equipment (diesel/gas turbine engines and generators).

Project developments are aligned with the Navy's 30 year shipbuilding plan via the Naval Power and Energy Systems Technology Development Roadmap (TDR), which outlines the way ahead for future developments and provides a basis for coordinated planning and investment by the Navy and private industry.

This project develops and transitions products that electrically integrate and provide power to mission systems, integrates those components and systems into ship platforms, increases energy efficiency, and provides cybersecurity capabilities for current in-service Hull, Mechanical and Electrical (HM&E) systems as well as future systems.

The systems developed by this Project are the power and energy foundation of the ships kill chain, and are developed with efficiency requirements as part of total life cycle cost minimization. Efforts within Power and Energy Systems are to design, develop, test and integrate shipboard power systems to incorporate advanced sensors, directed energy and other advanced weapons. Design and testing includes modeling and simulation, as well as land based testing, to reduce risk and demonstrate readiness for shipboard use.

Cybersecurity: This PU will develop and test various SABER prototype hardware that monitors the HM&E network and system communications to detect potential cyber attacks. SABER hardware will transition to appropriate back-fit and forward fit ship installations, as appropriate, once development and testing completes. The Cyber funding also supports using cyber analysis tools to identify potential vulnerabilities in HM&E enclave architectures, hardware components, and software for applicable surface ships.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Power and Energy Systems	12.787	16.457	30.952	0.000	30.952

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-

FY 2020 Plans:
EM prototype: Continue to execute the Energy Magazine - Prototype Engineering Change Proposal (ECP). Specific FY20 efforts include: order long lead time material(s), complete the design, commence the build of the EM prototype and fabricate artifacts to be used in the redesigned battery modules and commence safety testing. Continue to support PEO IWS and ONR laser testing. Evaluate performance of the EM prototype and, as applicable, incorporate lessons learned into EM procurement

Energy Magazine (EM): Following source selection, competitively award EM contracts to up to two (2) vendors to fulfill the need for at least two (2) viable sources of supply for EM with lithium ion batteries, and/or capacitors, and/or flywheel energy storage and power electronics for shipboard applications. In FY 2020, selected vendors will begin design of a modular, scalable, multi-application EM; an energy storage system that serves as the energy resource to enable the introduction of pulsed high power and energy weapons and sensor systems. EM simultaneously supports multiple pulsed loads such as laser, electronic warfare, radars, etc. When fully integrated, EM is expected to also reduce the number of Uninterruptable Power Supply (UPS) on ships which decreases maintenance and costs. This PE will transition ONR Future Naval Capabilities (FNC) products, advanced circuit protection devices and Multi-Functional Energy Storage Module (MFESM). FY 2020 efforts include testing and documentation to transition into EM and Advanced Power Conversion Module (APCM). The EM aligns with PEO IWS plans for development and deployment of shipboard high power directed energy weapons and sensors.

Conduct system simulations that focus on EM performance, generate detailed interface requirements, test scenarios and sequences, and incorporate in Power Hardware In the Loop (PHIL) demonstration(s).

Continue to conduct feasibility studies, cost based assessments, and develop technical and performance specifications for an Integrated Power & Energy System (IPES) in support of Future Surface Combatant power and energy requirements. Identify shared energy storage and advanced controls requirements enabling an affordable, scalable and flexible power system to meet current and future needs. Refine IPES notional architectures and risk assessments through studies and industry engagement. Draft performance specifications for IPES system, equipment and components.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue to identify requirements for Advanced Controls in order to take full advantage of power and energy resources within the ship's machinery control system and to deliver mission systems the power and energy they require when required. Advanced controls configure the system to operate at max efficiently when appropriate and switch to max performance when necessary through three-way communication and control between the machinery control system, mission planning and pulsed high power and energy weapon systems and sensors. In FY20 this PE will perform advance control optimization based on impact, availability, and resources with a focus on how to use controls to optimize the amount and cost of energy storage in the system taking into consideration stability and pulse-power support for determining energy storage needs. Continue to conduct PHIL demonstrations. In FY 2020 PHIL demonstrations will focus on a modular scalable multi-purpose Energy Magazine and future surface combatants with multiple high pulsed power loads; demonstrating advanced electrical architectures, power conversion equipment, and controls for implementation into an IPES. Execute computer component models and system level modeling and simulation efforts. Plan for land based testing activities. This PE will transition ONR Future Naval Capabilities (FNC) products, advanced circuit protection devices and Multi-Functional Energy Storage Module (MFESM). FY 2020 efforts include testing and documentation to transition into EM and APCM. Advanced Power Generation Modules (APGM): Continue to define performance requirements, explore trade space in next generation compact high power Advanced Power Generation Modules (APGM), continue to develop characterization data used to conduct ship design studies and to establish a benchmark for performance comparison, continue to develop a stand-alone technical description document which describes performance characteristics, continue to evaluate the effect of large pulse loads from future electric weapons on the cycle life of gas turbine engines, and engine capability to respond to such pulse loads without an unacceptable reduction in time between overhaul. Advanced Power Conversion Module (APCM): Continue to conduct feasibility studies, Cost Based Assessments, and development of performance and technical specifications for next generation compact high power APCM incorporating high band gap materials such as silicon carbide. Continue to develop computer component models					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and system level modeling and simulation efforts. FY 2020 efforts include evaluating the use of silicon carbide high band gap material in EM.					
FY 2021 Base Plans: This PE has pursued an evolutionary energy storage development strategy for surface ships. Prior to FY 2021, this PE has designed, built, and tested at the Center for Advanced Power System at Florida State University (FSU CAPS) the Energy Storage Module (ESM) prototype, the Energy Magazine Bread Board (to test active front end technology to enable peak shaving) and multiple other energy storage devices designed and built outside of this PE. These include the United Kingdom (UK) Flywheel Energy Storage System, the Johns Hopkins University Adaptable Power Supply, and the Northrop Grumman Energy Storage System. This testing has de-risked the Energy Magazine technical specification and increased Navy expertise in the use of advanced energy storage technologies. Energy Storage is a key enabler for high-powered directed energy weapons. The stored energy of the Energy Magazine is required to supplement typical ship service power so that large pulsed loads do not directly tie to the electrical power generator, which potentially damages the shipboard power system. The Energy Magazine consists of power electronics, energy storage media, and controls. The Energy Magazine is a common, modular, scalable intermediate power system that standardizes energy storage across multiple mission systems and ships classes, eliminating wasteful need for mission systems to each develop, build, test and qualify/certify their own unique energy storage systems. The Energy Magazine also provides stable backup power functionality and leads to reduction of uninterruptable power supplies (UPS) aboard ship. Approximately 30-40% of the cabinet components that support weapons and sensing systems are power conditioning; these can be functionally replaced by the Energy Magazine as a more universal power conditioning and energy storage unit that is ship power "reloadable" for multiple directed energy engagements. The Energy Magazine is designed for both new construction and back-fit applications where advanced combat systems loads are being deployed. Energy Magazine-Prototype (EM-P): Continue to execute the Energy Magazine - Prototype (EM-P) Engineering Change Proposal (ECP). Specific FY21 efforts include: order all material, complete build, and conduct Test Readiness Reviews prior to testing the EM-P, conduct first article and factory testing, verify through testing that the EM Prototype performance meets the physical, functional and performance requirements. Continue to support PEO IWS and ONR laser testing. Evaluate performance of the EM prototype and, as applicable, incorporate lessons learned into EM procurement. Commence preparation of test plans and procedures and test site modifications.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Energy Magazine (EM): Continue executing Energy Magazine (EM) contracts awarded competitively in FY20 to up to two (2) vendors to fulfill the need for at least two (2) viable sources of supply for EM with lithium ion batteries, and/or capacitors, and/or flywheel energy storage and power electronics for shipboard applications. Complete EM preliminary design, commence detailed design, complete S9310-AQ-SAF-010 characterization for Li Batteries / Flywheel Technology Readiness Level (TRL) demonstration, order Long Lead Time Material (LLTM), and prepare to build the prototype units, including strengthening vendor industrial base relationships to ensure receipt of hardware on time to maintain schedule. -- Design activities include: Complete requirements analysis to transition Navy requirements into design, performance and operational environment requirements from which system configuration items (e.g. subsystem and major components) can be designed, integrated and tested; interface management to coordinate interface requirements, assess and document performance in the areas of acoustics, Electromagnetic Interference (EMI); transient stability, load flow, harmonic and system fault analysis; trade-off analyses used to arrive at the design, details of methods used in the design process, the status of the risk management efforts, an assessment of the impact of cost drivers in the design, and a program review of the status of the design to date; and, thermal analysis, mechanical stress analysis, modal analysis, electrical insulation stress analysis, critical charge levels, flame resistance and toxicity of self-extinguishing insulation material, vibration and shock. -- Prepare and deliver a Preliminary Design Report and conduct a Preliminary Design Review (PDR) to review key performance parameters along with preliminary component designs, control philosophy and documentation, system functional requirements, interface requirements, size, weight, electromagnetic fields and interference criteria, thermal management, and performance requirements. -- Fabricate the artifacts to be used in destructive characterization testing for energy storage based on each vendors' designs, conduct characterization testing, and prepare certification data needed for the approval to install the Energy Magazine at Navy land based facilities for testing and for installation aboard ship. Complete appropriate drawings describing the LLTM component usage, prepare LLTM specifications of the LLTM components, and procure LLTM. -- Continue to conduct system simulations that focus on EM performance, generate and validate detailed interface requirements, test scenarios and sequences, and incorporate in Power Hardware In the Loop (PHIL) demonstration(s).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Integrated Power and Energy System (IPES): An IPES is described in the Naval Power and Energy Systems Technology Development Roadmap (NPES TDR) as an advanced power architecture that incorporates multi-use distributed energy storage as well as advanced controls and energy management. An IPES is an evolution of an Integrated Power System (IPS), specifically from that installed on DDG 1000. Changes from IPS on DDG 1000 range from system level improvements such as variable speed prime movers, higher bus voltages, common intra-zone power conversion, improved electrical disconnects, advanced circuit protection, and cybersecurity to component and device improvements such as increased efficiency and performance leveraging industry's advancements in power conversion technology since DDG 1000 was designed. IPES is a system that fully integrates all generated and stored electrical energy in the ship platform so that it is available to all electrical users, including high power weapons, advanced sensors, and electric propulsion, as mission scenarios dictate. IPES removes the need for individual Uninterruptible Power Supplies (UPS) now proliferating on ships. An IPES breaks this paradigm of stove piped energy storage and allows all users to benefit from common, shared sources of energy whether that be for mission systems or providing ride through power for mission critical systems or ship systems. Ship power systems today do not have the capability to share energy resources. In FY21, continue to conduct feasibility studies, cost based assessments, computer real time simulations, and develop technical and performance specifications for an Integrated Power & Energy System (IPES) in support of Future Surface Combatant power and energy requirements. Identify shared energy storage and advanced controls requirements enabling an affordable, scalable and flexible power system to meet current and future needs. Refine IPES notional architectures and risk assessments through studies and industry engagement. Draft performance specifications for IPES system, equipment and components. Continue to engage in robust component-level prototyping of potential new critical systems, including those related to propulsion and electrical distribution in support of future surface combatants to the maximum extent possible. Execute computer component models and system level modeling and simulation efforts. Plan for land based testing activities focused on testing prototypes, validating specifications and standards and interfaces, and functionality of advanced controls. In order to obtain early insight into the effects of high power and energy mission systems on ships electric power systems, evaluate shipboard power and energy systems, and evaluate power system performance at lower cost than full-scale hardware system testing, simulated electrical system integration testing using power and energy system components will be conducted. This lower-cost approach to testing is referred to as Power Hardware In the Loop (PHIL). PHIL includes development of component computer models that simulate and emulate actual operating machinery components and shipboard power and energy systems. PHIL testing replaces component models with hardware once hardware development is complete. PHIL testing costs less than full-					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
scale hardware system testing, shortens development time, and affords the opportunity to identify and mitigate risks in a deliberate fashion from specification development to computer model development to hardware development resulting in a more affordable and robust end product. PHIL testing reduces developmental risk, and demonstrates performance potential prior to live hardware integration testing.Continue to conduct PHIL demonstrations. In FY 2021 PHIL demonstrations will focus on available propulsion and electrical distribution component prototypes to support design efforts. Advanced Power Conversion Module (APCM): Continue to conduct feasibility studies, Cost Based Assessments, and developing performance and technical specifications for next generation compact high power Advanced Power Conversion Module (APCM) incorporating high band gap materials such as silicon carbide. Continue to develop computer component models and system level modeling and simulation efforts. Advanced Power Generation Modules (APGM): Continue to define performance requirements, explore trade space in next generation compact high power Advanced Power Generation Modules (APGM), continue to develop characterization data used to conduct ship design studies and to establish a benchmark for performance comparison, continue to develop a standalone technical description document which describes performance characteristics, continue to evaluate the effect of large pulse loads from future electric weapons on the cycle life of gas turbine engines, and engine capability to respond to such pulse loads without an unacceptable reduction in time between overhaul. Continue scale generator physical modeling efforts at Sandia National Labs Small Scale Microgrid to determine the feasibility and operational characteristics of dual wound generators operating through active rectifiers to supply a scale medium voltage DC ships electrical bus with scale pulsed, high power weapons and sensors.Continue industry engagement in early trade and concept studies to determine the cost and feasibility of dual wound, variable speed gas turbine generators. Continue to support maturation and transition of ONR Future Naval Capabilities (FNC) products. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase from FY 2020 to FY 2021 supports FY 2020 competitively awarded contracts of up to two (2) vendors to design and build the modular scalable shipboard multi-application Energy Magazine which enables new pulsed, high power directed energy weapons (lasers) and sensors. Contract awards fulfill the need for at least two (2) viable sources of supply for EM with lithium ion batteries, and/or capacitors and or flywheel based energy storage systems and power electronics for shipboard applications. FY2021 includes resource					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
requirements for characterization and qualification of lithium ion battery based energy storage to safe and reliable shipboard service.					
Title: Naval Power Technology Development / Platform Integration & Transition	1.104	1.104	1.104	0.000	1.104
Articles:	-	-	-	-	-
FY 2020 Plans: Continue to execute the Advanced Electric Power and Propulsion Systems Development Project (short title is AEP3), Project Arrangement (PA) ref DoD-MOD-N-12-0001 which is an agreement between the US and UK Governments to cooperate on a scope of work associated with characterizing, developing, modeling, and de-risking electrical power and propulsion system architectures and equipment for future surface and submarine platforms to meet the needs of both Navies. Continue to develop power and propulsion system configurations in support of future surface ship acquisition programs. Develop alternative power and propulsion solutions for future surface combatants and amphibious ships. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, and ship integration studies and planning. Continue to analyze alternatives for supplying power to advanced radars, combat systems, and electric weapons power demands and potential interfaces to develop optimum alternative solutions. Continue assessments of Naval Power and Energy System alternate architectures to best meet emerging ship requirements. Commence biennial update of the Naval Power and Energy Systems (NPES) Technology Development Roadmap (TDR). Continue to support maturation and transition of ONR Future Naval Capabilities (FNC) products to meet NPES TDR identified gaps. Support transition from ONR of Silicon Carbon (and other high bandgap semiconductor materials) based power electronic modules. High band gap semiconductor materials operate at high speeds and temperatures as compared with silicon based materials affording more compact, thermally tolerant power conversion equipment making them highly desirable for naval applications. Continue Combat Power and Energy System Overarching Integrated Product Team (OIPT).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue to generate strategy, technology development plan and resource requirements for future surface combatant integrated power and energy system.					
FY 2021 Base Plans: Continue to execute the Advanced Electric Power and Propulsion Systems Development Project (short title is AEP3), Project Arrangement (PA) ref DoD-MOD-N-12-0001 which is an agreement between the US and UK Governments to cooperate on a scope of work associated with characterizing, developing, modeling, and de-risking electrical power and propulsion system architectures and equipment for future surface and submarine platforms to meet the needs of both Navies. Scope of AEP3 PA was modified in FY19 via amendment 2 to include development and testing of advanced cooling methods and distributed thermal management systems, and to jointly develop advanced control methods, technologies, and hardware for management of advanced shipboard power and energy systems. Thermal management of shipboard power and energy systems has lagged behind the rapid development of shipboard electrical power systems. Both nations seek to apply innovative cooling methods derived from academia, industry, and mission systems communities to electric power conversion and distribution. Advanced controls are required to support the rapid power and energy system reconfiguration needed on future surface ships. The benefits to both Participants will be the ability to power revolutionary Directed Energy Weapons on existing ships and field future shipboard electrical architectures with performance thresholds that exceed current thermal management and controls limits.					
Continue to develop power and propulsion system configurations in support of future surface ship acquisition programs. Develop alternative power and propulsion solutions for future surface combatants and amphibious ships. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, and ship integration studies and planning. Continue to analyze alternatives for supplying power to advanced radars, combat systems, and electric weapons power demands and potential interfaces to develop optimum alternative solutions. Continue assessments of Naval Power and Energy System alternate architectures to best meet emerging ship requirements. Continue Combat Power and Energy System Overarching Integrated Product Team (OIPT) activities. Continue to generate strategy, technology development plan and resource requirements for future surface combatant integrated power and energy system.					
Issue biennial update of the Naval Power and Energy Systems (NPES) technology development roadmap (TDR)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Support transition from ONR of Silicon Carbon (and other high bandgap semiconductor materials) based power electronic modules. High band gap semiconductor materials operate at high speeds and temperatures as compared with silicon based materials affording more compact, thermally tolerant power conversion equipment making them highly desirable for naval applications. ***FY 2021 OCO Plans:*** N/A					
Title: Situational Awareness, Boundary Enforcement & Response (SABER) - Hardware Development / Prototyping	7.557	7.847	6.393	0.000	6.393
Articles:	-	-	-	-	-
FY 2020 Plans: Continue SABER hardware design, First Article Test (FAT) unit fabrication, and Environmental Qualification Testing (EQT). Continue build of SABER Computing Hardware Lab units for ship integration testing at NSWC Philadelphia Division, Philadelphia PA to support installations. Commence design, FAT fabrication, and EQT of the SABER sensor known as the Copper Tap & Aggregator unit. Commence build of a small Low Rate Initial Production (LRIP) quantity of Copper Tap & Aggregator Units for lab testing at NSWC Philadelphia Division, Philadelphia PA. Develop and test an additional variant of the WeaselBoard (SABER sensor) for shipboard integration. Support the two current Non-Permanent Changes (NPCs) on the host ships. Perform a Cyber Table Top type event on DDG-51 class HM&E Control Systems and a cyber vulnerability analysis of the main DDG-51 class HM&E/Navigation control system network via Model Based Systems Engineering tools. ***FY 2021 Base Plans:*** Continue build of SABER Computing Hardware Lab units for NSWC Philadelphia Division, Philadelphia PA for ship integration testing to support installations in FY 2022 and FY 2023. Develop and test additional WeaselBoard variants.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Conduct Cyber Table Top type events and cyber vulnerability analysis via Model Based Systems Engineering tools of HM&E systems/networks on additional ship classes. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease from FY 2020 to FY 2021 is to account for the availability of prior year execution balances.					
Accomplishments/Planned Programs Subtotals	21.448	25.408	38.449	0.000	38.449

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This program develops and transitions higher performance and more affordable electric power and propulsion systems to both new construction and back fit ship applications using an evolutionary acquisition approach. For new contract awards, full and open competition is utilized to the maximum extent possible to provide maximum benefit to the Navy at the lowest possible cost to the taxpayer. When able to meet Navy requirements, commercial technology is leveraged to further minimize cost to the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/FFP	Rolls Royce : Walpole, MA	37.903	0.080	Jun 2019	0.100	Nov 2019	0.100	Nov 2020	-		0.100	Continuing	Continuing	Continuing
Product Development	TBD	TBD : TBD	0.000	0.000		2.000	Jun 2020	17.268	Oct 2020	-		17.268	0.000	19.268	-
Product Development	C/FFP	DRS : DRS, Milwaukee WI	48.820	6.053	Mar 2019	6.607	Oct 2019	5.445	Oct 2020	-		5.445	Continuing	Continuing	Continuing
Product Development	C/CPFF	Various : Various	47.500	3.204	Oct 2018	3.900	Oct 2019	4.095	Oct 2020	-		4.095	Continuing	Continuing	Continuing
Product Development	WR	NSWCPD : Phila, PA	60.997	3.303	Oct 2018	3.352	Oct 2019	3.485	Oct 2020	-		3.485	Continuing	Continuing	Continuing
Cybersecurity	WR	NSWCPD : Phila, PA	8.243	3.231	Nov 2018	2.998	Nov 2019	2.835	Nov 2020	-		2.835	Continuing	Continuing	Continuing
Cybersecurity	C/CPIF	Boeing : Huntington Beach, CA	1.000	0.250	Feb 2019	0.250	May 2020	0.250	May 2021	-		0.250	Continuing	Continuing	Continuing
Cybersecurity	C/FP	Various HM&E Equipment Vendors : Various	1.998	0.000		0.250	Jan 2020	0.250	Jan 2021	-		0.250	Continuing	Continuing	Continuing
Cybersecurity	C/CPIF	Various : Various	3.266	0.215	Jan 2019	0.367	Jan 2020	0.024	Jan 2021	-		0.024	Continuing	Continuing	Continuing
Cybersecurity	C/CPFF	TBD Comp HW : TBD	0.000	1.200	Jul 2019	1.500	Nov 2019	1.000	Nov 2020	-		1.000	0.000	3.700	-
Cybersecurity	C/CPFF	JHU APL : Laurel, MD	2.631	1.125	Dec 2018	0.500	Nov 2019	1.000	Nov 2020	-		1.000	0.000	5.256	-
Cybersecurity	C/CPFF	TBD Tap-Agg : TBD	0.000	0.000		1.000	Nov 2019	0.400	Nov 2020	-		0.400	0.000	1.400	-
Cybersecurity	MIPR	Sandia National Labs : Albuquerque, NM	0.750	1.536	Nov 2018	1.000	Nov 2019	0.634	Nov 2020	-		0.634	0.000	3.920	-
		Subtotal	213.108	20.197		23.824		36.786		-		36.786	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test and Evaluation	WR	NSWCCD-SSES : Phila, PA	24.954	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	24.954	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management	C/CPFF	Herren Associates : Alexandria, VA	6.092	1.251	Oct 2018	1.584	Oct 2019	1.663	Oct 2020	-		1.663	Continuing	Continuing	Continuing
		Subtotal	6.092	1.251		1.584		1.663		-		1.663	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	244.154	21.448		25.408		38.449		-		38.449	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2471				
Power and Energy Systems	1	2019	4	2025
Naval Power Technology Development / Platforms Integration & transition	1	2019	4	2025
Situational Awareness, Boundary Enforcement & Response (SABER) previously Cybersecurity BDC	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	4.824	62.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	66.824
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Adds:

Silicon Carbide Power Modules (C447): FY 2019 of $4.824M and FY 2020 of $7.000M
Advanced Power Electronics Integration (C540): FY 2020 of $5.000M
Surface Combatant Component-level Prototyping (C541): FY 2020 of $50.000M

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Silicon Carbide Power Modules ***FY 2019 Accomplishments:*** Commenced development of requirements and Silicon Carbide (SiC) Power Converter Simulation, Medium Voltage (MV) SiC Semiconductor Module Refinement and Validation, and MV SiC Semiconductor Module Endurance Test and Prototype Power Converter Development ***FY 2020 Plans:*** Continue SiC power module efforts including development, qualification, and systems integration. Specific efforts include SiC semiconductor module refinement and validation, endurance test and prototype power converter development, modeling, prototype power converter testing, etc.	4.824	7.000
Congressional Add: Advanced power electronics integration ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Initiate design integration efforts of Silicon Power Modules into a new 4-6MW advanced power conversion module with integrated energy storage known as the Flexible Bus Node.	0.000	5.000
Congressional Add: Surface combatant component-level prototyping ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Initiate design activities and build initiation of Integrated Power and Energy (IPES) Test Facility known as the "ITF" as a land based test facility by refurbishment and reuse of certain DDG1000 developmental power system components, and other prototype hardware to support advanced controls development and	0.000	50.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
integration of distributed and federated energy storage into ship agnostic Tactical Energy Management for use on future surface ships.		
Congressional Adds Subtotals	4.824	62.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SiC Power Modules	C/CPFF	RCT : Linthicum Heights MD	0.000	4.000	Feb 2019	0.000		0.000		-		0.000	0.000	4.000	-
SiC Power Modules	Various	Various : Various	0.000	0.824	May 2019	7.000	May 2020	0.000		-		0.000	0.000	7.824	-
Adv. Power electronics Integration	Various	Various : Various	0.000	0.000		5.000	May 2020	0.000		-		0.000	0.000	5.000	-
Suface Combatant Component Level prototyping	Various	Various : Various	0.000	0.000		50.000	May 2020	0.000		-		0.000	0.000	50.000	-
		Subtotal	0.000	4.824		62.000		0.000		-		0.000	0.000	66.824	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	4.824		62.000		0.000		-		0.000	0.000	66.824	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9999																												
SiC Power Modules																												
Advanced Power Electronics Integration																												
Advanced Surface Component Prototyping																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
SiC Power Modules	2	2019	4	2021
Advanced Power Electronics Integration	2	2020	4	2021
Advanced Surface Component Prototyping	2	2020	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603576N / *CHALK EAGLE*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	33.943	54.877	71.181	-	71.181	82.623	102.058	118.197	133.430	Continuing	Continuing
1578: *Chalk Eagle*	0.000	33.943	54.877	71.181	-	71.181	82.623	102.058	118.197	133.430	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	29.353	64.877	59.895	-	59.895
Current President's Budget	33.943	54.877	71.181	-	71.181
Total Adjustments	4.590	-10.000	11.286	-	11.286
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-10.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	5.650	0.000			
• SBIR/STTR Transfer	-1.060	0.000			
• Program Adjustments	0.000	0.000	11.341	-	11.341
• Rate/Misc Adjustments	0.000	0.000	-0.055	-	-0.055

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,388.183	36.864	16.934	32.178	-	32.178	82.206	96.503	40.871	77.067	Continuing	Continuing
3096: *Littoral Combat Ship*	1,328.889	16.458	8.781	30.781	-	30.781	80.654	95.148	39.938	76.116	Continuing	Continuing
4506: *LCS Training*	49.643	10.759	1.153	1.397	-	1.397	1.552	1.355	0.933	0.951	Continuing	Continuing
9999: *Congressional Adds*	9.651	9.647	7.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.298

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 374

A. Mission Description and Budget Item Justification

The Littoral Combat Ship (LCS) Program Element (PE) provides funds for detailed design, development, construction, issue resolution, certification, integration, and testing of the Littoral Combat Ship (LCS). LCS operates with focused-mission packages that deploy manned and unmanned vehicles to execute a variety of missions, including Anti-Submarine Warfare (ASW), Surface Warfare (SUW) and Mine Countermeasures (MCM). LCS also possesses inherent capabilities, regardless of the Mission package installed, including intelligence/surveillance/reconnaissance (ISR), LCS SUW will also include Maritime Interdiction/interception Operations (MIO), Anti-Terrorism/Force Protection (AT/FP), air warfare self-defense, joint littoral mobility and logistic support for movement of personnel and supplies. This relatively small, shallow-draft, high-speed surface combatant complements the U.S. Navy's Surface Fleet by operating in environments where it is impossible or undesirable to employ larger, deeper-draft, multi-mission ships. LCS can deploy independently to overseas littoral regions or remain on station for extended periods of time either with a battle group or through a forward-basing arrangement. LCS will operate with Carrier Strike Groups, Surface Action Groups, or independently as dictated by the mission and environment. Additionally, LCS can operate cooperatively with the U.S. Coast Guard and Allies.

Beginning in FY 2021, this PE also provides funds for the design, development, engineering, implementation, and testing of the combat system modifications for Lethality and Survivability (L&S) for both LCS variants (Independence and Freedom). The L&S upgrades include the development of a common Combat Management System (CMS) and integration and testing of government furnished systems including the Gun Weapon System (GWS), Electronic Warfare (EW) system and Decoy Launching System (DLS) for both LCS Class Variant ships.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	37.997	9.934	34.581	-	34.581
Current President's Budget	36.864	16.934	32.178	-	32.178
Total Adjustments	-1.133	7.000	-2.403	-	-2.403
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	7.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.133	0.000			
• Program Adjustments	0.000	0.000	-0.625	-	-0.625
• Rate/Misc Adjustments	0.000	0.000	-1.778	-	-1.778

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *LCS Training Courseware*	9.647	0.000
Congressional Add: *Integrated fire control land-based test asset*	0.000	7.000
Congressional Add Subtotals for Project: 9999	9.647	7.000
Congressional Add Totals for all Projects	9.647	7.000

Change Summary Explanation

FY19: -$1.133M SBIR transfer
FY20: +$7.000M Congressional Add Integrated Fire Control Land Based Test Asset
FY21: -$1.999M due to availability of prior year execution balances; +$0.221M rate adjustments; -$0.625M for other program adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*				**Project (Number/Name)** 3096 / *Littoral Combat Ship*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3096: *Littoral Combat Ship*	1,328.889	16.458	8.781	30.781	-	30.781	80.654	95.148	39.938	76.116	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 374												

Note

The FY 2021 funding request has been reduced by $0.899M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The RDT&E portion of the LCS Program comprises design and development efforts required to field the LCS Class Ships, including integration with the Mission Packages (MCM, ASW and SUW) activities both pre- and post-delivery. It includes the design and development effort required to support the introduction and deployment of a Flight 0+ baseline (LCS 3/4 and Follow) with incorporation of lessons learned from the design and construction of USS FREEDOM (LCS 1) and USS INDEPENDENCE (LCS 2). Additionally, it includes design, development, issue resolution, certification and testing efforts required to support the design baseline for the six year block buy in FY10-15. This baseline will include lessons learned from the LCS 1 through LCS 4.

The LCS design and development phases include platform design and development, experimentation, ship system design and integration, hull platform testing, development of Technical Data Packages (TDPs), total ship system engineering and integration, combat systems and warfare systems certification, and planning and conduct of system testing. These efforts include procurement of combat and warfare system elements and/or simulators to support production representative testing in support of design, development, and certification efforts and ordnance in support of testing.

The RDT&E portion of LCS funding also comprises formal Developmental and Operational Assessment testing of the LCS Ships and Mission Packages. Test and Evaluation (T&E) will concentrate on verifying integration and interoperability of employed technologies and systems in the LCS seaframe designs and modular mission packages to achieve the mission capabilities and performance requirements as defined in the LCS program's Flight 0 and Flight 0+ Capabilities Development Documents (CDD). T&E functions will include the evaluation of Critical Technical Parameters (CTP), Measures of Effectiveness (MOE), Measures of Suitability (MOS), and Key Performance Parameters (KPP) for the core seaframe and the focused missions.

Beginning in FY 2021, this budget provides funds for the design, development, engineering, implementation, and testing of the combat system modifications for Lethality and Survivability (L&S) for both LCS variants (Independence and Freedom). The L&S upgrades include the development of a common Combat Management System (CMS) and integration and testing of government furnished systems including the Gun Weapon System (GWS), Electronic Warfare (EW) system, and Decoy Launching System (DLS) for both LCS Class Variants (Independence and Freedom)ships.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: LCS System-of-Systems Development, Engineering & Experimentation	14.030	6.697	5.902	0.000	5.902
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Provides for LCS program systems engineering in support of Flight 0, Flight 0+, the FY10 Block Buy baseline design, and future procurement baseline design, development, certification, and production (including ship system design and integration); combat system and C4I design, integration, and test; aviation (manned and unmanned) integration; Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) mission package (MP) integration; logistics product development; and various systems engineering activities required to perform risk analyses of new design and production technology concepts. ***FY 2020 Plans:*** Provide systems engineering support for SUW DT on the INDEPENDENCE Variant. Provide systems engineering support for ASW DT, TECHEVAL and IOT&E Mission Package on the FREEDOM Variant. ***FY 2021 Base Plans:*** Provide systems engineering support for MCM DT, MCM TECHEVAL, ASW DT ,and ASW IOT&E on INDEPENDENCE Variant. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in funding attributable to decrease in scope of efforts.					
Title: LCS Test & Evaluation	2.428	2.084	1.524	0.000	1.524
Articles:	-	-	-	-	-
Description: Execute formal LCS Developmental Testing and Operational Testing (DT/OT), including Live Fire Test & Evaluation (LFT&E), and procurement of T&E Ordnance. Execute DT and C4I integration and testing; aviation integration (manned and unmanned), Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW) and Surface Warfare (SUW) Mission Package (MP) integration. ***FY 2020 Plans:*** Conduct SUW DT on the INDEPENDENCE Variant. Conduct ASW DT Phase II, TECHEVAL, and IOT&E on the FREEDOM Variant. Begin planning MCM DT, TECHEVAL, and IOT&E on the INDEPENDENCE Variant. ***FY 2021 Base Plans:*** Conduct MCM DT, MCM TECHEVAL, ASW DT ,and ASW IOT&E on INDEPENDENCE Variant. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in funding attributable to decrease in scope of efforts.					
Title: LCS Lethality and Survivability	0.000	0.000	23.355	0.000	23.355
Articles:	-	-	-	-	-
Description: Provides engineering support to develop a common combat management system, leveraging COMBATSS-21 and a common source library, for installation on both LCS variants (Independence and Freedom). The Combat Systems baseline will be compatible with Program of Record (PoR) combat systems replacing Contractor Furnished Equipment (CFE) and integrate Over the Horizon (OTH) missile system. Funding includes logistic product development, Engineering Change Proposals (ECPs), ship structural analysis, development of an integrated test plan and cyber analysis to accomplish Risk Management Framework authorization. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Design and develop a common combat system for installation on both LCS variants (Independence and Freedom). The new baseline will interface with Program of Record Government Furnished Equipment(GFE) systems that will replace Contractor Furnished Equipment (CFE). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Beginning in FY21, funding for LCS Lethality and Survivability provides engineering support to develop a common combat management system for both LCS variants compatible with Program of Record (PoR) combat systems replacing Contractor Furnished Equipment (CFE) and to integrate Over the Horizon (OTH) missile system.					
Accomplishments/Planned Programs Subtotals	16.458	8.781	30.781	0.000	30.781

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/2127: *LCS Ship*	1,674.422	14.000	0.000	-	0.000	15.000	31.860	19.530	0.000	0.000	16,797.603
• 1604: *LCS In-Service Modernization*	0.000	0.000	0.000	31.388	31.388	63.185	66.907	87.729	85.567	Continuing	Continuing

Remarks

BLI 1604 supports Lethality and Survivability efforts on the LCS Ships

D. Acquisition Strategy

The LCS program takes an evolutionary approach to acquisition that emphasizes competition as a key to achieving affordability. Initially, two industry teams competed against each other with two distinctly different LCS designs. The decision produced two flights with a vessel from each design: Flight 0 (LCS 1 and LCS 2); and Flight 0+ (LCS 3 and out). The Flight 0+ baseline incorporates lessons learned from the design, construction, and testing of the Flight 0 ships. The Navy conducted a limited competition amongst the existing LCS industry teams or team participants for the award of a contract for the construction of a block buy of up to ten (10) LCS Flight 0+ Class ships, with an objective of competitively awarding a single contract to a single industry team.

By Acquisition Decision Memorandum of December 23, 2010, the USD (AT&L) authorized execution of an alternative acquisition strategy for the FY 2010 through FY 2015 procurement of 20 seaframes through two ten-ship block buy contracts. On December 29, 2010, the Navy awarded two contracts for block buys of up to ten ships, beginning with the award to each contractor of one FY 2010 ship and associated non-recurring engineering, the development of the Technical Data Package (TDP), core class services, and associated data. This was followed by the contractual funding of one ship to each contractor in FY 2011 and two ships each funded in FY 2012 through FY 2014.

On October 17, 2014 USD(AT&L) approved the Navy's plan to procure three ships in FY 2015 and three ships in FY 2016 by modifying the current block buy contracts. The modification to each of the block buy contracts completed the previously approved 20 ship block buy procurement and added options for two FY 2016 ships for a total of 26 LCS ships. The Navy's Acquisition strategy supported the procurement of three LCS ships in FY17, FY18, and FY19.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
L&S Product Development	SS/CPIF	LM : Moorestown, NJ	0.000	0.000		0.000		14.907	Jan 2021	-		14.907	Continuing	Continuing	Continuing
Product Development Summary	Various	Various : Various	479.868	0.000		0.000		0.000		-		0.000	0.000	479.868	-
		Subtotal	479.868	0.000		0.000		14.907		-		14.907	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NSWC/DD : Dahlgren, VA	72.273	2.460	Nov 2018	1.056	Nov 2019	1.374	Nov 2020	-		1.374	0.000	77.163	-
Government Engineering Support	WR	NSWC/PC : Panama City, FL	27.987	0.000		0.000		0.000		-		0.000	0.000	27.987	-
Government Engineering Support	WR	NUWC/N : Newport, RI	10.192	0.110	Nov 2018	0.122	Nov 2019	0.000		-		0.000	0.000	10.424	-
Government Engineering Support	WR	NAWC/AD : Pax River, MD	25.062	0.000		0.000		0.000		-		0.000	0.000	25.062	-
Government Engineering Support	WR	NSWC/CR : Crane, IN	17.722	0.000		0.000		0.000		-		0.000	0.000	17.722	-
Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	75.032	1.918	Nov 2018	1.105	Nov 2019	1.437	Nov 2020	-		1.437	0.000	79.492	-
Government Engineering Support	Various	Government Activities : Various	54.775	1.682	Nov 2018	1.180	Nov 2019	0.000		-		0.000	0.000	57.637	-
Contractor Engineering Support	C/CPAF	Alion/CSC : Arlington, VA	49.802	0.000		0.000		0.000		-		0.000	0.000	49.802	-
L&S Contractor Engineering Support	C/CPAF	Various : Various	24.678	1.641	Mar 2019	1.070	Mar 2020	0.798	Nov 2020	-		0.798	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.000		2.783	Oct 2020	-		2.783	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NAWC/AD : Saint Inigoes, MD	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/CR : Crane, IN	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
L&S Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	Government Activities : Various	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC/CD : Bethesda, MD	14.705	2.131	Feb 2019	1.044	Nov 2019	1.373	Nov 2020	-		1.373	0.000	19.253	-
L&S Government Engineering Support	WR	NSWC/CD : Bethesda, MD	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
Government Engineering Support	WR	PEO IWS : Various	5.375	2.945	Dec 2018	1.072	Mar 2020	0.000		-		0.000	0.000	9.392	-
L&S Government Engineering Support	WR	PEO IWS : Various	0.000	0.000		0.000		1.777	Oct 2020	-		1.777	Continuing	Continuing	Continuing
L&S Government Engineering Support	WR	NSWC/PHD : Port Hueneme, CA	0.000	0.000		0.000		0.490	Oct 2020	-		0.490	Continuing	Continuing	Continuing
Contractor Engineering Support	WR	General Dynamics Bath Iron Works : Bath, ME	0.933	0.000		0.000		0.000		-		0.000	0.000	0.933	-
Condition Based Maintenance	WR	NSWC/PHD : Port Hueneme, CA	5.180	0.000		0.000		0.000		-		0.000	0.000	5.180	-
Government Engineering Support	WR	NSWC/PHD : Port Hueneme, CA	0.917	1.143	Nov 2018	0.048	Nov 2019	1.718	Nov 2020	-		1.718	0.000	3.826	-
Frigate Government Engineering Support	WR	NSWC/CD : Carderock, MD	1.179	0.000		0.000		0.000		-		0.000	0.000	1.179	-
Frigate Government Engineering Support	WR	NSWC/PD : Philadelphia, PA	0.468	0.000		0.000		0.000		-		0.000	0.000	0.468	-
Frigate Contractor Engineering Support	C/CPAF	Alion : Arlington, VA	0.973	0.000		0.000		0.000		-		0.000	0.000	0.973	-
Frigate Contractor Engineering Support	C/CPAF	Booz Allen Hamilton : McLean, VA	0.345	0.000		0.000		0.000		-		0.000	0.000	0.345	-
		Subtotal	387.598	14.030		6.697		13.950		-		13.950	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation	C/CPAF	Alion/CSC : Arlington, VA	31.844	0.000		0.000		0.000		-		0.000	0.000	31.844	-
Test & Evaluation	WR	NSWC/PHD : Port Hueneme, CA	57.972	0.179	Nov 2018	0.079	Nov 2019	0.000		-		0.000	0.000	58.230	-
Test & Evaluation	WR	NSWC/PD : Philadelphia, PA	67.169	0.000		0.000		0.000		-		0.000	0.000	67.169	-
Test & Evaluation	WR	NSWC/PC : Panama City, FL	16.473	0.000		0.000		0.000		-		0.000	0.000	16.473	-
Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	14.893	0.757	Nov 2018	0.335	Nov 2019	0.342	Nov 2020	-		0.342	0.000	16.327	-
Test & Evaluation	WR	NSWC/COR : Corona, CA	18.431	0.106	Nov 2018	0.401	Nov 2019	0.000		-		0.000	0.000	18.938	-
Test & Evaluation	WR	Government Activities : Various	71.566	0.216	Mar 2019	0.096	Mar 2020	0.341	Nov 2020	-		0.341	0.000	72.219	-
Test & Evaluation	C/CPAF	LM/GD/Austal : Various	81.066	0.000		0.173	Mar 2020	0.341	Nov 2020	-		0.341	0.000	81.580	-
Test & Evaluation	WR	PEO C4I : Charleston, SC	11.562	0.000		0.000		0.000		-		0.000	0.000	11.562	-
T&E Ordnance/ Ammunition	WR	PEO IWS : Various	22.544	0.000		0.000		0.000		-		0.000	0.000	22.544	-
L&S Test & Evaluation	WR	NSWC/DD : Dahlgren, VA	0.000	0.000		0.000		0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
FSST Support	WR	NAVAIR : Patuxent River, MD	4.487	0.000		0.000		0.000		-		0.000	0.000	4.487	-
Range Support	WR	NAWC/WD : Pt. Mugu, CA	3.468	0.000		0.000		0.000		-		0.000	0.000	3.468	-
Test & Evaluation	WR	NSWC/CD : Bethesda, MD	22.614	1.170	Feb 2019	1.000	Nov 2019	0.000		-		0.000	0.000	24.784	-
FSST Support	C/BA	National Science Foundation : Arlington, VA	2.671	0.000		0.000		0.000		-		0.000	0.000	2.671	-
FSST Support	C/BA	NAVFAC Atlantic : Virginia Beach, VA	0.759	0.000		0.000		0.000		-		0.000	0.000	0.759	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation	C/BA	Naval Research Laboratory : Washington, DC	1.099	0.000		0.000		0.000		-		0.000	0.000	1.099	-
		Subtotal	428.618	2.428		2.084		1.524		-		1.524	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
L&S Program Management Support	WR	Various : Various	0.000	0.000		0.000		0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
Program Management Support- SEAPORT	C/CPAF	Alion/CSC : Arlington, VA	20.593	0.000		0.000		0.000		-		0.000	0.000	20.593	-
Program Management Support	Various	Various : Various	12.212	0.000		0.000		0.000		-		0.000	0.000	12.212	-
		Subtotal	32.805	0.000		0.000		0.400		-		0.400	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1,328.889	16.458		8.781		30.781		-		30.781	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Proj 3096

- LCS FSAR: LCS Final Survivability Assessment Report
- ADT: Air Defense Testing for Self Defense Test Ship
- ADST in Support of PRA Testing: Air Defense Seaframe Testing - INDEPENDENCE Variant
- DT SUW: Surface Warfare Developmental Test - Phase I - FREEDOM Variant
- TECHEVAL SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Technical Evaluation - FREEDOM Variant
- ADG Degaussing: Advanced Degaussing System - FREEDOM Variant
- AIMS Testing: Assessment and Identification of Mine Susceptibility - FREEDOM Variant
- AMISS Testing: Advanced Mine Simuation System - FREEDOM Variant
- VTUAV Dynamic Interface Testing: Vertical Take-off and Landing Unmanned Aerial Vehicle Dynamic Interface Testing - FREEDOM Variant
- IOT&E SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Initial Operational Test and Evaluation - FREEDOM Variant
- SUW DT: Surface Warfare Developmental Testing - INDEPENDENCE Variant

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 3096 / *Littoral Combat Ship*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3096				
LCS FSAR: LCS Final Survivability Assessment Report	1	2019	3	2019
ADT: Air Defense Testing for Self Defense Test Ship	1	2019	1	2019
ADST in Support of PRA Testing: Air Defense Seaframe Testing - INDEPENDENCE Variant	1	2019	3	2019
DT SUW: Surface Warfare Developmental Test - Phase I - FREEDOM Variant	1	2019	1	2019
TECHEVAL SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Technical Evaluation - FREEDOM Variant	1	2019	1	2019
ADG Degaussing: Advanced Degaussing System - FREEDOM Variant	1	2019	2	2019
AIMS Testing: Assessment and Identification of Mine Susceptibility - FREEDOM Variant	1	2019	3	2019
AMISS Testing: Advanced Mine Simuation System - FREEDOM Variant	1	2019	3	2019
VTUAV Dynamic Interface Testing: Vertical Take-off and Landing Unmanned Aerial Vehicle Dynamic Interface Testing - FREEDOM Variant	1	2019	2	2019
IOT&E SUW: Surface Warfare - Surface to Surface Mission Package (SSMM MP) Initial Operational Test and Evaluation - FREEDOM Variant	1	2019	3	2019
SUW DT: Surface Warfare Developmental Testing - INDEPENDENCE Variant	4	2019	1	2020
ASW DT: Anti-Submarine Warfare Developmental Test - FREEDOM Variant	1	2020	2	2020
ASW TECHEVAL: Anti-Submarine Warfare Technical Evaluation - FREEDOM Variant	2	2020	3	2020
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - FREEDOM Variant	3	2020	3	2020
ASW DT: Anti-Submarine Warfare Developmental Test - INDEPENDENCE Variant	1	2021	2	2021
DT MCM: Mine Countermeasures Mission Package Developmental Testing - INDEPENDENCE Variant	2	2021	3	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
ASW IOT&E: Anti-Submarine Warfare Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant	4	2021	1	2022
L&S IPR 1: LCS Lethality & Survivability In Progress Review	4	2021	4	2021
MCM TECHEVAL: Mine Countermeasures Mission Package Technical Evaluation - INDEPENDENCE Variant	4	2021	1	2022
MCM IOT&E: Mine Countermeasures Mission Package Initial Operational Test and Evaluation - INDEPENDENCE Variant	1	2022	2	2022
L&S IPR 2: LCS Lethality & Survivability In Progress Review	2	2022	2	2022
MCM DT: Modular Mine Countermeasure Mission Package Developmental Testing - FREEDOM Variant	3	2022	4	2022
L&S IPR 3: LCS Lethality & Survivability In Progress Review	4	2022	4	2022
MCM IOT&E: Modular Mine Countermeasure Mission Package Initial Operational Test and Evaluation - FREEDOM Variant	1	2023	1	2023
L&S IOT&E: LCS Lethality & Survivability Initial Operational Test and Evaluation - Both Variants	2	2023	4	2023
L&S Phase 2 TECHEVAL: LCS Lethality & Survivability Combat System Integration Analysis for Phase 2 - Both Variants	3	2023	3	2023
L&S Combat System Certification: LCS Lethality & Survivability Combat System Certification	1	2024	1	2024
L&S Combat System Test Period: LCS Lethality & Survivability Combat System Test Period	1	2024	3	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603581N / *Littoral Combat Ship*				Project (Number/Name) 4506 / *LCS Training*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
4506: *LCS Training*	49.643	10.759	1.153	1.397	-	1.397	1.552	1.355	0.933	0.951	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 374												

Note

The FY 2021 funding request was reduced by $1.100 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

As a minimally-manned ship, the LCS uses a Train-to-Qualify (T2Q)/Train-to-Certify (T2C) training process in an off-ship/shore-based virtual ship trainer environment. These simulators and blended training solutions focus on tactical, equipment operations, and maintenance training. When completely developed and procured, the LCS shore-based training capability will satisfy individual, team, unit, and force training, with an objective of meeting Capability Development Document (CDD) T2Q/T2C Key Performance Parameter (KPP) requirements.

FY 2021 funding will development upgrades of the Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. Additionally, after fielding more of the systems and courseware, out-year funding will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures, as well as test and evaluate training devices to verify compliance with requirements.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: LCS Total System Training Architecture	10.759	1.153	1.397	0.000	1.397
Articles:	-	-	-	-	-
FY 2020 Plans: FY20 funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. (Additionally, after fielding these systems and courseware, RDT&E funds will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures. RDT&E funds are also used to test and evaluate training devices to verify compliance with requirements.) This funding also provides NAWC TSD program management oversight while LCS deck operations (both variants) are completed, combat systems IVSE courseware and the combat systems part task trainer efforts are continued. (NAWC TSD will continue the development of the VTUAV visual display trainer, oversee performance of the development effort, while providing additional support efforts to the program). This funding also supports continued NAVFAC efforts preparing for additional small ship homeports required by the Strategic Laydown plan.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the training objectives. Additionally, after fielding these systems and courseware, RDT&E funds will be utilized to upgrade training to maintain conformity with LCS configurations and approved operational technical manuals and procedures. RDT&E funds are also used to test and evaluate training devices to verify compliance with requirements.) This funding also provides NAWC TSD program management oversight while LCS deck operations (both variants) are completed, combat systems IVSE courseware and the combat systems part task trainer efforts are continued. (NAWC TSD will continue the development of the VTUAV visual display trainer, oversee performance of the development effort, while providing additional support efforts to the program). This funding also supports continued NAVFAC efforts preparing for additional small ship homeports required by the Strategic Laydown plan. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The additional funding provides the development of additional Surface Training Advanced Virtual Environment (STAVE) courseware and associated simulators to achieve the LCS training objectives.					
Accomplishments/Planned Programs Subtotals	10.759	1.153	1.397	0.000	1.397

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/5664: *Surface Training Equipment*	227.791	233.175	195.033	-	195.033	128.097	82.968	85.932	78.793	Continuing	Continuing

Remarks

PEO USC funding accounts for only a portion of the OPN 5664 line.

D. Acquisition Strategy

Per the combined LCS Navy Training System Plan (NTSP), the LCS core crew training concept will meet Train to Qualify (T2Q) and Train to Certify (T2C) requirements incrementally, with expected completion in FY21. In the interim, individual qualifications for LCS crew members will be accomplished through a combination of vendor training, existing Navy training, new LCS courses and trainers that are presently online, and Under Instruction (U/I) time aboard LCS ships, prior to reporting for duty. Shore-based training requirements cannot be fully met with the interim LCS training strategy. Full realization will be achieved with the completed standup of the San Diego and Mayport, LCS Training Facilities (LTF), which include the Integrated Tactical Trainers, Bridge, Readiness Control Officer (RCO), Combat Systems and

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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Mission Package Training System (MPTS) part-task trainers, the Common Mission Package Trainer (CMPT), Mission Bay Trainer and Virtual Reality Labs to support the Train to Qualify operations and maintenance pipeline courses.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 4506 / *LCS Training*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Deck/Mission Bay Courseware	C/FFP	Cubic : Orlando, FL	1.878	0.000	Nov 2018	0.150	Nov 2019	0.225	Nov 2020	-		0.225	0.000	2.253	-
Combat Systems Courseware	C/FFP	Cubic : Orlando, FL	24.262	3.914	Nov 2018	0.150	Nov 2019	0.225	Nov 2020	-		0.225	7.800	36.351	-
Eng. Training Coursware	C/FFP	Cubic : Orlando, FL	1.092	0.000		0.000		0.000		-		0.000	0.000	1.092	-
Training Development - Support	WR	NAWC/TSD : Orlando, FL	11.125	0.587	Nov 2018	0.251	Oct 2019	0.344	Oct 2020	-		0.344	Continuing	Continuing	Continuing
VTUAV/MH60	C/FFP	TBD : TBD	0.000	0.000	Mar 2019	0.178	Nov 2019	0.186	Nov 2020	-		0.186	6.270	6.634	-
Combat System Part Task Trainer	C/FP	TBD : TBD	0.000	0.000	Mar 2019	0.000		0.000		-		0.000	0.000	0.000	-
Mission Bay Trainer	C/CPAF	Cubic : Orlando, FL	0.822	0.701	Aug 2019	0.000		0.000		-		0.000	0.000	1.523	-
		Subtotal	39.179	5.202		0.729		0.980		-		0.980	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Human Systems Integration	WR	NSWC, DD : Dahlgren Virginia	0.704	0.230	Jun 2019	0.030	Nov 2019	0.065	Nov 2020	-		0.065	Continuing	Continuing	Continuing
Information Assurance	WR	NSWC, DN : Dam Neck, VA	3.114	1.300	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Training ISEA	WR	NSWC/PHD : Port Huenume, CA	1.241	0.293	Jun 2019	0.194	Nov 2019	0.120	Nov 2020	-		0.120	Continuing	Continuing	Continuing
Warfare Center SME/ NAVFAC	WR	VARIOUS : VARIOUS	0.237	2.560	Nov 2018	0.050	Nov 2019	0.108	Nov 2020	-		0.108	Continuing	Continuing	Continuing
		Subtotal	5.296	4.383		0.274		0.293		-		0.293	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Support	C/CPAF	Various : Various	5.168	1.174	Mar 2019	0.150	Nov 2019	0.124	Nov 2020	-		0.124	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 4506 / *LCS Training*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	5.168	1.174		0.150		0.124		-		0.124	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	49.643	10.759		1.153		1.397		-		1.397	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 4506 / *LCS Training*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 4506 / *LCS Training*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4506				
Surface Training Advanced Virtual Environment (STAVE): DECK STAVE-Development: DECK STAVE - Development	1	2019	2	2025
Surface Training Advanced Virtual Environment (STAVE): Combat System Courseware Development: Combat System Courseware Development	1	2019	1	2024
Surface Training Advanced Virtual Environment (STAVE): VTUAV/MH60 Development: VTUAV/MH60 Contract Award	2	2020	2	2020
Surface Training Advanced Virtual Environment (STAVE): VTUAV/MH60 Development: VTUAV/MH60 Development	2	2020	4	2022
Training Development: Training Development: Training Development - Support	1	2019	4	2025
Combat System Part Task Trainer: Combat Systems Part Task Trainer - Contract Award	2	2020	2	2020
Combat System Part Task Trainer: Combat Systems Part Task Trainer - Development	2	2020	2	2022

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	9.651	9.647	7.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.298
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add funding will be used to develop Surface Training Advanced Virtual Environment (STAVE) courseware (previously titled Immersive Virtual Ship Environment (IVSE)), and associated simulators to achieve the training objectives. Funding will continue the courseware development efforts of the LCS STAVE Deck Operations (both variants FREEDOM / INDEPENDENCE), and LCS STAVE Combat Systems Trouble Shooting Courseware (both variants FREEDOM / INDEPENDENCE). FY20 Congressional Add funding to provide an LCS Integrated Fire Control Land Based Test Asset

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: LCS Training Courseware ***FY 2019 Accomplishments:*** Continue the Courseware development efforts of the LCS STAVE Deck Operations (both FREEDOM / INDEPENDENCE variants), and LCS STAVE Combat Systems Trouble Shooting Courseware (both FREEDOM / INDEPENDENCE variants). ***FY 2020 Plans:*** N/A	9.647	0.000
Congressional Add: Integrated fire control land-based test asset ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Congressional add to provide LCS integrated fire control land-based test asset.	0.000	7.000
Congressional Adds Subtotals	9.647	7.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Deck/Mission Bay Courseware	C/FFP	Cubic : Orlando, FL	3.625	3.763	Jun 2019	0.000		0.000		-		0.000	0.000	7.388	-
Combat Systems Courseware	C/FFP	Cubic : Orlando, FL	5.245	5.092	Jun 2019	0.000		0.000		-		0.000	0.000	10.337	-
Training Development Support	WR	NAWC TSD : Orlando, FL	0.781	0.792	Jun 2019	0.000		0.000		-		0.000	0.000	1.573	-
Integrated Fire Control Land Based Test Asset	C/FFP	SAAB : Syracuse, NY	0.000	0.000		7.000	Feb 2020	0.000		-		0.000	0.000	7.000	-
		Subtotal	9.651	9.647		7.000		0.000		-		0.000	0.000	26.298	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	9.651	9.647		7.000		0.000		-		0.000	0.000	26.298	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603581N / *Littoral Combat Ship*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
LCS Surface Training Advanced Virtual Environment (STAVE): LCS STAVE Deck Operations Development: LCS STAVE Deck Operations Development	1	2019	4	2019
LCS Surface Training Advanced Virtual Environment (STAVE): LCS STAVE Combat Systems Trouble Shooting Courseware Development: LCS STAVE Combat Systems Trouble Shooting Courseware Development	1	2019	4	2019
LCS Surface Training Advanced Virtual Environment (STAVE): Integrated Fire Control Land Based Test Asset: Integrated Fire Control Land Based Test Asset	2	2020	4	2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	422.832	15.710	17.251	17.843	-	17.843	17.991	18.353	18.724	18.646	Continuing	Continuing
0164: *Combat System Integration*	422.832	15.710	17.251	17.843	-	17.843	17.991	18.353	18.724	18.646	Continuing	Continuing

A. Mission Description and Budget Item Justification

Chief of Naval Operations (CNO) created the Navy's Strike Force Interoperability (SFI) program in 1998 in response to critical shortfalls in the introduction of integrated and interoperable System of Systems (SoS) to deploying Strike Forces. Interoperability concerns still exist today as new systems are introduced to the Fleet, interoperating with older systems, and the complexity of the Systems of Systems integration has continued to increase. These programs help prevent the situation that occurred in 1998 by catching those critical shortfalls before the systems are released to the Fleet. Warfighters depend on these programs on a daily basis to remove or reduce the interoperability risk associated with the systems they are tasked to operate. Commander, Naval Sea Systems Command (COMNAVSEA) acts as management lead for Joint System Command (SYSCOM) system certification policy and guidance and certifies platforms for interoperability within the platform and throughout the enterprise, in accordance with Commander, US Fleet Forces Command/Commander, Pacific Fleet COMUSFLTFORCOM/COMPACFLT) Ins. 4720.3C dated 18 SEP 2017 (C5ISR Modernization Policy). COMUSFLTFORCOM/COMPACFLT INST. 4720.3C also requires that COMNAVSEA act as administrative agent for Naval Information Forces (NAVIFOR) Command and Control, Communications, Computers, Combat Systems, Intelligence, Surveillance and Reconnaissance Modernization Process (C5IMP), and execution agent for Navy Command and Control, Communications, Computers, Combat Systems, Intelligence, and Surveillance and Reconnaissance Modernization Council (NCMC). This program conducts Interoperability Assessments that are required to certify Aircraft Carriers, Amphibious Assault Ships, and Surface Combatants in accordance with the Naval Warfare System Certification Policy (NWSCP) NAVSEAINST 9410.2A, NAVAIR 5230.20, AND SPAWAR 5234.1). The SFI program ensures overall Strike Force Interoperability is characterized and assessed. COMNAVSEA is assigned central United States Navy (USN) responsibility for interoperability, directing the development of policy and architecture for Strike Force Warfare Systems engineering and implementation of common warfare systems engineering processes.

There are three priorities within the Strike Force Interoperability Program:

(1) Support Fleet "as-is" state which includes Navigation System Certification (NAVCERT), Strike Group Interoperability (SGI) Capabilities & Limitations (CAPS&LIMS), and Interoperability Tactical Information Coordinator Technical Aids (TIC TECHAIDs). These functions provide the critical review, assessment and documentation to properly inform the warfighter of the status of the interoperability for the systems they operate.

(2) Support Ship's system modernization (non-HME) including warfighting capability & other C5I upgrades including C5IMP Baseline Management. These functions ensure the warfighter is provided integrated and interoperable fielded systems to fulfill mission success.

(3) Support Ship Warfare System Certification & Force Level Assessments. This includes Warfare Systems Certification, Interoperability Certification, Force Level Interoperability Analysis, & Assessments, Cybersecurity Assessments and recommendations for improvements to the program offices for implementation at the systems'

level. This critical function provides the confidence to the warfighter they are getting the best possible systems and that through the certification process the systems have been properly tested and assessed to ensure the best possible interoperability.

Project 0164 Combat System Integration:
This project consists of four key Pillars executed within the Strike Force Interoperability (SFI) Program:

(1) Command & Control, Communications, Computer, Combat Systems, Intelligence, Surveillance and Reconnaissance (C5ISR) Modernization Process (C5IMP). The C5IMP validates the introduction of new systems and upgrades to existing systems into the fleet and ensures systems' maturity prior to shipboard installation thereby reducing risk and enhancing readiness and effectiveness of deploying ships and strike groups.

(2) Warfare Systems Certification (WSCERT), which is essential to validating the maturity and operational performance of warfare systems prior to Fleet delivery and deployment.

(3) The integrated Navigation System Certification (NAVCERT) program certifies the shipboard integrated navigation suite for safe navigation using the Electronic Charting and Display Information System Navy (ECDIS-N) as the primary plot. To support Strike Force Interoperability and ship's mission requirements, it ensures that the installed integration navigation suite provides accurate and timely navigation information (position, velocity, speed, heading, roll, and pitch) to all navigation data consumers (Warfare/Weapons Systems, Control Systems, and precision approach and landing systems). This ensure the safe maneuver of naval forces to execute missions throughout the full spectrum of conflict.

(4) Interoperability Certification and Assessment (IOP C&A) is the critical independent assessment of strike group warfare systems operational performance. Interoperability assessment examines force level engagement threads, aircraft control, air battle management, and operational displays to ensure the warfighter is being provided the most interoperable systems available. Assessments of deploying ships in strike force configurations are accomplished through the use of the Navy's Distributed Integration and Interoperability Assessment Capability (DIIAC) which supports the Deputy Assistant Secretary of the Navy (DASN) "shift to the left" policy by providing early interoperability testing in the acquisition lifecycle. It is a Commander, U.S. Fleet Forces Command (CFFC) and Commander U.S. Pacific Fleet (COMPACFLT) requirement that all strike forces undergo interoperability assessment testing in the DIIAC prior to deployment. The support for DASN and requirements of the combatant commander cannot be accomplished without the full funding of these programs. Interoperability certification results are used to develop fleet tactical tools (Capabilities & Limitations (C&L) documentation and Tactical Information Coordinator Technical Aids (TIC TECHAIDS)) on which the warfighters rely daily, that ensure that systems' operators understand the interoperability capabilities and limitations of their combat systems, as well as all units within the networked architecture, and have the watch station tools necessary for the execution of their tactical responsibilities. These are Fleet desired and NAVSEA required programs that must be fully funded to ensure the warfighter awareness of Strike Force Interoperability.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	16.351	17.251	16.015	-	16.015
Current President's Budget	15.710	17.251	17.843	-	17.843
Total Adjustments	-0.641	0.000	1.828	-	1.828
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.641	0.000			
• Program Adjustments	0.000	0.000	1.708	-	1.708
• Rate/Misc Adjustments	0.000	0.000	0.120	-	0.120

Change Summary Explanation

FY19: Funding reduced in the amount of $0.641M for Small Business Innovative Research (SBIR) transfer.

FY21: Funding increased by $1.828M for Strike Force Interoperability (SFI) Core Program Wholeness and increase in scheduled NAVCERTs.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603582N / *Combat System Integration*				Project (Number/Name) 0164 / *Combat System Integration*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0164: *Combat System Integration*	422.832	15.710	17.251	17.843	-	17.843	17.991	18.353	18.724	18.646	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 0164: Combat System Integration:

This project consists of four key Pillars executed within the Strike Force Interoperability (SFI) Program:

(1) Command & Control, Communications, Computer, Combat Systems, Intelligence, Surveillance and Reconnaissance (C5ISR) Modernization Process (C5IMP). The C5IMP validates the introduction of new systems into the fleet and ensures systems' maturity prior to shipboard installation thereby reducing risk and enhancing readiness and effectiveness of deploying ships and strike groups.

(2) Warfare Systems Certification (WSCERT), which is essential to validating the maturity and operational performance of warfare systems prior to Fleet delivery and deployment.

(3) The integrated Navigation System Certification (NAVCERT) program certifies the shipboard integrated navigation suite for safe navigation using the Electronic Charting and Display Information System Navy (ECDIS-N) as the primary plot. To support Strike Force Interoperability and ship's mission requirements, it ensures that the installed integration navigation suite provides accurate and timely navigation information (position, velocity, speed, heading, roll, and pitch) to all navigation data consumers. This supports the following mission critical functions: pre-launch aircraft alignment, safe aircraft precision approach and landing operations, and accurate warfare/weapon systems targeting.

(4) Interoperability Certification and Assessment (IOP C&A), the independent assessment of strike group warfare systems operational performance. Interoperability assessment examines force level engagement threads, aircraft control, air battle management, and operational displays. Assessments of deploying ships in strike force configurations are accomplished through the use of the Navy's Distributed Integration and Interoperability Assessment Capability (DIIAC) which supports the Deputy Assistant Secretary of the Navy (DASN) "shift to the left" policy by providing early interoperability testing in the acquisition lifecycle. It is a Commander, U.S. Fleet Forces Command (CFFC) and Commander U.S. Pacific Fleet (COMPACFLT) requirement that all strike forces undergo interoperability assessment testing in the DIIAC prior to deployment. Interoperability certification results are used to develop fleet tactical tools (Capabilities & Limitations (C&L) documentation and Tactical Information Coordinator Technical Aids (TIC TECHAIDS)), that ensure that systems' operators understand the interoperability capabilities and limitations of their combat systems and have the watch station tools necessary for the execution of their tactical responsibilities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Navigation System Certification (NAVCERT)	1.225	1.117	1.152	0.000	1.152

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-

Description: Modern warfare systems installed in US Navy ships require accurate position and time to achieve required effects. At the strike force level, accurate position and time are required to enable interoperability of warfighting systems of systems. The Integrated Navigation Suite Certification (NAVCERT) pillar of SFI certifies the accuracy of ship's position information, and verifies that it is properly distributed to sensors and weapons systems installed in US Navy ships. Certification is required at five-year intervals, following Chief of Naval Operations Availabilities greater than six months, in support of Precision Approach and Landing System (PALS) certification, or when configuration changes have been made to the ships integrated navigation suite. Certification testing verifies the accuracy of sensors that determine heading, velocity, attitude, and position; and validates receipt of navigation data by all- consuming systems including Integrated Warfare (or Mission) Systems, Aircraft Inertial Alignment System, and Control Systems. The scope of the certification includes all inertial navigation system equipment as well as the Electronic Chart Display and Information System - Navy (ECDIS- N). Forecasting out year NAVCERT requirements is based on the projection of expiring certifications, scheduled maintenance availabilities, and modernization of installed integrated navigation systems. Wherever possible, the program leverages integrated navigation suite modernization efforts to reduce overall program costs.

FY 2020 Plans:
Conduct 25 scheduled NAVCERTs on Cruisers, Destroyers, Aircraft Carriers, and Amphibious Ships. Verify accuracy of ships heading, velocity, attitude, and position data and validated receipt by all integrated warfare systems. Document discrepancies and assess risk to safety of navigation and warfighting missions. Conduct scheduled NAVCERTS on USN Surface ships. Continue to minimize costs by leveraging test results from conjunctive alterations to navigation systems during modernization periods, wherever possible.

FY 2021 Base Plans:
(1) Conduct 27 scheduled NAVCERTS on USN Surface ships. Continue to minimize costs by leveraging test results from conjunctive alterations to navigation systems during modernization periods, wherever possible.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase due to Strike Force Interoperability (SFI) Core Program Wholeness and increase in scheduled NAVCERTs.					
Title: Command , Control, Communications, Computers, Combat Systems, Intelligence, Surveillance and Reconnaissance (C5ISR) Modernization Process (C5IMP)	2.093	2.208	2.208	0.000	2.208
Articles:	-	-	-	-	-
Description: Achieving and maintaining Strike Force Interoperability requires disciplined engineering, system integration, and configuration management at both the platform (ship or shore station) and strike force level (Carrier Strike Group/ Amphibious Readiness Group). The Command, Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, Reconnaissance (C5ISR) Modernization Program (C5IMP) pillar of SFI ensures deploying strike force ships receive modernized and interoperable warfighting capabilities in order to meet theater operational requirements. This project funds engineering assessments of proposed C5I capability improvements to determine maturity for installation as well as technical and schedule risk associated with proposed hardware and software changes. This project directly supports requirements of the Fleet C5I Modernization Policy (per COMUSFLTFORCOM/COMPACFLT Inst. 4720.3) which assigns responsibilities to NAVSEA 05H to assess operational risks associated with C5ISR modernization in both afloat and ashore units in support of the Optimized Fleet Response Plan (OFRP). The deliverables of this project are created by determining the maturity, through engineering analysis, of the critical linchpins needed to achieve interoperability for each proposed C5IMP capability improvement item to be installed in a ship's baseline, developing installation recommendations of C5I system upgrades for the Fleet Commanders, and researching and analyzing installation or operating problems. Failure to achieve required maturity for one system that is part of an interoperable warfare system package can prevent this system from being installed, thus breaking the capability planned for the entire original warfare package, which will impact Strike Group warfighting capabilities. There is close coordination with the FLTCDRs and TYCOMs as well as other members of the C5IMP community to address, coordinate, and resolve C5IMP modernization issues thereby reducing risk and enhancing readiness and effectiveness of deploying ships and strike groups. Focus is on key milestones such as Baseline Locking Events (BLEs) and Planned Not Authorized (PNA) reviews, and SG/ARG Analysis Reports which are Fleet required events. The BLEs, PNA Reviews, and SG/ARG Analysis Reports are the primary work products in the C5IMP process. Additionally, due to emerging warfighting requirements and the development of required hardware and software changes between CNO Availability periods, an electronic change control board has been developed (BFI-CCB) to facilitate the request, review and approval of proposed Baseline changes. Forecasting C5ISR requirements and schedules is based on the projection of ships' operating/maintenance schedules at the particular point in time. Due to changing operational needs, these schedules frequently change					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
causing availability extensions, deferrals, cancellations, or delays. The supporting C5IMP/C5ISR schedules must adjust accordingly, resulting in regular modifications to the numbers of events/requirements projected for C5IMP/C5ISR from period to period. C5ISR Configuration Control is maintained and updated continuously for every ship. Maintenance of the Afloat Master Planning System (AMPS) data for the approximately 285 active Battle Force ships, along with establishing initial configurations for the New Construction ships entering the Fleet each year is essential and a major effort. This data is extracted and formatted to develop the BLE and PNA Review presentations which enable the Fleet commanders and TYCOMs to make informed modernization decisions. Additionally, numerous data calls are requested each month to answer configuration queries and perform studies utilizing AMPS data. CUSFFC/CPF Instruction 4720.3C designates NAVSEA 05H4 as the executing agent for the two NCMCs held each year. This requires C5IMP personnel to make all logistical and administrative arrangements for the 150+ attendees, collect and present all briefs, set up VTC and phone centers for remote attendees, and maintain all associated records for these councils. Fleet Commanders, TYCOMs, SYSCOMs and supporting personnel gather at NCMCs to discuss advance plans, coordinate near term modernization plans, coordinate shore and shipboard installations to ensure support prior to deployments, resolve schedule issues and establish priorities. Action items are recorded and tracked by NAVSEA, and major issues are reported to a joint FFC/CPF flag/SES panel. ***FY 2020 Plans:*** (1) Facilitate reviews, assessments, and execution of C5ISR installations during approximately 81 CNO Availabilities. (2) Review approximately 820 warfare system Ship Change Documents. Assess impact to Strike Force Interoperability. Create and maintain database entries for approximately 1,300 new software and hardware upgrades to be entered and tracked in the Afloat Master Planning System (AMPS), the fleets authoritative database for C5I modernization. (3) Plan and execute 2 NCMCs. Identify and resolve fleet warfare system modernization issues. (4) Conduct 12 Monthly Baseline Locking Events where 105 Ships' Baselines will be reviewed and locked and 12 monthly PNA Review Meetings where the PNA status of 94 Ships will be reviewed. (5) Provide 2 SG/ARG Analysis Reports. Analyze assigned strike force mission areas. Identify misalignments in warfare system modernization planning that result in strike force interoperability issues that degrade primary/secondary missions and develop recommendations to resolve.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(6) Evaluate, comment on, and process approximately 2500 proposed Baseline changes via the Electronic Change Control Board process (BFI-CCB). These changes will include requests for addition of new hardware and software to ships, deletion from planned installations, and TCD Waiver requests. (7) Establish initial warfare system baselines for 8 new construction ships. ***FY 2021 Base Plans:*** (1) Facilitate reviews, assessments, and execution of C5ISR installations during seventy-four (74) CNO Availabilities. (2) Support two (2) NCMCs (3) Support twelve (12) Monthly Baseline Locking Events where sixty (64) Ships' Baselines will be reviewed and locked by the respective Fleet Commander representatives and twelve (12) monthly PNA Review Meetings where the PNA status of sixty (60) ships will be reviewed. (4) Evaluate, comment on, and process approximately 2500 proposed Baseline changes via the Electronic Change Control Board process (BFI-CCB). These changes will include requests for addition of new hardware and software to ships, deletion from planned installations and TCD Waiver requests. (Note: Due to existing funding shortfalls, no O-FRP products are currently planned to be produced). ***FY 2021 OCO Plans:*** N/A					
Title: Interoperability Certification and Assessment	10.469	11.336	11.705	0.000	11.705
Articles:	-	-	-	-	-
Description: This warfare critical project funds interoperability assessments via the Distributed Integration & Interoperability Assessment Capability (DIIAC), the technical assessment of interoperable systems to meet mission requirements, the updating of Strike Group Capabilities and Limitations (C&L) and the updating of the Tactical Information Coordinator Technical Aids (TIC TECHAIDs). The project ensures NAVSEA/PEOs are delivering mature and interoperable warfare systems at the platform and Strike Group levels to the warfighter, with NAVSEA providing Strike Force interoperability certification and assessments. This project focuses on force-level impact of new systems and platforms under development. Interoperability Assessments of deploying ships in Strike Force configurations are accomplished through the utilization of the Navy's DIIAC, located at multiple Navy land-based sites located across the country and connected via networking technology, and that provides operational configurations for all naval combat systems. It is a U.S. Fleet Forces Command requirement that all Strike Forces undergo Interoperability Assessment Testing in the DIIAC prior to deployment.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The DIIAC provides the only opportunity for comprehensive interoperability testing of combat system and C5I configuration items prior to shipboard delivery for operational use in surface combatant platforms and Strike Groups. DIIAC, with its ability to test systems in a Strike Group environment, is funded to support the warfare system's acquisition community to test their developmental items for interoperability. However, in this instance, while funds are provided to test the item in a Strike Group environment, funds are not provided for subsequent data analysis and risk assessment, as this is the cognizant acquisition program's responsibility. When the acquisition development is complete and corrections are made, DIIAC will then fund for the full interoperability certification testing of the baseline to include the requisite warfare system analysis and risk assessments needed to obtain an Interoperability Certification. Note, this effort also supports and feeds into the development of Fleet Tactical Tools such as Capabilities & Limitations (C&L) and Tactical Information Coordinator Technical Aids (TIC TECHAIDs), which are relied on daily to ensure that operators/warfighters understand the interoperability capabilities and limitations of their combat and C5I systems. C&Ls are published for all Strike Groups, Independent Deployers, and (when funded) their Coalition and Joint partners. TIC TECHAIDS are delivered to deploying Carrier Strike Groups (CSG's), Amphibious Ready Group (ARG's) and Independent Deployers prior to workups and then a final copy is provided prior to deployment. C&L and TIC TECHAIDS are the final report-out to Fleet operators/warfighters of the acquisition community's efforts. They are used on a daily basis and relied upon in every operational theater, as well as in every Navy and Joint Schoolhouse. Note, the DIIAC infrastructure is available, but not funded to support the surface Navy's participation in the Joint Testing Environments as well as the Maritime Theater Missile Defense (MTMD) Coalition Forces interoperability testing. ***FY 2020 Plans:*** (1)Conduct three (3) Interoperability Land-Based test events including the following: -Development interoperability test to support for ACS 9.C2.2 (B31); SSDS 10.11.02 (CVN Configuration); SSDS 10.11.0X (CVN 78 Configuration); and DDG 1000 (B8.9) -Certification Interoperability test for ACS 9.C2.2 (B31); AEGIS 5.4; SSDS 10.11.01 (LHD Configuration); SSDS 10.11.02 (CVN Configuration); and SSDS 10.11.0X (CVN 78 Configuration) -Certification Interoperability Risk assessment & Report for ACS 9.C2.1 (B29); ACS 9.A2.1 (B29); AEGIS 5.4; SSDS 10.11.01 (LHD Configuration) (2) Complete C&L and TIC TECHAIDS, normally a near constant yearly demand requirement. This will result in updates to Interoperability C&L for: -Thirty-four (34) Deploying Strike Group Ships (from a database containing 209 U.S. Surface Ships) and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Ten (10) Naval Air Squadrons (covering F/A-18s, F-35, E-2Cs, E-2Ds, MH-60Ss, MH-60Rs, EA-6Bs, EA-18Gs, P-3Cs and P-8As) (Note: Testing of all new Combat Systems will include IFF Mode 5 testing) (3) Provide annual deliveries of Initial/Draft/Final TIC TECHAIDS to: -Five (5) Carrier Strike Groups (CSG's) Thirty Two (32) Ships -Four (4) Amphibious Ready Group's (ARG's) Eight (8) Ships -Thirty-Five (35) BMD Ships -Fourteen (14) Forward Deployed Naval Force (FDNF) Ships - Forty Four (44) Independent Deploying Ships (CVN, CG, DDG, LCC and LCS) -Aegis Ashore Site (Romania) -Four (4) Fleet Area Control and Surveillance Facilities (FACSFAC's) -Ten (10) Fleet Maritime Operations Centers (MOC's) sites. (4) Support three (3) Interoperability Land-Based test events.					
FY 2021 Base Plans: (1) Conduct three (3) Interoperability Land-Based test events including the following: -Development interoperability test to support for ACS 9.C2.X (B35); ACS 9.A2.X (B35); DDG 1000 (B8.9); LCS Freedom 3.2 and LUSV -Certification Interoperability test for ACS 9.C2.X (B35); AEGIS 9.A2.X (B35); DDG 1000 (B8.9); LCS Freedom 3.2; and LUSV -Certification Interoperability Risk assessment & Report for ACS 9.C2.2 (B31); ACS 9.C2.X (B35); AEGIS 9.A2.X (B35); DDG 1000 (B8.9); and LCS Freedom 3.2 (2) Complete C&L and TIC TECHAIDS, normally a near constant yearly demand requirement, also address AEGIS Ashore. This will result in updates to Interoperability C&L for: -Twenty-six (26) Deploying Strike Group Ships (from a database containing 215 U.S. Surface Ships) and -Ten (10) Naval Air Squadrons (covering F/A-18s, F-35, E-2Cs, E-2Ds, MH-60Ss, MH-60Rs, EA-6Bs, EA-18Gs, P-3Cs and P-8As). (3) Provide annual deliveries of Initial/Draft/Final TIC TECHAIDS to: -Five (5) Carrier Strike Groups (CSG's) Thirty (30) Ships -Four (4) Amphibious Ready Group's (ARG's) Eight (8) Ships -Thirty-Five (35) BMD Ships -Fourteen (14) Forward Deployed Naval Force (FDNF) Ships - Forty Five (45) Independent Deploying Ships (CVN, CG, DDG, LCC and LCS) -Aegis Ashore Site (Romania and Poland)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Four (4) Fleet Area Control and Surveillance Facilities (FACSFAC's) -Ten (10) Fleet Maritime Operations Centers (MOC's) sites. - Support three (3) Interoperability Land-Based test events ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due to Strike Force Interoperability (SFI) Core Program Wholeness.					
Title: Warfare Systems Certification	1.923	2.590	2.778	0.000	2.778
Articles:	-	-	-	-	-
Description: Strike Force Interoperability (SFI) begins with properly engineered warfare systems installed in US Navy Ships. The Warfare Systems Certification (WSCERT) pillar of SFI certifies that modernized warfare systems are ready for installation, properly installed, and meet warfighting mission area requirements, to include the systems' interoperability and functional integration within the Strike Force that enables successful mission accomplishment. It funds the collection and independent technical assessment of that interoperability and integration using empirically derived Objective Quality Evidence (OQE) that installed warfare systems meet required performance specifications. Using established evaluation criteria, the project assesses the maturity of proposed warfare system modernizations prior to installation and certifies readiness of modernized warfare systems for operational deployment in ships, either independently or as components of Carrier/Expeditionary Strike Groups. When evaluation criteria are not met, the program funds the development and approval of operational risk assessments. This includes conducting an analysis of all work-arounds documented in Tactics, Techniques, and Procedures (TTPs), Capabilities & Limitations (C&L), and Trouble Reports (TR) to ensure that aggregate deficiencies and work-arounds do not render the warfare system, to include the operator, ineffective. NAVSEA accomplishes these efforts through a sequential series of technical reviews that begin 18-36 months prior to a scheduled modernization of a ship's warfare system, which includes development of a Warfare System Certification Plans (WSCP), conduct of Warfare Systems Certification Readiness Reviews (WSCRR), conduct of Warfare Systems Installation Assessments (WSIA), and prior to deployment, conduct of a Warfare Systems Certification Decisions (WSCD). ***FY 2020 Plans:*** (1) Develop, analyze and maintain scheduling and installation data required for the conduct of Warfare Systems Certification events for a subset of 20 criteria for 110 ships, including efforts for the conduct approximately 130 Warfare					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Systems Certification Events (WSIAs, and WSCDs) and development of sixty-four (64) WSCPs for applicable ship classes. (2) Full implementation and assessment of efficiencies identified in FY19. (3)Continue to strive for WSCERT execution efficiencies through workforce streamlining initiatives, criteria management and consolidation of WSCERT events. (4)Implement develop and implement a secure online tool to create, review, approve, monitor, and track warfare system non-compliances. ***FY 2021 Base Plans:*** (1) Conduct Warfare Systems Certifications Events for a subset of twenty (20) criteria for one hundred ten (115) ships, including efforts for approximately one hundred thirty (146) Warfare Systems Certification Events (WSIAs, and WSCDs) and development of seventy-three (73) WSCPs for applicable ship classes. (2) Continue to strive for significant WSCERT execution efficiencies through workforce streamlining initiatives, criteria management and consolidation of WSCERT events. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due Strike Force Interoperability (SFI) Core Program Wholeness.					
Accomplishments/Planned Programs Subtotals	15.710	17.251	17.843	0.000	17.843

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 2960: *ICSTF: Integrated Combat System Test Facility*	6.251	6.028	5.934	-	5.934	6.073	6.185	6.257	6.370	0.000	92.039

Remarks

D. Acquisition Strategy

RDTEN funding under this line supports independent certification of the integration of major capability upgrades acquired by Program Executive Offices (PEOs) into host Navy Platforms and Strike Forces. The RDTEN engineering and certification activities at field sites do not involve direct procurement of equipment or engineering

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services, and hence no acquisition strategy is required. The major capability upgrades evaluated under this program fall under their associated PEOs' acquisition strategies.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SF Requirements Engineering & Analysis	WR	NSWCs : DN/PHD/ Corona	5.157	0.000		0.000		0.000		-		0.000	0.000	5.157	-
SF Requirements Engineering & Analysis	WR	Non-NSWCs : Various	5.295	0.000		0.000		0.000		-		0.000	0.000	5.295	-
Platform/Strike Force Certification	WR	NSWCs : DD/ICSTD/ DN/Corona	39.732	0.000		0.000		0.000		-		0.000	0.000	39.732	-
Platform/Strike Force Certification	WR	Non-NSWCs : Various	27.843	0.000		0.000		0.000		-		0.000	0.000	27.843	-
Fleet Response Plan (FRP)	WR	NSWCs : DD/PHD/ DN	27.030	0.000		0.000		0.000		-		0.000	0.000	27.030	-
Fleet Response Plan (FRP)	WR	Non-NSWCs : Various	3.793	0.000		0.000		0.000		-		0.000	0.000	3.793	-
Combat Systems Cert ISO Platform Cert	WR	NSWCs : DN/DD/ PHD/Corona	24.640	0.000		0.000		0.000		-		0.000	0.000	24.640	-
Combat Systems Cert ISO Platform Cert	WR	Non-NSWCs : Various	1.853	0.000		0.000		0.000		-		0.000	0.000	1.853	-
C5IMP & Fleet Readiness	WR	NSWCs : PHD	14.096	2.575	Nov 2018	2.407	Nov 2019	2.473	Nov 2020	-		2.473	Continuing	Continuing	Continuing
C5IMP & Fleet Readiness	C/CPFF	Non-NSWCs : Various	0.240	0.198	Dec 2018	0.366	Dec 2019	0.372	Dec 2020	-		0.372	0.000	1.176	-
Warfare Systems Certification	WR	NSWCs : DD/Crane	18.503	0.285	Nov 2018	0.342	Nov 2019	0.351	Nov 2020	-		0.351	Continuing	Continuing	Continuing
Warfare Systems Certification	WR	Non-NSWCs : Various	3.500	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
CNI/Design Agent	SS/CPAF	General Dynamics : Not Specified	47.926	0.000		0.000		0.000		-		0.000	0.000	47.926	-
CNI/Software Engineering	WR	NSWC : Dahlgren	8.383	0.000		0.000		0.000		-		0.000	0.000	8.383	-
CNI/Test and Evaluation	WR	CDSA : Not Specified	3.922	0.000		0.000		0.000		-		0.000	0.000	3.922	-
CNI/Systems Engineering	WR	NSWC : PHD	2.645	0.000		0.000		0.000		-		0.000	0.000	2.645	-
CNI/Miscellaneous	WR	Various : Not Specified	7.529	0.000		0.000		0.000		-		0.000	0.000	7.529	-
OA Automated Test and Retest	WR	NSWCs : Various	17.500	0.000		0.000		0.000		-		0.000	0.000	17.500	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contract Engineering Support	C/CPFF	Gryphon Technology : VA	36.975	4.340	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Contract Program Management Support	C/CPFF	Delta Resources Inc. : VA	8.466	0.000		0.377	Jan 2020	0.387	Jan 2021	-		0.387	0.000	9.230	-
Travel	Allot	NAVSEA HQ : Washington, DC	2.371	0.019	Jan 2019	0.025	Jan 2020	0.026	Jan 2021	-		0.026	0.000	2.441	-
Interoperability Fixes	WR	NSWCs : Various	1.500	0.000		0.000		0.000		-		0.000	0.000	1.500	-
TIC TECHAIDS	WR	CSC : VA	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Warfare Systems Cybersecurity	WR	NSWCs : PHD, Dahlren & Corna	5.408	0.000	Jan 2019	0.000		0.000		-		0.000	0.000	5.408	-
Capabilities & Limitations	WR	NSWCs : PHD	11.134	2.539	Nov 2018	2.994	Nov 2019	3.076	Nov 2020	-		3.076	0.000	19.743	-
Cybersecurity IA	C/CPFF	CSC : VA	0.544	0.000		0.000		0.000		-		0.000	0.000	0.544	-
Contract Engineering Support	C/CPFF	Delta Resources Inc. : VA	1.110	0.000		3.612	Jan 2020	3.711	Jan 2021	-		3.711	0.000	8.433	-
		Subtotal	327.095	9.956		10.123		10.396		-		10.396	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Combat System Integration Testing (CSIT)	WR	NSWCs : DD/ICSTF	5.736	0.000		0.000		0.000		-		0.000	0.000	5.736	-
Interoperability Certification Assessment	WR	NSWCs : DD/ SPAWAR/San Diego	26.804	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Navigation System Certification	WR	NIWC : Charleston, SC	12.161	1.185	Nov 2018	1.322	Nov 2019	1.358	Nov 2020	-		1.358	0.000	16.026	-
DIIAC Engineering and Operations	WR	NSWCs : DD/DN/ SPAWAR	23.882	1.694	Jan 2019	1.974	Jan 2020	2.028	Jan 2021	-		2.028	Continuing	Continuing	Continuing
DEP Engineering and Operations	WR	NSWCs : Various	12.623	0.000		0.000		0.000		-		0.000	0.000	12.623	-
Interoperability Cert Assessment	WR	NSWCs : DD/DN/ Corona	8.425	1.980	Nov 2018	2.418	Nov 2019	2.484	Nov 2020	-		2.484	0.000	15.307	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Interoperability Cert Assessment	C/CPFF	Non-NSWCS : CNA	3.775	0.702	Jan 2019	1.414	Jan 2020	1.577	Jan 2021	-		1.577	0.000	7.468	-
Interoperability Cert Assessment	C/CPFF	CSC : Washington, DC	1.063	0.193	Jan 2019	0.000		0.000		-		0.000	0.000	1.256	-
Interoperability Cert Assessment	WR	NUWCs : Keyport	1.268	0.000	Jun 2019	0.000		0.000		-		0.000	0.000	1.268	-
		Subtotal	95.737	5.754		7.128		7.447		-		7.447	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	422.832	15.710		17.251		17.843		-		17.843	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
COMBAT SYSTEM INTEGRATION				
NAVCERT: FY19 NAVCERTs (2 CGs, 1 CVN, 3 DDG, 1 LCS, 1 LPD, 1 LSD, 1 MCM)	1	2019	1	2019
NAVCERT: FY19 NAVCERTs (2 DDGs, 1 LHA, 1 LHD, 1)	2	2019	2	2019
NAVCERT: FY19 NAVCERTs (3 CGs, 3 CVNs, 2 DDGs, 2 LCSs, 1 LPD, 2 LSDs)	3	2019	3	2019
NAVCERT: FY19 NAVCERTs (1 CG, 2DDGs, 2 LHDs, 1 LPD, 2 MCMs)	4	2019	4	2019
NAVCERT: FY20 NAVCERTs (2 DDGs, 2 LCSs, 3 PCs, 1 LHD)	1	2020	1	2020
NAVCERT: FY20 NAVCERTs (1 CG, 2 DDGs, 1 LPD, 1 LSD)	2	2020	2	2020
NAVCERT: FY20 NAVCERTs (1 CG, 1 CVN, 2 DDGs, 2 LHDs, 1 LPD, 1 LSD)	3	2020	3	2020
NAVCERT: FY20 NAVCERTs (1 CG, 1 DDG, 1 LCS, 2 LPDs, 1 PC)	4	2020	4	2020
NAVCERT: FY21 NAVCERTs (1 CVN, 5 DDGs, 1 LCS, 1 LPD, 1 MCM)	1	2021	1	2021
NAVCERT: FY21 NAVCERTs (2 CVNs, 1 LCS, 2 LHDs, 2 LSDs, 1 MCM)	2	2021	2	2021
NAVCERT: FY21 NAVCERTs (1 CG, 2 CVNs, 1 DDG, 1 LPD)	3	2021	3	2021
NAVCERT: FY21 NAVCERTs (3 DDGs, 1 LHD, 1 MCM)	4	2021	4	2021
NAVCERT: FY22 NAVCERTs (1 CVN, 1 LPD, 3 LSDs)	1	2022	1	2022
NAVCERT: FY22 NAVCERTs (1 CG, 1 CVN, 1 LHD, 1 LPD, 1 LSD)	2	2022	2	2022
NAVCERT: FY22 NAVCERTs (1 CG, 1 DDG, 2 LHDs, 1 LPD)	3	2022	3	2022
NAVCERT: FY22 NAVCERTs (1 CG, 4 DDGs, 3 LSDs)	4	2022	4	2022
NAVCERT: FY23 NAVCERT (LHD 1, LPD 21)	1	2023	1	2023
NAVCERT: FY23 NAVCERTs (2 CGs, 1 CVN, 1 DDG, 1 LPD)	2	2023	2	2023
NAVCERT: FY23 NAVCERTs (4 DDGs, 1 LHA , 1 LHD , 1 LPD)	3	2023	3	2023
NAVCERT: FY23 NAVCERTs (4 DDGs , 1 LSD)	4	2023	4	2023
NAVCERT: FY24 NAVCERTs (1 CG, 1 CVN, 3 DDGs, 1 LCS, 1 LHD, 1 LPD)	1	2023	1	2024
NAVCERT: FY24 NAVCERTs (1 CG, 1 DDG, 1 LPD)	2	2023	2	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
NAVCERT: FY24 NAVCERTs (1 CVN, 3 DDGs)	3	2024	3	2024
NAVCERT: FY24 NAVCERTs (3 DDGs, 1 LHD, 1 LPD, 2 LSDs)	4	2024	4	2024
NAVCERT: FY25 NAVCERTs (2 DDGs, 2 LCSs, 3 PCs, 1 LHD)	1	2025	1	2025
NAVCERT: FY25 NAVCERTs (1 CG, 2 DDGs, 1 LPD, 1 LSD)	2	2025	2	2025
NAVCERT: FY25 NAVCERTs (1 CG, 1 CVN, 2 DDGs, 2 LHDs, 1 LPD, 1 LSD)	3	2025	3	2025
NAVCERT: FY25 NAVCERTs (1 CG, 1 DDG, 1 LCS, 2 LPDs, 1 PC)	4	2025	4	2025
C5IMP: FY19 C5IMP Monthly Baseline (12/Year) 92 BL's planned	1	2019	4	2019
C5IMP: FY19 NCMC - 1	2	2019	2	2019
C5IMP: FY19 NCMC - 2	4	2019	4	2019
C5IMP: FY19 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2019	4	2019
C5IMP: FY19 PNA Reviews (12/Year) (Supports Approx 76 ship availabilities with total 82 PNAs planned)	1	2019	4	2019
C5IMP: FY19 BFI-CCB Review,comment on and process approximately 2300 proposed changes throughout the year.	1	2019	4	2019
C5IMP: FY20 C5IMP Monthly Baseline (12/Year) 105 BL's planned	1	2020	4	2020
C5IMP: FY20 NCMC - 1	2	2020	2	2020
C5IMP: FY20 NCMC - 2	4	2020	4	2020
C5IMP: FY20 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2020	4	2020
C5IMP: FY20 PNA Reviews (12/Year) (Supports 81 ship availabilities with 94 PNAs planned)	1	2020	4	2020
C5IMP: FY20 BFI-CCB Review,comment on and process approximately 2500 proposed changes throughout the year.	1	2020	4	2020
C5IMP: FY21 C5IMP Monthly Baseline (12/Year) 115 BL's planned	1	2021	4	2021
C5IMP: FY21 NCMC - 1	2	2021	2	2021
C5IMP: FY21 NCMC - 2	4	2021	4	2021
C5IMP: FY21 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2021	4	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
C5IMP: FY21 PNA Reviews (12/Year) (Supports 85 ship availabilities with 105 PNAs planned)	1	2021	4	2021
C5IMP: FY21 BFI-CCB Review,comment on and process approximately 2500 proposed changes throughout the year.	1	2021	4	2021
C5IMP: FY22 C5IMP Monthly Baseline (12/Year) 123 BL's planned	1	2022	4	2022
C5IMP: FY22 NCMC - 1	2	2022	2	2022
C5IMP: FY22 NCMC - 2	4	2022	4	2022
C5IMP: FY22 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2022	4	2022
C5IMP: FY22 PNA Reviews (12/Year) (Supports 87 ship availabilities with 112 PNAs planned)	1	2022	4	2022
C5IMP: FY22 BFI-CCB Review,comment on and process approximately 2800 proposed changes throughout the year.	1	2022	4	2022
C5IMP: FY23 C5IMP Monthly Baseline (12/Year) 130 BL's planned	1	2023	4	2023
C5IMP: FY23 NCMC - 1	2	2023	2	2023
C5IMP: FY23 NCMC - 2	4	2023	4	2023
C5IMP: FY23 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2023	4	2023
C5IMP: PNA Reviews (12/Year) (Supports 90 ship availabilities with 120 PNAs planned)	1	2023	4	2023
C5IMP: FY23 BFI-CCB Review,comment on and process approximately 3000 proposed changes throughout the year.	1	2023	4	2023
C5IMP: FY24 C5IMP Monthly Baseline (12/Year) 130 BL's planned	1	2024	4	2024
C5IMP: FY24 PNA Reviews (12/Year) (Supports 90 ship availabilities with 120 PNAs planned)	1	2024	4	2024
C5IMP: FY24 NCMC - 1	2	2024	2	2024
C5IMP: FY24 NCMC - 2	4	2024	4	2024
C5IMP: FY24 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2024	4	2024
C5IMP: FY24 BFI-CCB Review,comment on and process approximately 3000 proposed changes throughout the year.	1	2024	4	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
C5IMP: FY25 C5IMP Monthly Baseline(12/Year) (72 Ships)	1	2025	4	2025
C5IMP: FY25 PNA Reviews (12/Year) (70 Ships)	1	2025	4	2025
C5IMP: FY25 NCMC - 1	2	2025	2	2025
C5IMP: FY25 NCMC -2	4	2025	4	2025
C5IMP: FY25 SG/ARG Analysis Report (2/Year - Presented at NCMC)	2	2025	4	2025
C5IMP: FY25 BFI-CCB Review, comment on and process approximately 2,500 proposed changes throughout the year	1	2025	4	2025
Interoperability Certification & Assessments: FY19 IOP CERT/DEV Tests (19-1): ACS 7.2.3 (IFF Mode 5 only); AEGIS B/L 9A2.1/9C2.1 (Build 27); SSDS 10.11.00	1	2019	1	2019
Interoperability Certification & Assessments: FY19 IOP CERT/DEV Tests (19-2): AEGIS B/L 9A2.1/9C2.1 (Build 27); AEGIS 5.4	2	2019	2	2019
Interoperability Certification & Assessments: FY19 IOP CERT/DEV Tests (19-3): AEGIS B/L 9C2.2 (Build 30); AEGIS 5.4	3	2019	3	2019
Interoperability Certification & Assessments: FY20 IOP CERT/DEV Tests (20-1): ACS 9.C2.2 (B30); AEGIS 5.4	1	2020	1	2020
Interoperability Certification & Assessments: FY20 IOP CERT/DEV Tests (20-2): AEGIS B/L 9C2.2 (Build 30); SSDS 10.11.02 (CVN Configuration); SSDS B/L 11.X (ACB 20); and DDG 1000 (B8.7)	2	2020	2	2020
Interoperability Certification & Assessments: FY20 IOP CERT/DEV Tests (20-3): AEGIS B/L 9C2.2 (Build 30); SSDS 10.11.02 (CVN Configuration); SSDS B/L 11.X; and DDG 1000 (B8.7)	3	2020	3	2020
Interoperability Certification & Assessments: FY21 Event (21-1)	1	2021	1	2021
Interoperability Certification & Assessments: FY21 Event (21-2)	2	2021	2	2021
Interoperability Certification & Assessments: FY21 Event (21-3)	3	2021	3	2021
Interoperability Certification & Assessments: FY21 Event (21-4)	4	2021	4	2021
Interoperability Certification & Assessments: FY22 Event (22-1)	1	2022	1	2022
Interoperability Certification & Assessments: FY22 Event (22-2)	2	2022	2	2022
Interoperability Certification & Assessments: FY22 Event (22-3)	3	2022	3	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603582N / *Combat System Integration*	**Project (Number/Name)** 0164 / *Combat System Integration*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Interoperability Certification & Assessments: FY22 Event (22-4)	4	2022	4	2022
Interoperability Certification & Assessments: FY22 Event (23-1)	1	2023	1	2023
Interoperability Certification & Assessments: FY22 Event (23-2)	2	2023	2	2023
Interoperability Certification & Assessments: FY22 Event (23-3)	3	2023	3	2023
Interoperability Certification & Assessments: FY22 Event (23-4)	4	2023	4	2023
Interoperability Certification & Assessments: FY24 Event (24-1)	1	2024	1	2024
Interoperability Certification & Assessments: FY24 Event (24-2)	2	2024	2	2024
Interoperability Certification & Assessments: FY24 Event (24-3)	3	2024	3	2024
Interoperability Certification & Assessments: FY24 Event (24-4)	4	2024	4	2024
Interoperability Certification & Assessments: FY25 Event (25-1)	1	2025	1	2025
Interoperability Certification & Assessments: FY25 Event (25-2)	2	2025	2	2025
Interoperability Certification & Assessments: FY25 Event (25-3)	3	2025	3	2025
Interoperability Certification & Assessments: FY25 Event (25-4)	4	2025	4	2025
Warfare Systems Certification: FY19 Warfare Systems Cert (163 Certification Events + 77 WSCPs)	1	2019	4	2019
Warfare Systems Certification: FY20 Warfare Systems Cert (130 Certification Events + 64 WSCPs)	1	2020	4	2020
Warfare Systems Certification: FY21 Warfare Systems Cert (146 Certification Events + 73 WSCPs)	1	2021	4	2021
Warfare Systems Certification: FY22 Warfare Systems Cert (131 Certification Events + 12 WSCPs)	1	2022	4	2022
Warfare Systems Certification: FY23 Warfare Systems Cert (140 Certification Events + 20 WSCPs)	1	2023	4	2023
Warfare Systems Certification: FY24 Warfare Systems Cert (132 Certification Events +35 WSCPs)	1	2024	4	2024
Warfare Systems Certification: FY25 Warfare Systems Cert (142 Certification Events + 21 WSCPs)	1	2025	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	3,201.375	528.146	427.051	317.196	-	317.196	195.821	170.854	185.995	187.941	Continuing	Continuing
3220: *COLUMBIA Class Submarine Development*	3,177.248	501.133	419.051	317.196	-	317.196	195.821	103.802	117.601	118.179	Continuing	Continuing
3440: *SBSD Obsolescence*	0.000	0.000	0.000	0.000	-	0.000	0.000	20.281	20.687	21.101	Continuing	Continuing
3441: *SBSD Technology Refresh*	0.000	0.000	0.000	0.000	-	0.000	0.000	46.771	47.707	48.661	Continuing	Continuing
9999: *Congressional Adds*	24.127	27.013	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	59.140

A. Mission Description and Budget Item Justification

This program element supports innovative research and development in submarine Hull, Mechanical and Electrical (HM&E) and combat systems technologies and the subsequent evaluation, demonstration, and validation for submarine platforms over the life cycle of the COLUMBIA Class. It will increase the submarine technology base and provide subsystem design options not currently feasible. The program element also supports programs transitioning from Science and Technology (S&T), Defense Advanced Research Projects Agency (DARPA), Independent Research and Development, and Small Business Innovation Research (SBIR) projects.

The funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for Common Missile Compartment (CMC) design, whole ship design, and component technologies development for the next generation U.S. ballistic missile submarine (SSBN), the COLUMBIA Class.

Project Unit 3220:
The objective of the SSBN New Design project, the COLUMBIA Class is to design and prepare for construction of the replacement of the OHIO Class SSBN.

Project Unit 3440:
This project provides the engineering development and program management required to outfit, upgrade, and support each ship of the COLUMBIA Class Submarine with a combat system that satisfies requirements to meet its sole mission of Strategic Deterrence over the class life cycle.

Project Unit 3441:
This project encompasses ship system development, coordination, and management efforts for the COLUMBIA Class Submarine Technology Insertion Program and Technology Refresh Program over the class life cycle.

Project Unit 9999:
This Congressional Add project funds efforts for the Advanced Materials Propeller Program, Materials for Submarine Propulsor Applications and Naval Propulsion Foundry Center Facility Power Upgrades.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*

B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	542.846	419.051	313.582	-	313.582
Current President's Budget	528.146	427.051	317.196	-	317.196
Total Adjustments	-14.700	8.000	3.614	-	3.614
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	8.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-14.700	0.000			
• Rate/Misc Adjustments	0.000	0.000	3.614	-	3.614

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2019**	**FY 2020**
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Materials Propeller Program*	14.471	0.000
Congressional Add: *Naval Propulsion Foundry Center Facility Power Upgrades*	12.542	0.000
Congressional Add: *Materials for submarine propulsor applications*	0.000	8.000
Congressional Add Subtotals for Project: 9999	27.013	8.000
Congressional Add Totals for all Projects	27.013	8.000

Change Summary Explanation

The FY 2021 funding request was increased by +3.614M for rate/misc adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*				**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3220: *COLUMBIA Class Submarine Development*	3,177.248	501.133	419.051	317.196	-	317.196	195.821	103.802	117.601	118.179	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The COLUMBIA Submarine Class Program (previously the OHIO Replacement Class) is developing the next generation sea-based strategic deterrent. The funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for Common Missile Compartment (CMC) design, whole ship design, and component technologies development for the next generation U.S. ballistic missile submarine (SSBN). This RDT&E program supports cooperation with the United Kingdom (UK) to maintain strategic deterrence, based on a single effort to develop a CMC as agreed by the UK Secretary of State for Defense and the U.S. Secretary of Defense in 2009.

The COLUMBIA program strategy is to leverage the re-use of existing Submarine system designs (as applicable), focus on lifecycle Total Ownership Cost (TOC) affordability, and meet the military requirements established for this SSBN to achieve mission success in a challenging environment. The requested funding levels provide for the Technology Development, Design, Engineering, and Integration efforts necessary to support the COLUMBIA Class SSBN lead ship construction start in FY 2021 along with continued development efforts for the class. In support of award for the COLUMBIA Build I modification (SSBN 826, SSBN 827, and associated design/support efforts) planned for FY2020, the Navy and Electric Boat reached a signed settlement framework on 20 December 2019. This will be a modification under the existing IPPD contract (N00024-17-C-2117). Award of the modification (as an option for the two hulls) is targeted for 3QFY2020 (baseline was October 2020). This in in line with the program's approved Acquisition Strategy. The program will request authorization of SSBN 826 in FY21, funded with three years of incremental funding in FY21-23, and authorization of SSBN 827 in FY24, funded with two years of incremental funding in FY24-25. The RDT&E efforts support this plan.

The following key activities support the COLUMBIA Class SSBN Program:

1. Design and development of a missile compartment, launch system, and Strategic Weapons Support Systems (SWSS) to meet U.S. strategic requirements while cooperating with the UK on modernizing its strategic deterrent in accordance with Presidential direction (December 2006).
2. Concept Definition, System Definition, and Detailed Design for remaining portions of the ship accomplished through a Design/Build/Sustain approach modeled after the approach used by the VIRGINIA Class program.
3. Engineering and integration of existing technologies and development of new technologies required to provide the capabilities necessary to ensure platform operational effectiveness and minimize life cycle cost.

COLUMBIA Class SSBN concept study, system definition prototyping, and technology development efforts support design, systems engineering, component development and vendor qualification activities needed to develop the CMC design and the COLUMBIA whole ship design. The COLUMBIA design timelines are based on a design approach proven on the VIRGINIA Class Program, adjusted for the additional complexity of a missile compartment and Strategic Weapons Systems (SWS). Planned technical studies and prototyping are necessary to reduce risks associated with updating SSBN system designs for current technical standards and demonstrating design feasibility of developmental technology to meet the ship design and construction schedule.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

The Navy continues to invest in program funded affordability initiatives similar to those employed successfully for VIRGINIA Class, but tailored to the unique SSBN mission and operational tempo of COLUMBIA Class to drive down overall program costs. Efforts focus on reducing ship construction costs through implementing more effective design features and fabrication and assembly methods for a more affordable submarine. As part of this effort, alternative procurement and contracting strategies are also being utilized to include Multi-Program Material Procurement (MPMP) and Economic Order Quantity (EOQ).

Activities were executed for the first article quad pack (FAQP) prototype of the CMC to support the UK DREADNOUGHT Program and COLUMBIA Program, and to continue validation of the Integrated Tube and Hull (ITH) build strategy. These activities included the continuation of the construction of the FAQP, which began August 2016, with a planned completion in 2019. The CMC program will mature required technologies and re-host the TRIDENT II D5 SWS (Launcher, Fire Control and Navigation) while ensuring no degradation to D5 security, safety, and performance. In addition, whole ship design efforts are focused on technologies requiring significant engineering, integration, and development time as well as those technologies that are required to support ship design and construction schedules such as the propulsor and maneuvering/ship control. These technologies are critical for stealth capability for a ship class that will be in service until the 2080s. Ship detailed design efforts include important pre-construction activities such as finalizing ship arrangements, development of design disclosures to support build products, risk characterization, and mitigation, improvement and validation of performance prediction tools and improvement of design tools. Technology development will address engineering and integration of existing technologies as well as maturation of developmental technologies.
On 14 December 2016, the Secretary of the Navy announced the lead ship of the OHIO Replacement Program will be USS COLUMBIA (SSBN 826) which officially designates this program the COLUMBIA Class Submarine Program.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Common Missile Compartment Design and Prototyping, and Whole Ship Design	156.744	143.080	126.464	0.000	126.464
Articles:	-	-	-	-	-
FY 2020 Plans: The combination of CMC Design and Prototyping with Whole Ship Study and Design represents the required LDY Shipbuilder design effort for the COLUMBIA Program. CMC Design and Prototyping: This funding applies to the design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for CMC design and component / technology development for the COLUMBIA submarine. Included in this effort is continued development of CMC design products. Specific planned efforts in FY 2020 include: - The completion of all CMC Design Disclosures (approximately 1059 design disclosures) in support of the MTM build - Formal start of Lead Ship Construction in October 2020 which includes continued fabrication of MTs, manufacture of the MTM and delivery, and integration and test of SWSS systems for the land based test facility					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Whole Ship Study and Design: This funding applies to the shipbuilder design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for whole ship design and component / technology development for the COLUMBIA submarine. Specific efforts in FY 2020 include: - The completion of all Arrangements (approximately 4086 arrangements including CMC arrangement) - 83 percent of total Design Disclosures (approximately 3904 design disclosures including CMC design disclosures) - Approximately 16 percent of logistics products (approximately 1575 logistics products including CMC products) Lead Ship Construction efforts commence in October 2020. Efforts will also continue towards integration of all CMC systems and interfaces with Rest of Ship and progressing ship integration of the Propulsor design.					
FY 2021 Base Plans: The combination of CMC Design and Prototyping with Whole Ship Study and Design represents the required LDY Shipbuilder design effort for the COLUMBIA Program. CMC Design and Prototyping: This funding applies to the design, systems engineering, prototyping construction, and vendor qualification activities needed required to execute the schedule for CMC construction schedule, design and component and/ technology development for the COLUMBIA submarine. Included in this effort is continued development of CMC design products and associated engineering/management efforts. Specific planned construction efforts for FY 2021 includes continued fabrication of Missile Tubes, Strategic Weapons Support System (SWSS) kits and continued construction of the Missile Tube Module (MTM). Whole Ship Study and Design: - This funding applies to the shipbuilder design, systems engineering, prototyping, and vendor qualification activities needed to execute the schedule for whole ship design and component / technology development for the COLUMBIA submarine. - Specific efforts in FY2021 include: - About 95 percent of total Design Disclosures (approximately 4470 design disclosures including CMC design disclosures) - Approximately 30 percent of logistics products (approximately 2950 logistics products including CMC products)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Planned construction effort in FY2021 includes construction efforts on all Super Modules (1, 2, 3, 4, 5, and 6) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding levels decreased as efforts continued shift to Detailed Design and construction efforts as engineering and component development efforts ramp down and are incorporated into the SCN-funded detail design (Plans).					
Title: NAVSEA R&D and Prototyping	169.323	158.808	128.422	0.000	128.422
Articles:	-	-	-	-	-
FY 2020 Plans: This funding applies to the Government combat systems, component and technology development for the COLUMBIA submarine essential to achieving required survivability, combat and communications capabilities. Efforts planned in FY 2020 include: Combat Systems: - Complete revisions to any Government Furnished Information (GFI) required to support construction and continue to deliver remaining GFI - Execute non-recurring engineering development activities required for COLUMBIA unique combat system components - Complete AN/BRR-6 reliability based engineering changes and conduct AN/BST-1 reliability engineering changes, qualification, and testing - Fabricate developmental Structurally Integrated Enclosures for combat systems vendor sites - Continue early environmental qualification testing of Government Furnished Equipment Component Development: - Continue Government support and oversight of development of the approximately 84 remaining of 101 remaining engineered components - Support diesel generator integration testing at compatibility test facility - Complete critical qualification testing for the air conditioning unit and commence COLUMBIA production unit build - Refurbish Advanced Carbon Dioxide Removal Unit (ACRU) following qualification testing and deliver to Naval Surface Warfare Center for reliability testing					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Support ACRU OPALT installation - Award ACRU production contract - Continue development and qualification of additive manufacturing processes for various components to meet performance requirements while reducing cost and schedule Propulsor and Shafting: - Complete down-select for the rotating portion of the propulsor after completing LSV testing and associated analysis - Begin reconfiguration of the Full Scale Bearing Test Facility (FSBTF) and installation of a propulsor bearing engineering demonstration model - Complete equipment installation and acceptance at the Naval Foundry and Propeller (NFPC) Shock, Structures and Composites: - Complete analysis of combined shock and submergence test results and full-scale design assessments - Continue assessment of which components require Large Vehicle Shock Testing for qualification - Continue fabrication of the forward pressure hull confirmation model - Complete fabrication of mold for Out of Autoclave bow dome - Continue navigation sonar system window fabrication - Complete development of composites inspection and maintenance procedures, criteria and evaluation methods Signatures: - Continue evaluation of data from PIKE model testing with stern section and update modeling tools as appropriate - Complete confirmation testing of the forward area design on DOLLY VARDEN and continue analysis of data - Update whole-boat signature predictions using updated modeling and predictive tools - Support Shipbuilder qualification testing of machinery components and devices Maneuvering, Ship Control and Hydrodynamic: - Continue developing CLB Submerged Operating Envelope by characterization of near-surface behavior for various sea states - Conduct Free Running Model hydrodynamic testing					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
This funding applies to the Government combat systems, component and technology development for the COLUMBIA submarine essential to achieving required survivability, combat and communications capabilities. Efforts planned in FY 2021 include: Combat Systems: - Initiate development of TI-24 Government Furnished Information in support of detailed design, production, and manufacturing integration - Continue AN/BST-1 reliability based engineering changes, qualification, and testing - Complete early environmental qualification testing of Government Furnished Equipment - Deliver developmental Structurally Integrated Enclosures to combat system vendor sites - Execute shock, explodable volume, HEMP, and early integration testing of components Component Development: - Continue Government support and oversight of development of the approximately 50 remaining out of 101 total engineered components - Complete shock and vibration testing of the diesel generator and commence COLUMBIA production unit build - Complete qualification testing for the air conditioning unit and complete COLUMBIA production unit build - Begin production of lead ship ACRU - Continue at-sea operational assessment of ACRU Propulsor and Shafting: - Complete reconfiguration of the Full Scale Bearing Test Facility with the installation of a propulsor bearing engineering demonstration model and commence testing - Complete documentation associated with lead ship propulsor down-selection Shock, Structures and Composites: - Begin procurements, planning and preparations for a large vehicle shock test series - Continue fabrication and begin instrumentation of the forward pressure hull confirmation model - Complete fabrication of Out of Autoclave bow dome and associated inspections - Continue navigation sonar system window fabrication Signatures: - Update whole-boat signature predictions using updated modeling and predictive tools					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Perform assessments on the impact of shipbuilder design/construction changes on performance - Provide test support, modeling updates and assessments for shipbuilder system development, component development and qualification testing Maneuvering, Ship Control and Hydrodynamic: - Continue developing CLB Submerged Operating Envelope by characterization of near-surface behavior for various sea states - Continue Free Running Model hydrodynamic testing - Continue maneuvering capability studies - Continue Hovering Missile Compensation Control System development - Continue Ship Control System development ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding levels decreased as government engineering and component development efforts ramp down and are incorporated into the SCN-funded detail design (Plans).					
Title: Systems Engineering/Program Management	59.342	61.865	35.395	0.000	35.395
Articles:	-	-	-	-	-
FY 2020 Plans: Continue Program Management and System Engineering activities including: - Program Office will continue efforts to manage, coordinate, and oversee all efforts of the program including shipbuilder and government activities - Early Strategic Program System Integration into NPES Systems - Continue efforts on the COLUMBIA Electronics Integration Plan to support shore side Command and Control integration and test, and execution of integration risk mitigations as identified by the Integration Working Group (IWG) - The COLUMBIA LFT&E program will conduct COTS fragility testing of Sonar, Combat, and Imaging (and potentially SWS) components on the DSSM at NSWC Philadelphia - Procure Strategic Weapons System components in support of fragility testing in late FY 2021 or early FY 2022 - Test the COLUMBIA Class Shock Isolated Deck high capacity mounts (HCMs) and Fluid Viscous Dampers (FVDs) to determine the level of shock at which they fail					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Maturation of COLUMBIA survivability M&S and reporting of developmental test results will continue at NUWC Newport to support Commander Operational Test & Evaluation Force (COMOPTEVFOR) accreditation before Initial Operational Test and Evaluation (IOT&E) in FY 2028 - Continue multi-year Gap Analysis Industrial Utilization Study (GAIUS) to determine CLB unique maintenance facility requirements for Trident Refit Facilities - Continue non-MILCON studies and preparations at affected shore facilities - Conduct Cybersecurity EDT events on Submarine Warfare Federated Tactical Systems (SWFTS) components not assessed in prior years and to assess Technology Insertion and Advanced Processer Build (TI/APB) fixes from the 2017 and 2018 Cybersecurity EDT events - Report on results of developmental testing conducted to DD(DTE&P) in accordance with the TEMP					
FY 2021 Base Plans: Program Office will continue efforts to manage, coordinate, and oversee all efforts of the program including shipbuilder and government activities - Conduct SWS fragility testing at NSWC Philadelphia - Execute the COLUMBIA Survivability M&S execution plan at NUWC with the objective of assuring that the suite will support accreditation by COMOPTEVFOR before Initial Operational Test and Evaluation in FY2028 - Test the COLUMBIA Class Shock Isolated Deck high capacity mounts and fluid viscous dampers as part of the COLUMBIA LFT&E program - Complete and validate the USS COLUMBIA (SSBN 826) Program Validated Online Lifecycle Threat (VOLT) report - Complete the Joint COLUMBIA Class and VIRGINIA Class SWFTS TI-16 Cybersecurity Early Developmental Test (EDT) 18-1 test event by the National Cyber Range (NCR) and the NAVSEA Red Team - The COLUMBIA Class Program Office will continue to report on results of developmental testing being conducted to DD(DT&E) in accordance with the TEMP - Conduct Cyber Risk assessments to support continual cyber security development - The NPES division will manage and coordinate government laboratories and sub-system Participating Area Managers (PARMs) to begin detailed design of the SSBN827 TI-24 NPES configuration - Conduct efforts to validate that the design of the TI-24 COATS configuration can be retrofit on lead ship during PSA with acceptable risk - Early Strategic Program System Integration into NPES Systems - Continue multi-year GAIUS to determine CLB unique maintenance facility requirements for Trident Refit Facilities					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue non-MILCON studies and preparations at affected shore facilities, such as Utility and Mooring assessments - Receive stakeholder concurrence on maintenance product development processes, including roles and responsibilities ultimately resulting in an approved Class Maintenance Plan to support Lead Ship Delivery - Maintenance of COLUMBIA Electronics Integration Plan to support shore side Command and Control integration and test, and execution of integration risks as identified by the Integration Working Group (IWG) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding levels in RDTE decrease as Program Management and oversight of the design and construction begins to shift to into the SCN-funded Plans line.					
Title: Strategic Weapons System Integration	115.724	55.298	26.915	0.000	26.915
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue system engineering efforts required for the re-hosting and integration of the TRIDENT II (D5) SWS on the COLUMBIA submarine including review, modification and update of SWS Coordination, Interface and Arrangement Drawings for SWS equipment within the CMC and performing associated Logistic Support activities - Complete the launcher qualification report - Continue utilization of the SWS Fire Control and Navigation Engineering Test Systems within the land-based test berths / facilities for SWS Subsystem hardware and software integration, verification and validation - Continue development of special test vehicles - Complete installation of the COLUMBIA Launch Tube at SWS Ashore and achieve COLUMBIA configuration Initial Operating Capability (IOC) - Commence Strategic Weapon Support Systems (SWSS) Verification and Validation (V&V) testing at SWS Ashore - Commence proofing of Shipyard Installation Test Program (SITP) Test Procedures at SWSA - Conduct SWS Training System-level CDR involving both the SWS Fire Control and Navigation Subsystems - Conduct Strategic Weapon Training System (SWTS) Preliminary Design Review (PDR) - Deliver a Guidance Handling Cart prototype to SWS Ashore - Conduct Production Readiness Reviews for SWS Launcher, Fire Control and Guidance Subsystems					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct Navigation Software Qualification Test, Pre-Production performance testing and Navigation Trainer Production Readiness Review - Deliver Reentry Body Simulator Assemblies - Continue efforts of the Integration Working Group for the integration of NPES with the SWS ***FY 2021 Base Plans:*** - Continue system engineering efforts required for the re-hosting and integration of the TRIDENT II (D5) SWS on the COLUMBIA submarine including review, modification and update of SWS Coordination, Interface and Arrangement Drawings for SWS equipment within the CMC and performing associated Logistic Support activities - Continue utilization of the SWS Fire Control Engineering Test Systems within the land-based test berths / facilities for SWS Subsystem hardware and software integration, verification and validation - Conduct Fire Control System / SWSS Regression Testing - Complete development of and conduct verification testing of special test vehicles - Continue Strategic Weapon Support Systems (SWSS) Verification and Validation (V&V) testing at SWS Ashore - Continue proofing of Shipyard Installation Test Program (SITP) Test Procedures at SWSA - Conduct Strategic Weapon Training System (SWTS) Critical Design Review (CDR) - Continue efforts of the Integration Working group for the integration of NPES with the SWS ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding levels decreased as SWS Integration efforts ramp down and are incorporated into the SCN-funded detail design (Plans).					
Accomplishments/Planned Programs Subtotals	501.133	419.051	317.196	0.000	317.196

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603570N/3219: *SBSD Nuclear Technology Development*	190.100	114.006	80.085	-	80.085	60.142	56.841	54.400	44.385	Continuing	Continuing
• RDTEN/0101221N/0951: *Joint Warhead Fuze Sustainment Program*	61.612	23.226	17.330	-	17.330	6.872	3.091	0.000	0.000	0.000	722.664

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/5358: *Strategic Missile Systems Equip*	253.579	258.933	258.910	-	258.910	272.865	271.139	263.819	269.083	0.000	2,917.401
• WPN/1250: *TRIDENT II Mods*	1,048.011	1,165.736	1,173.837	-	1,173.837	1,159.348	1,187.041	1,247.575	1,291.194	2,176.384	19,011.964
• OMN/1D2D: *Fleet Ballistic Missile*	1,357.232	1,418.436	1,428.102	-	1,428.102	1,474.696	1,528.487	1,571.917	1,606.044	0.000	10,384.914
• SCN/1045: *COLUMBIA Class Submarine*	3,173.400	1,820.927	4,014.650	-	4,014.650	3,996.677	4,150.151	5,204.052	6,107.939	85,685.907	115,788.666
• MCN/32414106: *Submarine Propulsor Manufacturing Support Facility*	71.050	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	71.050
• MCN/64482044: *MCON Design*	114.476	233.220	85.747	10.790	96.537	98.201	80.502	86.809	86.429	0.000	796.174
• MCN/42237676: *TRIDENT Training Facility Phase I*	0.000	0.000	0.000	-	0.000	0.000	53.100	0.000	0.000	0.000	53.100
• MCN/42237684: *TRIDENT Refit Facility*	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	26.700	0.000	26.700

Remarks

D. Acquisition Strategy

The Common Missile Compartment (CMC) is designed and developed to support the U.S. and UK in development of the COLUMBIA and DREADNOUGHT SSBN programs enabling a common U.S.-UK CMC and maximizing the benefit of the ongoing U.S.-UK partnership in strategic deterrence. The COLUMBIA Class Program RDT&E efforts will support the design, construction and operations & support portions of the program. RDT&E efforts will be performed by Navy laboratories, shipyards, private industry, and University Affiliated Research Centers.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/CPFF	Ship Design Contractor-EB : Groton, CT	1,447.732	156.744	Oct 2018	143.080	Oct 2019	126.464	Oct 2020	-		126.464	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Carderock, MD	484.468	72.115	Oct 2018	59.196	Oct 2019	37.461	Oct 2020	-		37.461	Continuing	Continuing	Continuing
Product Development	WR	NSWC : Philadelphia, PA	58.933	18.250	Oct 2018	19.577	Oct 2019	16.207	Oct 2020	-		16.207	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Newport, RI	79.093	26.182	Oct 2018	36.263	Oct 2019	39.309	Oct 2020	-		39.309	Continuing	Continuing	Continuing
Product Development	Various	NAVSEA : Various	189.772	52.776	Oct 2018	43.772	Oct 2019	35.445	Oct 2020	-		35.445	Continuing	Continuing	Continuing
Product Development	SS/CPFF	ARL Penn State University : State College, PA	2.261	0.950	Oct 2018	0.600	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	NGMS : Sunnyvale, CA	171.788	22.109	Oct 2018	3.860	Oct 2019	0.014	Oct 2020	-		0.014	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JHU/APL : Laurel, MD	20.096	5.310	Jan 2019	2.765	Nov 2019	1.507	Nov 2020	-		1.507	Continuing	Continuing	Continuing
Product Development	WR	NUWC : Keyport, WA	0.652	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	DRAPER : Cambridge, MA	9.938	0.228	Oct 2018	0.074	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	LMRMS : Mitchel Field, NY	71.379	8.436	Oct 2018	4.442	Oct 2019	0.020	Oct 2020	-		0.020	Continuing	Continuing	Continuing
Product Development	C/CPFF	EMCUBE : Alexandria, VA	3.199	0.587	Oct 2018	0.247	Oct 2019	0.589	Oct 2020	-		0.589	Continuing	Continuing	Continuing
Product Development	SS/CPFF	LMS : Sunnyvale, CA	95.302	15.954	Feb 2019	6.186	Oct 2019	1.913	Oct 2020	-		1.913	Continuing	Continuing	Continuing
Product Development	SS/CPFF	JRC : Washington, DC	3.517	1.176	Oct 2018	1.139	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	C/CPFF	GDMS : Pittsfield, MA	128.181	20.779	Nov 2018	5.412	Oct 2019	9.911	Oct 2020	-		9.911	Continuing	Continuing	Continuing
Product Development	WR	CNSW : China Lake, CA	69.701	12.542	Nov 2018	8.085	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	IEC : Anaheim, CA	3.319	0.384	Oct 2018	0.107	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	WR	NSWC : Dahlgren, VA	20.694	7.182	Oct 2018	5.159	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/CPFF	BAE : Rockville, MD	36.740	6.316	Oct 2018	3.223	Oct 2019	4.529	Oct 2020	-		4.529	Continuing	Continuing	Continuing
Product Development	SS/CPFF	BNA : Huntington Beach, CA	3.217	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	WR	NSWC Crane : Crane, IN	54.113	7.491	Nov 2018	7.914	Nov 2019	6.308	Nov 2020	-		6.308	Continuing	Continuing	Continuing
Product Development	SS/CPFF	GDEB : Groton, CT	4.670	2.723	Oct 2018	0.769	Oct 2019	0.189	Oct 2020	-		0.189	Continuing	Continuing	Continuing
Product Development	Various	SSP : Various	15.346	1.869	Oct 2018	4.325	Oct 2019	1.935	Oct 2020	-		1.935	Continuing	Continuing	Continuing
Product Development	SS/CPFF	SPA : Alexandria, VA	9.871	1.688	Oct 2018	0.991	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	2,983.982	441.791		357.186		281.801		-		281.801	Continuing	Continuing	N/A

Remarks

The funding values in FY19 and FY20 was adjusted from the FY 2020 President's Budget request values in order to reflect execution actuals in FY19 and to properly align the execution of funding for FY20 within Product Development. The overall funding requirement has not increased and there is no cost growth. FY20 amounts for GDMS and BAE do not reflect the application of United Kingdom (UK) Common R&D funding for Common Missile Compartment (CMC) non-recurring engineering (NRE) efforts, which aligns with the approved UK funding profile, noted in the SAR report. UK funding accounts for 53% of SSP SWS CMC NRE efforts in FY20 and 22% in FY21.
Note: Various is used for multiple activities with different award dates.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Management Support	C/CPFF	Various : Multiple Awards	102.925	34.145	Nov 2018	34.814	Nov 2019	17.750	Nov 2020	-		17.750	Continuing	Continuing	Continuing
Government Management Support	WR	Various: NSWC : Carderock, MD	68.049	14.350	Oct 2018	14.549	Oct 2019	9.295	Oct 2020	-		9.295	Continuing	Continuing	Continuing
Government Management Support	WR	Various: NSWC : Philadelphia, PA	6.529	2.415	Oct 2018	2.345	Oct 2019	1.802	Oct 2020	-		1.802	0.000	13.091	-
Government Management Support	WR	Various: NUWC : Newport, RI	10.143	3.947	Oct 2018	3.929	Oct 2019	2.673	Oct 2020	-		2.673	0.000	20.692	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Management Support	WR	Vairous: SUPSHIP : Groton, CT	3.514	3.845	Oct 2018	5.576	Oct 2019	3.375	Oct 2020	-		3.375	0.000	16.310	-
Travel	WR	NAVSEA HQ : Washington, D.C.	2.106	0.640	Nov 2018	0.652	Nov 2019	0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
		Subtotal	193.266	59.342		61.865		35.395		-		35.395	Continuing	Continuing	N/A

Remarks

The funding values in FY19 and FY20 was adjusted from the FY 2020 President's Budget request values in order to reflect execution actuals in FY19 and to properly align the execution of funding for FY20 within Management Services. The overall funding requirement has not increased and there is no cost growth.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	3,177.248	501.133		419.051		317.196		-		317.196	Continuing	Continuing	N/A

Remarks

The listed Award Dates represent the date on which initial obligations occur for the effort.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

CDD - Capabilities Development Document
CDR - Critical Design Review
CPD - Capability Production Document
DAB - Defense Acquisition Board
IPR - In Progress Review
JROC - Joint Requirements Oversight Council
LLTM - Long Lead Time Material
PDR - Preliminary Design Review
PRR – Production Readiness Review
RDT&E - Research, Development, Test, & Evaluation
RFP - Request for Proposal
SCN - Shipbuilding and Conversion, Navy
SRR - System Requirements Review

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 3220 / *COLUMBIA Class Submarine Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Notes: * Effort began prior to 1st Quarter FY 2019. ** Effort continues past 4th Quarter FY 2025				
Ship Detailed & Support Arrangements*	1	2019	1	2022
Ship Design Disclosure and Construction Data*	1	2019	1	2024
Research, Development, and Prototyping for Lead Ship*, **	1	2019	4	2025
Component Development/Component Qualification* , **	1	2019	4	2025
Gen 2 Propulsor Design*	1	2019	4	2019
Large Scale Vehicle (LSV) Trials*	1	2019	4	2020
Advanced Propulsor Bearing Prototype*	1	2019	1	2024
Advanced Carbon Dioxide Removal Unit (ACRU)*, **	1	2019	4	2025
SCN Design*, **	1	2019	4	2025
Lead Ship Construction**	1	2021	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*				**Project (Number/Name)** 3440 / *SBSD Obsolescence*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3440: *SBSD Obsolescence*	0.000	0.000	0.000	0.000	-	0.000	0.000	20.281	20.687	21.101	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project provides the engineering development and program management required to outfit, upgrade, and support each ship of the COLUMBIA Class Submarine with a combat system that satisfies requirements to meet its sole mission of Strategic Deterrence over the class life cycle. The fully integrated combat system, also referred to as the Non-Propulsion Electronics System (NPES), is comprised of a collection of functional sub-systems, including Sonar, Tactical Navigation, Exterior Communications, Radar, Imaging, Large Vertical Array, Submarine Warfare Federated Tactical System (SWFTS) virtualization, Electronic Support, etc., which evolve over the life of the program due to either competitive selection of new suppliers, component obsolescence replacement, increased technical performance, or improvements in reliability. Non-recurring engineering activity is needed to perform platform integration of the components, and software modification to accommodate electronic data exchange, unique submarine environment qualification and update of all logistics products.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603595N / *SSBN New Design*				Project (Number/Name) 3441 / *SBSD Technology Refresh*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3441: *SBSD Technology Refresh*	0.000	0.000	0.000	0.000	-	0.000	0.000	46.771	47.707	48.661	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project encompasses ship system development, coordination, and management efforts for the COLUMBIA Class Submarine Technology Insertion Program and Technology Refresh Program over the life cycle. The purpose of the Technology Insertion Program is to efficiently upgrade performance of future hulls by virtue of improvements in ship systems. The purpose of the Technology Refresh Program is to develop, coordinate, and manage technical refresh plans for ship systems reliant on Commercial off the Shelf (COTS) technology that have short product life cycles to ensure materiel solutions for obsolescence issues. Technology development implementation and logistics for developmental items, and COLUMBIA Class test & evaluation for these items are also included. Technologies developed in this program will be considered for applicability to the VIRGINIA Program for commonality opportunities. The thrust of these efforts will be to maintain required technical performance and materiel readiness of COLUMBIA SSBNs in order to support the Sea Based Strategic Deterrence (SBSD) mission.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	24.127	27.013	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	59.140
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add supporting the development of composite materials for COLUMBIA Class Propulsion. FY19 Congressional Add supports the continued development of composite materials and also provides funding for the Naval Propulsion Foundry Center Facility Power Upgrades.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Advanced Materials Propeller Program ***FY 2019 Accomplishments:*** Continue the design and fabrication of composite Advanced Propulsor Bearing shaft components, Advanced Composite Control Surfaces, as well as composite CNC machining and inspection/handling fixturing for propulsor components. ***FY 2020 Plans:*** Using the FY19 funding, continue the design and fabrication of composite Advanced Propulsor Bearing shaft components, Advanced Composite Control Surfaces, as well as composite CNC machining and inspection/handling fixturing for propulsor components.	14.471	0.000
Congressional Add: Naval Propulsion Foundry Center Facility Power Upgrades ***FY 2019 Accomplishments:*** Complete initial Power/Utility upgrades, and support power/utility work and execute procurement of large, high speed milling machines contracted via Defense Logistics Agency (Aviation). These new machines will make use of the additional power provided to the Naval Foundry and Propeller Center (NFPC). Installation, acceptance and turnover to production for the machines will complete in FY20. ***FY 2020 Plans:*** Using the FY19 funding, complete installation, acceptance, and turnover to production for the machines.	12.542	0.000
Congressional Add: Materials for submarine propulsor applications ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Continue efforts from Advanced Materials Propeller Program for the design and fabrication of composite Advanced Propulsor Bearing shaft components, Advanced Composite Control Surfaces, as well as composite CNC machining and inspection/handling fixturing for propulsor components.	0.000	8.000
Congressional Adds Subtotals	27.013	8.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/CPFF	Seeman Composites : Gulfport, MS	1.171	0.000		8.000	Aug 2020	0.000		-		0.000	0.000	9.171	-
Product Development	TBD	Seeman Comp : Gulfport, MS	20.442	11.209	Sep 2019	0.000		0.000		-		0.000	0.000	31.651	-
Product Devlopment	WR	NSWC : Carderock, MD	2.514	3.262	Nov 2019	0.000		0.000		-		0.000	0.000	5.776	-
Product Development	C/FFP	DLA Aviation : Richmond, VA	0.000	12.542	Nov 2018	0.000		0.000		-		0.000	0.000	12.542	-
		Subtotal	24.127	27.013		8.000		0.000		-		0.000	0.000	59.140	N/A

Remarks

Seeman Composites follow on contract plan award date February 2019.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	24.127	27.013		8.000		0.000		-		0.000	0.000	59.140	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603595N / *SSBN New Design*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999 Note: * Effort began prior to 1st quarter FY 2019				
Initial Award on Current Vehicle (Delivery Order #15)*	1	2019	2	2020
SCI SBIR Phase III, Task Order #1, Composite Component Development	2	2019	4	2022
Task Order #2, HYSHMA Industrialization	3	2019	4	2022
Task Order #3, Composite Shafting and Propulsor Components	4	2019	2	2021
Task Order #4, Advanced Composite Manufacturing Technology Development	4	2019	4	2022
External Power Upgrade*	1	2019	3	2019
Power/Compressed Air Equipment Connection Projects*	1	2019	4	2019
First large high speed milling machine*	1	2019	3	2019
Second large high speed milling machine*	1	2019	4	2019
Third large high speed milling machine*	1	2019	1	2020

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	625.684	99.728	108.505	67.875	-	67.875	54.332	35.502	43.922	35.364	Continuing	Continuing
2550: *Mine Countermeasure (MCM) Mission Package*	0.000	40.175	39.499	26.895	-	26.895	27.853	10.687	10.859	11.044	Continuing	Continuing
2551: *Anti-Submarine Warfare (ASW) Mission Package*	0.000	39.925	41.580	23.897	-	23.897	17.585	15.796	23.865	14.938	Continuing	Continuing
2552: *Surface Warfare (SUW) Mission Package*	0.000	10.923	17.558	8.115	-	8.115	0.000	0.000	0.000	0.000	0.000	36.596
3129: *LCS Mission Package Development*	625.684	8.705	9.868	8.968	-	8.968	8.894	9.019	9.198	9.382	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 443

A. Mission Description and Budget Item Justification

The Littoral Combat Ship (LCS) Mission Modules (MM) Program Element (PE) provides funds for detailed design, development, issue resolution, certification, integration, and testing of the LCS MM. LCS is a fast, agile, and networked surface combatant with capabilities optimized to defeat asymmetric threats, and ensure naval and joint force access into contested littoral regions. It uses open-systems architecture design, modular weapons, sensor systems, and a variety of manned and unmanned vehicles to expand the battle space and project offensive power into the littoral.

The LCS MM Program employs an incremental development approach to deliver capability, which allows for insertion of mature capabilities throughout the life of the program without the need for modifications to the sea frames. Future capabilities will be considered when joint warfighting objectives or changing threats create new operational capability requirements that cannot be met by current mission package designs, or when new technological opportunities allow significant progress toward delivering cost effective, enhanced capabilities. Future mission module increments can be tested, constructed, and incorporated into existing mission packages, one of the most important benefits of LCS modular design.

Beginning in FY 2019, Mission Package funding is realigned into four (4) projects:
2550 Mine Countermeasures (MCM) Mission Package
2551 Anti-Submarine Warfare (ASW) Mission Package
2552 Surface Warfare (SUW) Mission Package
3129 LCS Mission Package Development

Prior to FY 2019 all Mission Package funding was in Project 3129.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*

MCM MP: Counters bottom, tethered, near surface, and surface mines in the littorals without putting sailors in the minefield.

SUW MP: Increases firepower and offensive/defensive capabilities against large numbers of highly maneuverable, fast, small craft threats, giving LCS the ability to protect the sea lanes while moving a force quickly through a choke point or other strategic waterway, and to conduct maritime security missions.

ASW MP: Enables the LCS to conduct detect-to-engage operations against modern submarines that pose a threat.

C5I: Enabling products required by all MPs such as common hardware interfaces, computer operating environment (Mission Package Computing Environment (MPCE)), communications systems (Multi-Vehicle Communications System (MVCS)), aviation interface systems, and Mission Package Portable Control Stations (MPPCS). MPCE provides common services and an Operating Environment to support all Mission Package Application Software (MPAS) and Open Architecture Products. MVCS enables the simultaneous control and data exchange between unmanned mission vehicles and the Ship. Aviation interface systems include integration and management of data communications, data processing, and physical hardware interfaces such as common equipment and containers used by all mission packages. MPPCS provides a mobile operating environment installed in a 20ft ISO container and serves as a surrogate Ship during mission package development and integration test events at test ranges.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	103.559	108.505	44.694	-	44.694
Current President's Budget	99.728	108.505	67.875	-	67.875
Total Adjustments	-3.831	0.000	23.181	-	23.181
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.831	0.000			
• Program Adjustments	0.000	0.000	22.800	-	22.800
• Rate/Misc Adjustments	0.000	0.000	0.381	-	0.381

Change Summary Explanation

FY 2019: -$3.831M SBIR transfer

FY 2021: +$6.400M for ASW MP ACB/TI Development; +$8.300M for ASW MP TEMP requirements; +$8.100M for SUW MP Temp requirements; and $0.381M NWCF rate adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2550: *Mine Countermeasure (MCM) Mission Package*	0.000	40.175	39.499	26.895	-	26.895	27.853	10.687	10.859	11.044	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 443

A. Mission Description and Budget Item Justification

The MCM Mission Package (MP) employs an incremental development approach to deliver capability, which allows the continued insertion of mature capabilities throughout the life of the program without the need for modifications to the sea frames. The focus is to minimize service life extensions to both MCM-1 ships and the MH-53E Helicopters. Future MCM MP capabilities will be considered when joint warfighting objectives or changing threats create new operational capability requirements that cannot be met by current mission package designs, or when new technological opportunities allow significant progress toward delivering cost effective, enhanced capabilities. Future mission module increments can be tested, constructed, and incorporated into existing mission packages, one of the most important benefits of LCS modular design.

The Program has begun investigation into the feasibility of integrating the MCM MP on Vessels of Opportunity (VOO). In FY2019, the Program demonstrated the flexibility of the modular MCM MP components by conducting a MCM Vessel of Opportunity (VOO) at-sea demonstration onboard the USNS Hershel "Woody" Williams (T-ESB 4).

The MCM MP will counter deep, shallow, and tethered mines in the littoral without putting Sailors in the minefield. When the MCM MP is embarked, LCS is capable of conducting detect-to-engage operations (hunting, sweeping, and neutralization) against very shallow to deep-water sea mine threats. The MCM MP provides these capabilities through the use of sensors and weapons deployed from an MH-60S multi-mission helicopter, unmanned offboard vehicles, and support equipment/ containers. The MCM MP consists of the following modules:
- Remote Minehunting (RMH) Module: Unmanned Surface Vehicle (USV) + Minehunting Payload Delivery System + AN/AQS-20 Minehunting Sonar
- Coastal Mine Reconnaissance (CMR) Module: Coastal Battlefield Reconnaissance & Analysis (COBRA) + MQ-8B Fire Scout Vertical Take-off and Landing Tactical Unmanned Aerial Vehicle (VTUAV)
- Near Surface Detection (NSD) Module: Airborne Laser Mine Detection System (ALMDS) + MH-60S Helicopter
- Airborne Mine Neutralization (AMN) Module: Airborne Mine Neutralization System (AMNS) + MH-60S Helicopter
- Unmanned Minesweeping (UMS) Module: Unmanned Influence Sweeping System (UISS) (USV + Minesweeping Payload Delivery System)
- Buried Minehunting (BMH) Module: Knifefish Unmanned Underwater Vehicle (UUV)

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Mine Countermeasures (MCM) Mission Modules	40.175	39.499	26.895	0.000	26.895

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-

FY 2020 Plans:
For the MCM MP Unmanned Minesweeping (UMS) module, the program is supporting the Unmanned Influence Sweep System (UISS) Developmental Test (DT) and Operational Assessment (OA) on LCS Independence variant, and will begin efforts to certify UMS for deployment on LCS Independence variant. In addition, the program is planning to integrate UMS on LCS Freedom variant and conduct LCS based integration testing (UISS Launch and Recovery).

For the MCM MP Buried Minehunting (BMH) Module, the program is supporting Knifefish integration testing on LCS Independence variant. Program has commenced planning to integrate BMH on LCS Freedom variant and has initiated LCS based integration testing.

For the MCM MP Remote Minehunting (RMH) Module, the program is supporting the system level at-sea developmental testing and is preparing for formal testing of the MCM MP on the Independence variant in FY 2021. Testing requires placement and removal of exercise mines in a minefield along with 24 hour monitoring of the minefield with an at-sea chase boat for the duration of the test event. In support of testing the program is procuring test spares and test support equipment.

The program is in the process of completing integration of Net-Centric Sensor Analysis for Mine Warfare (NSAM) and MCM USV with AQS-20C software along with development and incorporation of Problem Trouble Reports (PTRs) into MCM MPAS Build 3.0 to support formal MCM MP Developmental and Operational Testing in FY21. The program is integrating MPAS Build 3.0 into the Common Mission Package Trainer.

The program is continuing vendor training for MCM MP crews until outfitting of LCS Training Facilities is completed in FY 2023, to include crew travel to facilities.

The program has commenced development of test scenarios conduct work-ups and test plan for execution of at-sea MCM MP developmental testing (DT-B10 Phase I and II) to be conducted in FY 2021.

The tactics team is conducting test analysis for both the Freedom and Independence hull variants. Will execute test scenarios on the Naval Mine Warfare Simulator (NMWS) to support certification events, Mission Package Readiness Assessments (MPRAs), and the Tactical Action Working Group meetings.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The Program is certifying all aviation modules (NSD, AMN, CMR) for deployment on Freedom variant and executing a follow-on VOO event - MCM VOO Phase III aboard USNS Herschel "Woody" Williams (T-ESB-4). The program is performing systems engineering (risk management, information assurance, human systems integration, safety), configuration management and Integrated Logistics Support (ILS) efforts. The program is continuing to compile system and package level Reliability and Maintainability (RAM-C) data to support reliability engineering and a prioritized initial spares list. The program has initiated Full Operational Capability (FOC) RAM-C analysis with updated data and update RAM-C Rationale Report. The program is continuing efforts on MCM MP Failure Reporting, Analysis, and Corrective Action System (FRACAS).					
FY 2021 Base Plans: For the MCM MP Unmanned Minesweeping (UMS) module, the program will certify UMS for deployment on both LCS Independence and Freedom variants. For the MCM MP Buried Minehunting (BMH) Module, the program will support the Knifefish system-level operational assessment on LCS Independence variant. The Program will conduct Knifefish Launch and Recovery (L&R) testing and certify BMH for deployment on both LCS Independence and Freedom variants. For the MCM MP Remote Minehunting (RMH) Module, the program will conduct RMH integration tests on LCS Independence variant. The program will conduct MCM MP developmental testing (DT-B10 Phase I and II) and begin TECHEVAL. Testing requires placement and removal of exercise mines in a minefield along with 24 hour monitoring of the minefield with an at-sea chase boat for the duration of the test. Testing also requires procuring test spares and test support equipment. The program will complete development and incorporation of PTRs into MCM MPAS Build 3.0 to support FY 2022 MCM MP IOC. Integrate MPAS Build 3.0 into the Common Mission Package Trainer. The program will support Barracuda development efforts to ensure the system development accounts for eventual integration with the MCM MP and LCS Seaframe.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue vendor training for MCM MP crews until outfitting of LCS Training Facilities is completed in FY 2023, to include crew travel to facilities. The tactics team will continue to conduct test analysis for both the Freedom and Independence hull variants. Will execute test scenarios on the Naval Mine Warfare Simulator (NMWS) to support certification events, Mission Package Readiness Assessments (MPRAs), and the Tactical Action Working Group meetings. The program will perform systems engineering (risk management, information assurance, human systems integration, safety), configuration management and Integrated Logistics Support (ILS)). Continue to compile system and package level Reliability and Maintainability (RAM-C) data to support reliability engineering and a prioritized initial spares list. Initiate Full Operational Capability (FOC) RAM-C analysis with updated data and update RAM-C Rationale Report. Continue MCM MP Failure Reporting, Analysis, and Corrective Action System (FRACAS) effort. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease between FY 2020 and FY 2021 reflects the program completing mission system integration and mission system testing. Starting in FY 2021 the program will focus on Mission Package formal testing and fielding. MCM Mission Package is scheduled to IOC based on Independence variant testing in FY 2022.					
Accomplishments/Planned Programs Subtotals	40.175	39.499	26.895	0.000	26.895

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 1600: *LCS Common Mission Modules Equipment*	33.237	38.730	39.714	-	39.714	72.210	29.929	30.330	30.921	724.161	1,459.057
• OPN 1601: *LCS MCM Mission Modules*	98.901	64.789	218.822	-	218.822	222.754	234.330	243.187	247.949	1,111.812	2,666.795

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

Remarks

D. Acquisition Strategy

The LCS MM Acquisition Strategy employs an incremental procurement approach to allow for the rapid introduction of additional capabilities as system technology matures. This phased plan provides incremental fielding of capability as technology is matured, into the MCM MP until the full baseline capability defined in the Capability Development Document (CDD) is reached.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MCM MP	WR	NSWC PCD : Panama City, FL	0.000	19.604	Nov 2018	13.487	Nov 2019	4.480	Dec 2020	-		4.480	Continuing	Continuing	Continuing
MCM MP	Sub Allot	PMS 406 : Various	0.000	5.000	Feb 2019	2.650	Nov 2019	0.000		-		0.000	6.400	14.050	-
MCM MP	Sub Allot	PMS 495 : Various	0.000	1.000	Feb 2019	0.000		0.000		-		0.000	2.400	3.400	-
MCM MP	WR	NSWC PHD : Port Hueneme, CA	0.000	4.571	Dec 2018	5.000	Mar 2020	0.000		-		0.000	12.800	22.371	-
MCM MP	C/CPIF	Northrop Grumman : Bethpage, NY	0.000	9.600	Jan 2019	3.700	Jan 2020	4.047	Nov 2020	-		4.047	4.800	22.147	-
		Subtotal	0.000	39.775		24.837		8.527		-		8.527	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MCM MP Test Support	WR	NSWC PCD : Panama City, FL	0.000	0.000		14.162	Nov 2019	13.439	Dec 2020	-		13.439	0.000	27.601	-
MCM MP Test Support	WR	NSWC PHD : Port Hueneme, CA	0.000	0.000		0.000		4.432	Jan 2021	-		4.432	0.000	4.432	-
		Subtotal	0.000	0.000		14.162		17.871		-		17.871	0.000	32.033	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MCM Program Management	C/CPFF	Booz Allen Hamilton : Washington, DC	0.000	0.400	Oct 2018	0.500	Oct 2019	0.497	Nov 2020	-		0.497	1.680	3.077	-
		Subtotal	0.000	0.400		0.500		0.497		-		0.497	1.680	3.077	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*	

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	40.175		39.499		26.895		-		26.895	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

2021PB - 0603596N - 2550

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

2021PB - 0603596N - 2550

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2550				
UISS Mission System IOC	1	2021	1	2021
Knifefish Mission System IOC	3	2022	3	2022
USV + AN/AQS-20 DT / OA	4	2020	2	2021
BMH Integration Testing	3	2020	4	2020
UMS Integration Testing	3	2020	3	2020
DT-B10 (Phase 1)	2	2021	2	2021
DT-B10 (Phase 2)	3	2021	3	2021
DT-C10 TECHEVAL	4	2021	1	2022
OT-C10 IOT&E	1	2022	2	2022
MCM MP IOC on Independence Variant	3	2022	3	2022
Barracuda Integration	1	2023	1	2024
Barracuda Testing MCM Mission Package	2	2025	2	2025
Page2				
MCM Integration and Testing on Freedom Variant (FV): Knifefish L & R	4	2020	1	2021
MCM Integration and Testing on Freedom Variant (FV): UISS Launch and Recovery Testing	4	2020	4	2020
MCM Integration and Testing on Freedom Variant (FV): BMH Integration Testing	2	2021	2	2021
MCM Integration and Testing on Freedom Variant (FV): UMS Integration Testing	4	2021	4	2021
MCM Integration and Testing on Freedom Variant (FV): DT-B9 (Phase 1)	3	2022	3	2022
MCM Integration and Testing on Freedom Variant (FV): DT-B9 (Phase 2)	4	2022	4	2022
MCM Integration and Testing on Freedom Variant (FV): OT-C9 IOT&E	1	2023	1	2023

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2550 / *Mine Countermeasure (MCM) Mission Package*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MCM Integration and Testing on Freedom Variant (FV): Barracuda Integration	1	2024	4	2024
MCM Integration and Testing on Freedom Variant (FV): Barracuda Testing	4	2025	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603596N / *LCS Mission Modules*				Project (Number/Name) 2551 / *Anti-Submarine Warfare (ASW) Mission Package*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2551: *Anti-Submarine Warfare (ASW) Mission Package*	0.000	39.925	41.580	23.897	-	23.897	17.585	15.796	23.865	14.938	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 443												

A. Mission Description and Budget Item Justification

The ASW MP enables LCS to conduct detect-to-engage operations against submarines. Specific ASW capabilities include protecting forces in transit, protecting joint operating areas, and establishing ASW barriers. The ASW MP provides the warfighter capabilities that can be employed for ASW area search as well as high value unit escort missions. Key components of the ASW MP include a Variable Depth Sonar, a Multi-Function Towed Array and sonar signal processing. The individual systems are combined into modules: an ASW Escort Mission Module (EMM) that provides High Value Unit (HVU) escort capability and an Aviation Module that offers airborne threat localization and engagement capability through a MH-60R with MK54 torpedoes.

This project delivered the ASW EMM Pre-Production Test Article (PPTA) and the Aviation Module in Q1 FY 2019. Following the delivery of the PPTA, the ASW MP was installed on board a Freedom variant hull in Q4 FY 2019, to support Developmental Testing (DT) and Initial Operational Test & Evaluation (IOT&E) to support Initial Operational Capability (IOC) in FY 2020. Following integration and testing onboard a Freedom variant, this project will transition to production in FY 2020.

Due to a shift in test platform from LCS 4 to LCS 22, Independence variant ASW MP testing will complete later in FY22 than previously reported. The ASW MP performance will be demonstrated during the Freedom variant testing and will achieve IOC in FY20. Because the ASW MP is embarked with its own sonar signal processing capability, Independence variant testing is focused on the physical integration and employment/recovery.

The ASW MP will take advantage of improvements developed under the submarine Advanced Processing Build (APB), Advanced Surveillance Build (ASB) and Advanced Capability Build (ACB) and will in turn share unique improvements developed under this program with the submarine, surface combatants, and surveillance ASW communities. All programs (ACB, ASB, and APB) are managed under a common development process and titled AxB. While the LCS ASW MP will retains its uniqueness and focus in functional domains essential to mission package success, a premium is placed on development of common capabilities and modular architecture technologies to maximize commonality and cost effectiveness.

The Open System Architecture (OSA) and high performance Commercial Off-The-Shelf (COTS) sonar processing hardware, provided as an adjunct to the Mission Package Computing Environment (MPCE), will be fielded with the ASW MP and will provide an opportunity to integrate emergent, transformational ASW technological improvements that were previously unachievable. The ASW MP will require periodic upgrades to remain effective well into the 21st century and to pace the threat. Software upgrades target capability increases in high interest areas as prescribed by the Fleet and captured in campaign analysis. To achieve this, this project will package and deliver incremental upgrades every four years to the ASW MP baseline via an ACB development process by inserting maturing Undersea Warfare (USW) technologies and addressing hardware technology obsolescence.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Anti-Submarine Warfare (ASW) Mission Modules	39.925	41.580	23.897	0.000	23.897
Articles:	-	-	-	-	-

FY 2020 Plans:
COMPLETE FORMAL TESTING ON FREEDOM VARIANT:
1.) Conduct and complete DT-B3 Phase I and Phase II
2.) Conduct and complete DT-C3 (TECHEVAL)
3.) Conduct and OT-C3 (IOT&E)
4.) Conduct the Data Analysis Working Group (DAWG) and complete the Test Report
5.) Achieve ASW MP Initial Operational Capability (IOC) based on Freedom Variant testing
6.) Disembark the ASW Mission Package off LCS 3

Following the completion of testing on LCS 3 and debarkation of the ASW MP, perform Find-Fix-Repair efforts on the ASW MP to ensure ready for testing on LCS 22. Refurbish the Dual Array Mode Transmitter (DART) Pre-Production Test Article (PPTA).

In support of transitioning EMM to production, will complete System Qualification Testing (SQT), System Verification Review (SVR), Functional Configuration Audit (FCA), Physical Configuration Audit (PCA), and validation of sonar acoustic performance, shipboard interfaces, and launch, handling and recovery. The project will conduct a Production Readiness Review (PRR) in FY 2020.

Continue development of the EMM acoustic processing software and hardware (ACB19 software and TI20 sonar signal processing hardware) per IWS 5.0 AxB common development process. Integrate IWS 5.0 software baseline into ASW MPAS 2.2. Install and checkout ASW MPAS 2.2 at the General Dynamics Testing Facility in preparation for Land-Based integration in FY 2021.

Continue development of ASW MP operator training materials and course curriculum to support Train to Qualify and Train to Certify requirements. Continue development of component and system level modeling and simulation capabilities to enable high fidelity virtual reality training. Conduct vendor training events in support of formal courseware development. Continue development of Common Skills, ASW Skills, and O&M training to incorporate ASW MP capabilities for delivery to the LCS Training Facility and ASW Fleet Training Center in support of ready for training in FY 2022. Continue to provide initial training to LCS Sailors in support of key test events as well as temporary vendor training to ensure Sailors are receiving adequate ASW MP operation and

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
maintenance training until formal Navy training is fully established. Provide travel costs for Sailors to attend initial and vendor training. Perform systems engineering (risk management, information assurance, human systems integration, safety), configuration management, and Integrated Logistics Support (ILS). Develop draft Logistics materials. In support of preparation for Independence variant testing, update the Interface Control Document (ICD), complete the development of Ship Installation Drawings (SIDs) and Ship Change Documents (SCDs), and complete the design of the LCS 22 SHIPALT. ***FY 2021 Base Plans:*** INITIATE INTEGRATION OF THE ASW MP ON INDEPENDENCE VARIANT IN PREPARATION FOR FORMAL TESTING: 1.) Complete ACB 14.13L software baseline changes required to integrate with the LCS 22 Combat System (ICMS 6.2.1.X). Conduct Land-Based integration testing of ACB 14.13L baseline on-site at Lockheed Martin. 2.) Install and checkout ASW MPAS at the General Dynamics Testing Facility and perform Land-Based integration to certify the software for LCS 22. 3.) Perform Find-Fix-Repair efforts on the installation and embarkation material to ensure ready for testing on LCS 22. Modify material to incorporate Independence variant ship design changes. 4.) Conduct ship checks and embark the ASW MP to support formal testing. 5.) Embark the ASW MP onto LCS 22 and conduct Installation and Check Out (INCO) procedures. 6.) Initiate formal developmental testing and conduct DT-B6 Phase 0. 7.) Conduct LCS 22 Crew Training. 8.) Finalize safety analysis of the ASW MP equipment on the Independence variant. 9.) Finalize test objectives, performance prediction modeling, and test plans to support formal testing. Complete development of EMM acoustic processing software and hardware (ACB19 software and TI20 sonar signal processing hardware). Initiate Software Certification of ACB 20.19L, conduct shipboard integration and testing. Conduct Environmental Qualification Testing of the Sonar Signal Processing System (SSPS). Complete the development of ASW MP operator training materials and course curriculum to support Train to Qualify and Train to Certify requirements. Complete development of component and system level modeling and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
simulation capabilities to enable high fidelity virtual reality training. Conduct vendor training events in support of formal courseware development. Complete the development of Common Skills, ASW Skills, and O&M training to incorporate ASW MP capabilities for delivery to the LCS Training Facility and ASW Fleet Training Center in support of ready for training in FY 2022. Continue to provide initial training to LCS Sailors to ensure Sailors are receiving adequate ASW MP operation and maintenance training until formal Navy training is fully established. Provide travel costs for Sailors to attend initial and vendor training. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease between FY2020 and FY2021 reflects the program completing all integration and testing on the Freedom variant and the transition to production.					
Accomplishments/Planned Programs Subtotals	39.925	41.580	23.897	0.000	23.897

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 1600: *LCS Common Mission Modules Equipment*	33.237	38.730	39.714	-	39.714	72.210	29.929	30.330	30.921	724.161	1,459.057
• OPN 1602: *LCS ASW Mission Modules*	0.000	24.617	61.759	-	61.759	78.112	83.024	10.096	1.799	37.248	296.655

Remarks

D. Acquisition Strategy

The LCS MM Acquisition Strategy is employing an incremental procurement approach to allow for the rapid introduction of additional capabilities as system technology matures. This phased plan provides incremental fielding of capability through the introduction of mature programs of record into the respective Mission Packages until the full baseline capability defined in the Capability Development Document (CDD) is reached.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

Product Development ($ in Millions)

				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	**Contract Method & Type**	**Performing Activity & Location**	**Prior Years**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Cost To Complete**	**Total Cost**	**Target Value of Contract**
2.0 ASW MP	Various	PEO IWS 5E : Various	0.000	1.500	Nov 2018	0.000		0.150	Jan 2021	-		0.150	0.000	1.650	-
2.0 ASW MP	WR	NUWC NPT : Newport RI	0.000	2.380	Nov 2018	1.600	Nov 2019	1.800	Nov 2020	-		1.800	Continuing	Continuing	Continuing
2.0 ASW MP	WR	NIWC : San Diego, CA	0.000	0.750	Dec 2018	0.000		0.250	Jan 2021	-		0.250	0.000	1.000	-
2.0 ASW MP	C/CPFF	Northrop Grumman : Bethpage, NY	0.000	2.800	Jan 2019	0.000		1.500	Dec 2020	-		1.500	0.000	4.300	-
2.0 ASW MP	Sub Allot	PEO IWS 5A : Various	0.000	13.800	Mar 2019	12.200	Mar 2020	13.400	Mar 2021	-		13.400	Continuing	Continuing	Continuing
2.0 ASW MP	C/CPFF	CACI : Washington, DC	0.000	0.255	Jan 2019	0.000		0.000		-		0.000	0.000	0.255	-
2.0 ASW MP	WR	NSWC DD : Dahlgren, VA	0.000	0.225	Nov 2018	0.000		0.000		-		0.000	0.000	0.225	-
2.0 ASW MP	WR	SUPSHIP Bath : Bath, Me	0.000	1.550	Oct 2018	3.500	Oct 2019	0.000		-		0.000	0.000	5.050	-
2.0 ASW MP	MIPR	NAWC WD : Point Mugu, CA	0.000	0.410	Dec 2018	0.000		0.000		-		0.000	0.000	0.410	-
2.0 ASW MP	C/FFP	Raytheon : Portsmouth, RI	0.000	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	0.000	-
2.0 ASW MP	C/CPFF	Huntington Ingalls Industry : Pascagoula MS	0.000	0.000		0.000		2.200	Jan 2021	-		2.200	0.000	2.200	-
		Subtotal	0.000	23.670		17.300		19.300		-		19.300	Continuing	Continuing	N/A

Support ($ in Millions)

				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	**Contract Method & Type**	**Performing Activity & Location**	**Prior Years**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Award Date**	**Cost**	**Cost To Complete**	**Total Cost**	**Target Value of Contract**
2.0 ASW MP	WR	NUWC KPT : Keyport, Wa	0.000	0.500	Nov 2018	0.800	Nov 2019	0.850	Dec 2020	-		0.850	0.000	2.150	-
		Subtotal	0.000	0.500		0.800		0.850		-		0.850	0.000	2.150	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
2.0 ASW MP Test and Evaluation	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.550	Oct 2018	0.550	Oct 2019	0.200	Nov 2020	-		0.200	0.000	1.300	-
2.0 ASW MP Test and Evaluation	WR	NSWC PHD : Port Hueneme, Ca	0.000	1.766	Dec 2018	5.730	Dec 2019	0.300	Dec 2020	-		0.300	0.000	7.796	-
2.0 ASW MP Test and Evaluation	WR	Range Service : Var*	0.000	3.154	Oct 2018	4.300	Oct 2019	0.000		-		0.000	0.000	7.454	-
2.0 ASW MP Test and Evaluation	WR	NUWC NPT : Newport, RI	0.000	5.734	Dec 2018	8.400	Dec 2019	0.800	Nov 2020	-		0.800	0.000	14.934	-
2.0 ASW MP Test and Evaluation	WR	NUWC KPT : Keyport, Wa	0.000	2.600	Nov 2018	2.500	Nov 2019	0.000		-		0.000	0.000	5.100	-
2.0 ASW MP Test and Evaluation	C/CPFF	Raytheon : Portsmouth, RI	0.000	1.400	Jan 2019	1.400	Jan 2020	0.500	Dec 2020	-		0.500	0.000	3.300	-
2.0 ASW MP Test and Evaluation	C/CPFF	Northrop Grumman : Bethpage, NY	0.000	0.000		0.000		1.300	Dec 2020	-		1.300	0.000	1.300	-
		Subtotal	0.000	15.204		22.880		3.100		-		3.100	0.000	41.184	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
2.0 ASW MP	C/CPIF	Booz Allen Hamilton : Washington, DC	0.000	0.551	Jan 2019	0.600	Jan 2020	0.647	Jan 2021	-		0.647	0.000	1.798	-
		Subtotal	0.000	0.551		0.600		0.647		-		0.647	0.000	1.798	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	39.925		41.580		23.897		-		23.897	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Project 3129.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2551				
ASW MP Acquisition Milestones: DART Pre-Production Test Article Delievery	1	2019	1	2019
ASW MP Acquisition Milestones: White Ship Testing AUTEC	2	2019	2	2019
ASW MP Acquisition Milestones: EMM Production Transition	3	2019	2	2020
ASW MP Acquisition Milestones: EMM Production Readiness Review	3	2020	3	2020
Freedom Variant (FV) ASW Integration and Testing: ASW MP SHIPALT Execution on LCS 3	3	2019	4	2019
Freedom Variant (FV) ASW Integration and Testing: ASW MP Readiness Assessment (MPRA)/Mission Readiness Assessment	2	2019	2	2019
Freedom Variant (FV) ASW Integration and Testing: ASW MP Embark, INCO, DT Phase 0 on LCS 3	4	2019	4	2019
Freedom Variant (FV) ASW Integration and Testing: ASW MP DT-B3 Phase 1	1	2020	2	2020
Freedom Variant (FV) ASW Integration and Testing: ASW MP DT-B3 Phase 2	2	2020	2	2020
Freedom Variant (FV) ASW Integration and Testing: ASW MP DT/IT-C3 TECHEVAL	2	2020	3	2020
Freedom Variant (FV) ASW Integration and Testing: ASW MP OT-C3	3	2020	3	2020
Freedom Variant (FV) ASW Integration and Testing: ASW MP IOC	3	2020	3	2020
Independent Variant (IV) ASW Integration and Testing: ASW Mission Package SCD/ SID Development for Indepencence Variant	3	2020	1	2021
Independent Variant (IV) ASW Integration and Testing: ASW MP SHIPALT Execution	3	2021	4	2021
Independent Variant (IV) ASW Integration and Testing: ASW MP Embark, INCO, DT Phase 0	4	2021	4	2021
Independent Variant (IV) ASW Integration and Testing: ASW MP DT-B6 Phase 1	1	2022	1	2022
Independent Variant (IV) ASW Integration and Testing: ASW MP DT-B6 Phase 2	2	2022	2	2022

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2551 / *Anti-Submarine Warfare (ASW) Mission Package*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Independent Variant (IV) ASW Integration and Testing: ASW MP OT-C6	3	2022	4	2022
ASW MP AxB Development Process: ACB-19 with TI-20	1	2019	4	2022
ASW MP AxB Development Process: ACB-23 with TI-24	1	2022	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2552: *Surface Warfare (SUW) Mission Package*	0.000	10.923	17.558	8.115	-	8.115	0.000	0.000	0.000	0.000	0.000	36.596
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 443

A. Mission Description and Budget Item Justification

The SUW MP increases firepower and offensive/defensive capabilities against large numbers of highly maneuverable, fast, small craft threats, giving LCS the ability to protect the sea lanes and move a force quickly through a choke point or other strategic waterway. The SUW MP is composed of several modules including the Gun Mission Module (GMM), the Aviation Module, the Maritime Security Module (MSM), and the Surface-to-Surface Missile Module (SSMM). The GMM is comprised of two high velocity 30mm cannons and is augmented with the ship's 57mm gun to counter close in to mid-range threats. The Aviation Module uses the embarked MH-60R helicopter with Hellfire missile and the MQ-8B Fire Scout VTUAV for the detection, identification, and classification of surface contacts and to engage long range threats. The MSM supports the embarkation of a Visit, Board, Search, and Seizure (VBSS) team. The SSMM is a self-contained module consisting of 2 Missile Exhaust Containment Structures (MECS), integrated articulating hatch covers, a fire control system, and 12 two-rail MK 210 launchers to support load out and firing of 24 Longbow Hellfire missiles. SSMM provides missile coverage for mid-range threats and small boats.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Surface Warfare (SUW) Mission Modules	10.923	17.558	8.115	0.000	8.115
Articles:	-	-	-	-	-
FY 2020 Plans: Complete integration of SSMM with Independence variant Combat Management System (CMS), obtain Weapon Systems Explosives Safety Review Board/Software Systems Safety Technical Review Panel (WSESRB/ SSSTRP) approvals, and IA approvals necessary for formal shipboard testing on Independence variant. Assess performance envelope capabilities. Completed formal DT-B12 Phase I/II, and completed IT-C12 on Independence variant. Conducting the Data Analysis Working Group (DAWG) and completing the Test Report for SSMM testing on the Independence variant. Complete Combat System Certification in support of Deployment on Freedom Variant.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Initiate Cyber Security Test planning in preparation of Cyber Security testing in FY21. Update SSMM MPAS to incorporate testing findings. (Find-fix-Repair) Completed the nomenclature change for the SSMM Launcher from Army (M299) to Navy (MK 210). Redline the preliminary ILS and Training materials during testing to capture deltas between Freedom and Independence variant: 1.) Preliminary interim Training for Independence 2.) Preliminary Combat Systems Operational Sequencing System (CSOSS) manuals 3.) Preliminary SSMM Operators Manual 4.) Preliminary Technical Manual for MK 210 launcher 5.) Preliminary SSMM MPAS integration with CMPT					
FY 2021 Base Plans: Conduct Cyber Security Testing on Freedom and Independence Variant Complete Combat System Certification in support of Deployment on Independence Variant. Update Longbow Hellfire Tactical Software based on testing findings Incorporate all Independence test findings and finalize all ILS and Training material in support of SSMM fielding and deployments on Independence Variant: 1.) Interim Training for Independence 2.) Combat Systems Operational Sequencing System (CSOSS) manuals 3.) SSMM Operators Manual 4.) Technical Manual for MK 210 launcher 5.) SSMM MPAS integration with CMPT					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The decrease from FY2020 to FY2021, reflects the program completing formal testing and transitioning from development to Production and Sustainment. The efforts in FY2021 product development include find-fix-repair of test findings, conducting Cyber Security testing and complete final revision of Logistic and training support products.					
Accomplishments/Planned Programs Subtotals	10.923	17.558	8.115	0.000	8.115

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 1600: *LCS Common Mission Module Equipment*	33.237	38.730	39.714	-	39.714	72.210	29.929	30.330	30.921	724.161	1,459.057
• OPN 1603: *LCS SUW Mission Module*	13.025	14.598	24.412	-	24.412	25.240	28.858	0.924	0.920	22.070	271.796
• WPN 4221: *LCS Module Weapons*	11.350	10.998	4.253	-	4.253	3.961	4.039	4.120	4.268	54.190	110.565

Remarks

D. Acquisition Strategy

The LCS MM Acquisition Strategy is employing an incremental procurement approach to allow for the rapid introduction of additional capabilities as system technology matures. This phased plan provides incremental fielding of capability through the introduction of mature programs of record into the respective Mission Packages until the full baseline capability defined in the Capability Development Document (CDD) is reached.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
3.0 SUW MP	MIPR	JAMS PO : Various	0.000	1.350	Jan 2019	0.400	Jan 2020	0.500	Feb 2021	-		0.500	0.000	2.250	-
3.0 SUW MP	WR	NSWC DD : Dahlgren, VA	0.000	4.653	Nov 2018	3.100	Nov 2019	0.400	Nov 2020	-		0.400	0.000	8.153	-
		Subtotal	0.000	6.003		3.500		0.900		-		0.900	0.000	10.403	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
3.0 SUW MP	C/CPIF	Northrop Grumman : Bethpage, NY	0.000	0.800	Dec 2018	0.000		1.800	Nov 2020	-		1.800	0.000	2.600	-
3.0 SUW MP	WR	NSWC PHD : Port Hueneme, CA	0.000	0.000		0.000		2.000	Dec 2020	-		2.000	0.000	2.000	-
		Subtotal	0.000	0.800		0.000		3.800		-		3.800	0.000	4.600	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
3.0 SUW MP CYBER Testing	Sub Allot	NSWC PHD : Port Hueneme, CA	0.000	1.970	Jan 2019	3.058	Jan 2020	0.750	Dec 2020	-		0.750	0.000	5.778	-
3.0 SUW MP CYBER Testing	WR	NSWC Corona : Corona, CA	0.000	0.950	Jan 2019	1.000	Jan 2020	0.000		-		0.000	0.000	1.950	-
3.0 SUW MP CYBER Testing	WR	NSWC DD : Dahlgren, VA	0.000	0.750	Jan 2019	8.900	Jan 2020	2.015	Jan 2021	-		2.015	0.000	11.665	-
3.0 SUW MP CYBER Testing	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.000		0.600	Jan 2020	0.200	Dec 2020	-		0.200	0.000	0.800	-
		Subtotal	0.000	3.670		13.558		2.965		-		2.965	0.000	20.193	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
3.0 SUW MP	C/CPIF	Booz Allen Hamilton : Washington, DC	0.000	0.450	Jan 2019	0.500	Jan 2020	0.450	Jan 2021	-		0.450	0.000	1.400	-
		Subtotal	0.000	0.450		0.500		0.450		-		0.450	0.000	1.400	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	10.923		17.558		8.115		-		8.115	0.000	36.596	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

2021PB - 0603596N - 2552

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 2552 / *Surface Warfare (SUW) Mission Package*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2552				
Acquisition Milestones: Manufacturing actoring Readiness Review (MRR) for SSMM	2	2019	2	2019
SUW Testing on Freedom Variant: SSMM IOC	2	2019	2	2019
SUW Testing on Freedom Variant: SSMM Cyber Test Planning	2	2020	1	2021
SUW Testing on Freedom Variant: Conduct Cyber Security Testing Freedom Variant	2	2021	2	2021
SUW Testing on Independence Variant: SSMM TRACKEX	2	2019	2	2019
SUW Testing on Independence Variant: SSMM Structual Test Fire (STF)	3	2019	3	2019
SUW Testing on Independence Variant: SSMM DT-B12 Phase I	4	2019	4	2019
SUW Testing on Independence Variant: SSMM DT-B12 Phase II	1	2020	1	2020
SUW Testing on Independence Variant: SSMM IT-C12	1	2020	2	2020
SUW Testing on Independence Variant: Conduct the DAWG and Complete SSMM Test Report	2	2020	4	2020
SUW Testing on Independence Variant: MPAS 2.4.6 Updates to Incorporated Testing Findings	3	2020	4	2020
SUW Testing on Independence Variant: Cyber Security Testing Independence Variant	3	2021	3	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*				**Project (Number/Name)** 3129 / *LCS Mission Package Development*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3129: *LCS Mission Package Development*	625.684	8.705	9.868	8.968	-	8.968	8.894	9.019	9.198	9.382	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 443												

A. Mission Description and Budget Item Justification

The LCS MM Common Equipment consists of enabling products required by all MPs to provide common hardware interfaces, computer operating environment, communications systems, aviation interface systems, and portable development & integration test-sets. Common hardware interfaces include definition, installation, and control of mechanical, electrical, and cooling requirements common to all mission packages. The Mission Package Computing Environment (MPCE) provides common services and Operating Environment to support all Mission Package Application Software and Open Architecture Products. The Multi-Vehicle Communications System (MVCS) enables the control and data exchange of simultaneous unmanned mission vehicles and the Ship. Aviation interface systems include integration and management of data communications, data processing, and physical hardware interfaces such as common equipment and containers used by all mission packages. Development and integration test-sets provide a mobile operating environment installed in the Mission Package Portable Control Stations (MPPCS) to serve as a surrogate Ship during mission package development and integration test events at test ranges.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Command, Control, Communication, Computers, Cyber and Intelligence (C5I) and Mission Package Tactical Team Trainers	8.705	9.868	8.968	0.000	8.968
Articles:	-	-	-	-	-
FY 2020 Plans: Mission Package Computing Environment (MPCE) - AN/SYK-31 Complete Tech Refresh development of MPCE v2.0 and start Mission Package integration. Complete patching updates to Mission Package Software (MPS) and Mission Package Operating Environment (MPOE) to meet cybersecurity requirements. Establish updated MPS and MPOE baselines and conduct Government Factory Acceptance Test (GFAT). Integrate Mission Package Application Software for each of the three mission packages into MPCE v2.0, conduct element level testing at the Mission System Integration Center (MSIC) and the Distributed Integration Facility (DIF), and complete certification for use on LCS. Transition MPCE v2.0 for deployment and sustainment. Multi-Vehicle Communications System (MVCS) - AN/SYC-31:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Complete Tech Refresh development of MVCS 1.2.1 and support formal shipboard integration and testing with the MCM Mission Package. Continue development of MVCS v1.3. Start integration and testing of MVCS 1.3 into the off-board vehicles (UISS, MCM USV and Knifefish), and validate the Anti-Jam capabilities between the off-board vehicles and ship. Complete development and begin fielding of the Tech Refreshed MVCS on MCM division LCS ships. Common Mission Package Trainer (CMPT): Following the completion of the MPCE Technology Refresh, integration the updated hardware into the test platform for CMPT and certify the baseline for installation into the LTFs. Continue to compile system data to support Reliability and Maintainability (RAM-C) data to support reliability engineering and analysis. Continue FRACAS effort.					
FY 2021 Base Plans: Mission Package Computing Environment (MPCE) - AN/SYK-31 Complete MPCE v2.0 integration and certification for use with each of the Mission Package Application Software. Update and Certify all Logistic documentation to incorporate all MPCE v2.0 changes. Update the MPCE Training material in support of MPCE v2.0 Multi-Vehicle Communication System (MVCS) - AN/SYC-31: Begin integration of MVCE v1.3 into the MCM Mission Package. The integration and testing of MVCS v1.3 will initiate in FY 2021 and complete in FY 2023 and will incorporate Beyond Line Of Sight (BLOS) capability. Common Mission Package Trainer (CMPT): Complete the Technology Refresh of CMPT in alignment with MPCE v2.0. Continue to compile system data to support Reliability and Maintainability (RAM-C) data to support reliability engineering and analysis. Continue FRACAS effort.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY2021 decreased funding reflects the required level of support of Technology Refresh of the MPCE, MVCS and CMPT. These systems are on a four year refresh cycle to minimize obsolescence.					
Accomplishments/Planned Programs Subtotals	8.705	9.868	8.968	0.000	8.968

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 1600: *LCS Common Mission Modules Equipment*	33.237	38.730	39.714	-	39.714	72.210	29.929	30.330	30.921	724.161	1,459.057
• OPN 1601: *LCS MCM Mission Modules*	98.901	64.789	218.822	-	218.822	222.754	234.330	243.187	247.949	1,111.812	2,666.795
• OPN 1602: *LCS ASW Mission Modules.*	0.000	24.617	61.759	-	61.759	78.112	83.024	10.096	1.799	37.248	296.655
• OPN 1603: *LCS SUW Mission Modules*	13.025	14.598	24.412	-	24.412	25.240	28.858	0.924	0.920	22.070	271.796
• WPN 4221: *LCS Module Weapons*	11.350	10.998	4.253	-	4.253	3.961	4.039	4.120	4.268	54.190	110.565

Remarks

D. Acquisition Strategy

The LCS Mission Module Acquisition Strategy is employing an incremental procurement approach to allow for the rapid introduction of additional capabilities as system technology matures. This phased plan provides incremental fielding of capability through the introduction of mature programs of record into the respective Mission Packages until the full baseline capability defined in the Capability Development Document (CDD) is reached.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
6.1 System Engineering	WR	NSWC PCD : Panama City, FL	0.275	0.000		0.000		0.000		-		0.000	0.000	0.275	-
6.1 System Engineering	WR	NSWC DD : Dahlgren, VA	1.784	0.000		0.000		0.000		-		0.000	0.000	1.784	-
6.1 System Engineering	WR	NAVSEALOGCEN : Norfolk, VA	1.520	0.000		0.000		0.000		-		0.000	0.000	1.520	-
6.1 System Engineering	C/CPFF	Northrop Grumman : Bethpage, NY	14.542	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
6.1 System Engineering	WR	NSWC Carderock : Bethesda, MD	2.610	0.000		0.000		0.000		-		0.000	0.000	2.610	-
6.1 System Engineering	WR	NSWC PHD : Port Hueneme, CA	1.568	0.000		0.000		0.000		-		0.000	0.000	1.568	-
6.1 System Engineering	WR	NIWC : San Diego, CA	7.660	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
6.1 System Engineering	C/CPIF	Booz Allen Hamilton : Washington, DC	0.355	0.000		0.000		0.000		-		0.000	0.000	0.355	-
6.4 Integration, Assembly, Test and Checkout	Sub Allot	CECOM Bldg 1207 : Various	1.092	0.000		0.000		0.000		-		0.000	0.000	1.092	-
6.4 Integration, Assembly, Test and Checkout	WR	NAWC AD : Patuxent River, MD	1.930	0.000		0.000		0.000		-		0.000	0.000	1.930	-
6.4 Integration, Assembly, Test and Checkout	WR	NSWC DD : Dahlgren, VA	0.203	0.000		0.000		0.000		-		0.000	0.000	0.203	-
6.4 Integration, Assembly, Test and Checkout	WR	NSWC PC : Panama City, FL	0.075	0.000		0.000		0.000		-		0.000	0.000	0.075	-
6.4 Integration, Assembly, Test and Checkout	C/CPFF	Northrop Grumman : Bethpage, NY	1.498	0.000		0.000		0.000		-		0.000	0.000	1.498	-
6.4 Integration, Assembly, Test and Checkout	WR	NSWC Carderock : Bethesda, MD	8.625	0.000		0.000		0.000		-		0.000	0.000	8.625	-
6.4 Integration, Assembly, Test and Checkout	C/CPFF	PMS 501 : Various	1.075	0.000		0.000		0.000		-		0.000	0.000	1.075	-
6.4 Integration, Assembly, Test and Checkout	WR	NIWC : San Diego, CA	1.857	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
6.4 Integration, Assembly, Test and Checkout	WR	NSWC PHD : Port Hueneme, CA	1.312	0.000		0.000		0.000		-		0.000	0.000	1.312	-
6.4 Integration, Assembly, Test and Checkout	C/CPIF	Booz Allen Hamilton : Washington, DC	0.950	0.000		0.000		0.000		-		0.000	0.000	0.950	-
6.4 Integration, Assembly, Test and Checkout	WR	NAVAIR : Lakehurst, NJ	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	C/CPFF	AAC : Uniontown, PA	15.263	2.500	Jan 2019	2.928	Jan 2020	2.635	Jan 2021	-		2.635	0.000	23.326	-
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	NAWC TSD : Orlando, FL	1.104	0.550	Dec 2018	0.650	Dec 2019	0.000		-		0.000	0.000	2.304	-
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	C/CPFF	Northrop Grumman : Bethpage, NY	2.600	0.990	Jan 2019	0.892	Jan 2020	0.800	Nov 2020	-		0.800	Continuing	Continuing	Continuing
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	NSWC PC : Panama City, FL	12.870	2.083	Nov 2018	2.187	Nov 2019	1.943	Nov 2020	-		1.943	Continuing	Continuing	Continuing
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	NUWC NPT : Newport, RI	2.074	0.550	Nov 2018	0.450	Nov 2019	0.205	Dec 2020	-		0.205	Continuing	Continuing	Continuing
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	C/CPIF	Booz Allen Hamilton : Washington, DC	1.469	0.820	Dec 2018	0.836	Dec 2019	0.802	Nov 2020	-		0.802	0.000	3.927	-
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	NIWC : San Diego, CA	3.949	0.469	Nov 2018	1.175	Nov 2019	1.058	Jan 2021	-		1.058	0.000	6.651	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	NSWC DD : Dahlgren, VA	2.669	0.743	Nov 2018	0.750	Dec 2019	0.675	Dec 2020	-		0.675	Continuing	Continuing	Continuing
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	WR	PMW 760 : Various	0.889	0.000		0.000		0.000		-		0.000	0.000	0.889	-
4.0 Command, Control, Communication, Computers, Collaboration and Intelligence (C5I)	C/CPFF	Progeny : Manassas, VA	1.730	0.000		0.000		0.000		-		0.000	0.000	1.730	-
1.0 MCM MP	WR	NSWC PC : Panama City, FL	71.297	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
1.0 MCM MP	Sub Allot	PMS 406 : Various	42.761	0.000		0.000		0.000		-		0.000	0.000	42.761	-
1.0 MCM MP	Sub Allot	PMS 495 : Various	0.249	0.000		0.000		0.000		-		0.000	0.000	0.249	-
1.0 MCM MP	WR	NSWC PHD : Port Hueneme, CA	2.300	0.000		0.000		0.000		-		0.000	0.000	2.300	-
1.0 MCM MP	C/CPIF	Booz Allen Hamilton : Washington, DC	0.400	0.000		0.000		0.000		-		0.000	0.000	0.400	-
1.0 MCM MP	C/CPFF	Northrop Grumman : Bethpage, NY	1.892	0.000		0.000		0.000		-		0.000	0.000	1.892	-
1.0 MCM MP	WR	Various : Various	1.124	0.000		0.000		0.000		-		0.000	0.000	1.124	-
2.0 ASW MP	Sub Allot	PEO IWS5E : Various	41.094	0.000		0.000		0.000		-		0.000	0.000	41.094	-
2.0 ASW MP	WR	NUWC NPT : Newport, RI	29.320	0.000		0.000		0.000		-		0.000	0.000	29.320	-
2.0 ASW MP	WR	SSC PAC : San Diego, CA	4.967	0.000		0.000		0.000		-		0.000	0.000	4.967	-
2.0 ASW MP	WR	CDSA Dam Neck : Virginia Beach, VA	11.145	0.000		0.000		0.000		-		0.000	0.000	11.145	-
2.0 ASW MP	C/CPFF	Northrop Grumman : Bethpage, NY	10.914	0.000		0.000		0.000		-		0.000	0.000	10.914	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
2.0 ASW MP	WR	PEO IWS 5A : Various	9.301	0.000		0.000		0.000		-		0.000	0.000	9.301	-
2.0 ASW MP	C/CPFF	SPA : Washington, DC	1.687	0.000		0.000		0.000		-		0.000	0.000	1.687	-
2.0 ASW MP	WR	NSWC DD : Dahlgren, VA	0.871	0.000		0.000		0.000		-		0.000	0.000	0.871	-
2.0 ASW MP	WR	NUWC KPT : Keyport, WA	1.095	0.000		0.000		0.000		-		0.000	0.000	1.095	-
2.0 ASW MP	WR	NSWC PHD : Port Hueneme, CA	1.550	0.000		0.000		0.000		-		0.000	0.000	1.550	-
2.0 ASW MP	C/FPIF	Booz Allen Hamilton : Washington, DC	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
2.0 ASW MP	WR	NAWC WD : Point Mugu, CA	5.430	0.000		0.000		0.000		-		0.000	0.000	5.430	-
2.0 ASW MP	C/CPFF	Various : Various	3.757	0.000		0.000		0.000		-		0.000	0.000	3.757	-
2.0 ASW MP	Sub Allot	Raytheon : Portsmouth, RI	42.056	0.000		0.000		0.000		-		0.000	0.000	42.056	-
3.0 SUW MP	C/CPFF	JAMS PO : Various	7.980	0.000		0.000		0.000		-		0.000	0.000	7.980	-
3.0 SUW MP	WR	NAWC WD : Ridgecrest, CA	7.826	0.000		0.000		0.000		-		0.000	0.000	7.826	-
3.0 SUW MP	C/CPFF	Northrop Grumman : Bethpage, NY	60.524	0.000		0.000		0.000		-		0.000	0.000	60.524	-
3.0 SUW MP	WR	NSWC CD : Crane, IN	0.396	0.000		0.000		0.000		-		0.000	0.000	0.396	-
3.0 SUW MP	WR	NSWC Corona : Corona, CA	1.695	0.000		0.000		0.000		-		0.000	0.000	1.695	-
3.0 SUW MP	WR	NSWC DD : Dahlgren, VA	60.316	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
3.0 SUW MP	WR	NSWC PHD : Port Hueneme, CA	30.437	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
3.0 SUW MP	Sub Allot	PEO IWS 3 : Various	9.819	0.000		0.000		0.000		-		0.000	0.000	9.819	-
		Subtotal	556.451	8.705		9.868		8.118		-		8.118	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
6.5 Training Systems Development	WR	NAWC TSD : Orlando, Fl	0.909	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
6.5 Training Systems Development	WR	NSWC PHD : Port Hueneme, CA	0.390	0.000		0.000		0.000		-		0.000	0.000	0.390	-
6.5 Training Systems Development	C/CPIF	Booz Allen Hamilton : Washington, DC	0.268	0.000		0.000		0.000		-		0.000	0.000	0.268	-
6.5 Training Systems Development	C/CPAF	Northrop Grumman : Bethpage, NY	0.575	0.000		0.000		0.000		-		0.000	0.000	0.575	-
6.5 Training Systems Development	Sub Allot	Various : Various	3.221	0.000		0.000		0.000		-		0.000	0.000	3.221	-
6.5 Training Systems Development	WR	JHU/APL : Laurel, MD	1.479	0.000		0.000		0.000		-		0.000	0.000	1.479	-
		Subtotal	6.842	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
6.3 System Test and Evaluation	WR	NSWC PHD : Port Hueneme, CA	27.963	0.000		0.000		0.000		-		0.000	0.000	27.963	-
6.3 System Test and Evaluation	WR	COMOPTEVFOR : Norfolk, VA	4.944	0.000		0.000		0.000		-		0.000	0.000	4.944	-
6.3 System Test and Evaluation	WR	NSWC Corona : Corona, CA	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
6.3 System Test and Evaluation	WR	NIWC : San Diego, CA	5.258	0.000		0.000		0.000		-		0.000	0.000	5.258	-
6.3 System Test and Evaluation	C/CPIF	Booz Allen Hamilton : Washington, DC	0.750	0.000		0.000		0.000		-		0.000	0.000	0.750	-
		Subtotal	39.415	0.000		0.000		0.000		-		0.000	0.000	39.415	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
6.2 Program Management	C/CPFF	CACI : Fairfax, VA	7.698	0.000		0.000		0.000		-		0.000	0.000	7.698	-
6.2 Program Management	C/CPIF	Booz Allen Hamilton : Washington DC	4.695	0.000		0.000		0.850	Nov 2020	-		0.850	0.000	5.545	-
6.2 Program Management	FFRDC	Mitre : McLean, VA	2.679	0.000		0.000		0.000		-		0.000	0.000	2.679	-
6.2 Program Management	FFRDC	JHU/APL : Laurel, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
6.2 Program Management	C/CPFF	Northrop Grumman : Bethpage, NY	4.977	0.000		0.000		0.000		-		0.000	0.000	4.977	-
6.2 Program Management	C/CPFF	NSWC Crane : Various	2.927	0.000		0.000		0.000		-		0.000	0.000	2.927	-
		Subtotal	22.976	0.000		0.000		0.850		-		0.850	0.000	23.826	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	625.684	8.705		9.868		8.968		-		8.968	Continuing	Continuing	N/A

Remarks

Beginning in FY 2019, Mission Package funding is realigned into four (4) projects:

2550 Mine Countermeasures (MCM) Mission Package
2551 Anti-Submarine Warfare (ASW) Mission Package
2552 Surface Warfare (SUW) Mission Package
3129 LCS Mission Package Development

Prior to FY 2019 all Mission Package funding was in Project 3129.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603596N / *LCS Mission Modules*	**Project (Number/Name)** 3129 / *LCS Mission Package Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3129				
LCS C5I: MPCE: Develop and establish baseline for MPCE v2.0 Technology Refresh (TR)	1	2019	2	2021
LCS C5I: MPCE: Conduct PDR and CDR for MPCE v2.0 (AN/SYK-31) TR	4	2019	4	2019
LCS C5I: MPCE: Develop two Production Test Articles (PTA) to support testing/ certification	1	2020	2	2020
LCS C5I: MPCE: Conduct testing and certification of MPCE v2.0 HW/SW	3	2020	2	2021
LCS C5I: MPCE: CMPT Technology Refresh	1	2021	4	2022
LCS C5I: MPCE: Technology Refresh MPCE and establish MPCE v3.0	1	2024	4	2025
LCS C5I: Multi-Vehicle Communication System (MVCS): Deliver MVCS v1.2.1	1	2020	1	2020
LCS C5I: Multi-Vehicle Communication System (MVCS): Development of MVCS 1.3 TR	1	2020	4	2023
LCS C5I: Multi-Vehicle Communication System (MVCS): MVCS 1.3 Testing with Barracuda	2	2023	4	2024

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	60.830	36.563	42.653	4.797	-	4.797	9.729	9.299	8.272	8.437	Continuing	Continuing
9999: *Congressional Adds*	16.406	28.942	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.348
9B88: *Automated Test and Analysis*	44.424	7.621	7.653	4.797	-	4.797	9.729	9.299	8.272	8.437	Continuing	Continuing

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $2.978 million to account for the availability of prior year execution balances.

In FY 2016, OPNAV N94 implemented a Naval enterprise approach to Automated Test and Analysis (ATA). ATA expands the automated test methods currently in use (Automated Test and Re-Test (ATRT)), adds new methods of testing and use of automated test technologies, and standardizes automated test practices, methods and tools. Examples from FY16 include but are not limited to improvements to Link-16 Non-C2 data collection, essential Mission Planning, Service Oriented Architecture Framework, AEGIS Enterprise Solution Enhancements, Strike Force Interoperability testing and Control System Restoration and Validation. In addition, funding supports the development of enterprise level strategies to apply ATA technologies to software-intensive acquisition programs. The FY 2015 ATRT project was funded on Program Element 0603597N: "Automated Test and Re-Test". Starting in FY16 and through the out-years, the project is renamed "Automated Test and Analysis" on Program Element 0603597N.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	37.931	7.653	7.775	-	7.775
Current President's Budget	36.563	42.653	4.797	-	4.797
Total Adjustments	-1.368	35.000	-2.978	-	-2.978
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	35.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.368	0.000			
• Program Adjustments	0.000	0.000	-2.975	-	-2.975
• Rate/Misc Adjustments	0.000	0.000	-0.003	-	-0.003

Congressional Add Details ($ in Millions, and Includes General Reductions)

FY 2019	FY 2020

Project: 9999: *Congressional Adds*

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2019**	**FY 2020**
Congressional Add: *Program Increase (ATA)*	28.942	0.000
Congressional Add: *ONR CTE*	0.000	35.000
Congressional Add Subtotals for Project: 9999	28.942	35.000
Congressional Add Totals for all Projects	28.942	35.000

Change Summary Explanation

FY21: Funding reduced by $2.978 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603597N / *Automated Test & Analysis*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	16.406	28.942	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.348
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In response to CNO initiatives, NAVSEA 05H, under the sponsorship of OPNAV N96, in 2008 began developing tools and executing projects for NAVSEA programs in support of "Automated Test and Re-Test". In 2014, CNO/ASN RDA implemented an "Enterprise" approach to automated testing to foster increased automated test tool use and collaboration between Navy SYSCOMs. PE 0603582N Project 9B88, "Automated Test and Re-Test," under OPNAV N96 was modified and moved in FY2016 to "Automated Test and Analysis" (ATA) under PE 0603597N under OPNAV N94. ATA expands the automated test methods currently in use (Automated Test and Re-Test (ATRT)), adds new methods of testing and use of automated test technologies, and standardizes automated test practices, methods and tools. In addition, funding supports the development of enterprise level strategies to apply ATA technologies to Navy software-intensive acquisition programs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Program Increase (ATA)	28.942	0.000

FY 2019 Accomplishments: With a Program Increase to Project Unit (PU) C449 of $30M received in FY 2019, ATA was able to provide support for the following efforts:

- Program Management
- Infrastructure Development
- Capability Enhancements
- Tools/Product Integration
- Capability Demonstrations

These efforts supported development of techniques/tools/solutions maturing automated test and analysis capabilities supporting NAVY Digital Transformation Initiatives. These efforts supported development of automatic techniques/tools/solutions to achieve NAVSEA Digital Transformation Initiatives to include DevSecOps, Agile software development, C2C24 (Compile to Combat in 24), System of Systems Virtualization, Digital Engineering, MBSE (Model Based System Engineering), AEGIS Virtual Twin, ONR Cloud Development Environment, and Capabilities Based/Mission Based T&E.

*Program Management efforts established a governance process to manage the projects across the Navy SYSCOMs and provide forums for technical exchanges amongst the projects.
*Infrastructure Development efforts established a virtual DevSecOps with automatic testing and analysis tools within a cloud environment for US Navy.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
*Capability Enhancement efforts proved the application of Automated Test and Analysis in several contexts, including Systems of Systems Analysis; Cybersecurity, and a DevSecOps environment. *Tools/Product Integration efforts proved out providing the Automated Test and Re-Test Tool suite as Application-As-A-Service within a cloud environment *Capability Demonstrations proved out the ability to use digital models and integrate in a Live, Virtual, and Constructive allowing Automated Testing and Analysis ***FY 2020 Plans:*** N/A		
Congressional Add: ONR CTE ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Planned efforts will focus on the continued develop of the Automated Test and Analysis Infrastructure within the Cloud and ensuring that processes/tools/models are interoperable with other Digital Transformation efforts and products. This will include adapting tools and processes into a common architecture and framework, demonstrating that interoperability, and finally applying and demonstrating these capabilities within Navy operational environments in systems of systems mission contexts. *Program Management efforts will provide governance across the Navy, technically manage the efforts, and ensure collaboration across projects and programs. *Infrastructure Development efforts will continue development of the virtual DevSecOps within a cloud environment and will add connecting classified nodes in a distributed environment. *Capability Enhancement efforts will expand the ability of Automated Test and Analysis tools to be interoperable with other digital transformation tools and products.. *Tools/Product Integration efforts proved out providing the Automated Test and Re-Test Tool suite as Application-As-A-Service within a cloud environment *Capability Demonstrations will continue efforts to integrate digital models in a Live, Virtual, and Constructive environment but expand to prove interoperability of digital models developed against a common framework. These capability demonstrations will target systems of systems testing in Navy Mission environments with the goal of providing decision quality design decisions earlier in the development process.	0.000	35.000
Congressional Adds Subtotals	28.942	35.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

D. Acquisition Strategy

The ATA program solicits automated test tool projects from all qualified sources that show the potential to significantly reduce the time to complete critical testing, increase productivity or system robustness, improve and speed test analysis, and identify commonalities for reuse in testing of Naval acquisition programs. All valid submitted projects will be evaluated for potential funding. Projects selected will typically be funded for one year, in which time they must demonstrate their ability to significantly reduce the time to complete critical testing, improve and speed test analysis, or find and correct critical design flaws in testing of Naval acquisition programs. Successful project artifacts will be advertised and made available across the Naval enterprise for acquisition program consideration, modification, and use.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Automated Test & Analysis	C/CPFF	Innovative Defense Technologies (IDT) : Ballston, VA	8.797	7.285	Jul 2019	19.500	May 2020	0.000		-		0.000	0.000	35.582	-
Automated Test & Analysis	WR	NIWC Pacific : San Diego, CA	4.383	0.000		0.000		0.000		-		0.000	0.000	4.383	-
Automated Test & Analysis	WR	Marine Corp : Not Specified	0.450	0.000		0.000		0.000		-		0.000	0.000	0.450	-
Automated Test & Analysis	WR	NAVAIR : Lakehurst NJ	2.095	0.267	Jun 2019	0.000		0.000		-		0.000	0.000	2.362	-
Automated Test & Analysis	WR	Various NSWCs : Various	0.000	3.328	Jan 2019	5.000	Apr 2020	0.000		-		0.000	0.000	8.328	-
Automated Test & Analysis	C/FFP	AFLCMC/AZS : Hanscomb AFB	0.478	0.000		0.000		0.000		-		0.000	0.000	0.478	-
Automated Test & Analysis	C/FFP	AFIT : Wright- : AFB, OH	0.203	0.000		0.000		0.000		-		0.000	0.000	0.203	-
Automated Test & Analysis	C/CPFF	NAVSEA HQ : Washington, DC	0.000	4.265	Jul 2019	1.000	Mar 2020	0.000		-		0.000	0.000	5.265	-
Automated Test & Analysis	TBD	ONR : VA	0.000	13.642	May 2019	5.000	Feb 2020	0.000		-		0.000	0.000	18.642	-
Automated Test & Analysis	TBD	SYSCOMS : Various	0.000	0.000		2.500	Apr 2020	0.000		-		0.000	0.000	2.500	-
		Subtotal	16.406	28.787		33.000		0.000		-		0.000	0.000	78.193	N/A

Remarks

Transfer of FY19 Automated Test and Analysis (ATA) from NAVSEA to ONR in the amount of $13,642,000 so funding can be directly executed to focus on the development, and edge deployment, of distributed combat system capabilities enabling the CNOs concept for distributed maritime operations. The prototype Cloud-To-Edge (CTE) environment will allow for secure combat system development, automated test and analysis, scalable distributed simulation and a seamless push to afloat, and airborne, edge infrastructure allowing the Navys designated user community to make software updates while maintaining, or eliminating, the need for an Authority to Operate (ATO). The collective infrastructure includes the cloud, software development tools, curation, security management, secure vendor access, cyber security oversight, and the deployed edge infrastructure is called the CTE environment.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Automated Test & Analysis	C/CPFF	DELTA Resources, Inc. : Washington, DC	0.000	0.155	Apr 2019	2.000	Apr 2020	0.000		-		0.000	0.000	2.155	-
		Subtotal	0.000	0.155		2.000		0.000		-		0.000	0.000	2.155	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	16.406	28.942		35.000		0.000		-		0.000	0.000	80.348	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
FY19 Project 1: SoS Virtualization (follow-on to FY18 SOS Virtualization effort):	2	2019	4	2020
FY19 Project 2: Aegis Virtual Twin:	3	2019	4	2020
FY19 Project 3:ONR Cloud Development Environment:	3	2019	4	2020
FY20 CTE Program Magt/ Governance Process/ Technical Exchanges:	1	2020	4	2021
FY20 CTE Infrastructure Development:	2	2020	4	2021
FY20 CTE Capability Enhancements:	2	2020	4	2021
FY20 CTE Tools/Product Integration:	2	2020	4	2021
FY20 CTE Capability Demonstrations:	2	2020	4	2021
FY20 CTE / AEGIS Virtual Twin:	1	2020	3	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*				**Project (Number/Name)** 9B88 / *Automated Test and Analysis*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
9B88: *Automated Test and Analysis*	44.424	7.621	7.653	4.797	-	4.797	9.729	9.299	8.272	8.437	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In FY 2016, OPNAV N94 implemented a Naval enterprise approach to Automated Test and Analysis (ATA). ATA expands the automated test methods currently in use (Automated Test and Re-Test (ATRT)), adds new methods of testing and use of automated test technologies, and standardizes automated test practices, methods and tools. Examples from FY16 include but are not limited to improvements to Link-16 Non-C2 data collection, essential Mission Planning, Service Oriented Architecture Framework, AEGIS Enterprise Solution Enhancements, Strike Force Interoperability testing and Control System Restoration and Validation. In addition, funding supports the development of enterprise level strategies to apply ATA technology to the software-intensive acquisition programs. The FY 2015 ATRT project was funded in Program Element 0603597N under Project Unit 9B88: "Automated Test and Re-Test". Starting in FY16 and through the out-years, the project is renamed "Automated Test and Analysis" in Program Element 0603597N under Project Unit 9B88.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Automated Test and Analysis	7.621	7.653	4.797	0.000	4.797
Articles:	-	-	-	-	-

FY 2020 Plans:

ATA projects will be selected based on their impact towards achieving the Navy's digital transformation and digital engineering strategy goals. This will continue to improve upon and leverage previous automated test and analysis investments while also pursuing system virtualization projects similar to Aegis Virtual Twin. Project will reevaluate selected ATA FY 2019 proposals for improving technologies in FY 2020 and potential collaboration in development. FY 2020 plans will also build upon the results and lessons learned from the FY 2018 and FY 2019 selection process for improved ATA program planning, selection, execution and analysis. The Navy intends to continue improvements in the quality of end products, reducing the time to plan, evaluate, analyze and/or report testing requirements, identify cost avoidance and determine the reduction in total ownership costs for each ATA project. The Navy will also determine enterprise solutions that significantly reduce test and evaluation man-hours, positively impact fleet training, and improve test plans and procedures.

The Navy will continue:
o Assessing undersea warfare capabilities or fleet modernization and future Navy testing competencies
o Evaluating best practices and research capabilities for platform network resiliency and system function validation

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
o Determining common elements through ATA analysis and reporting across multiple SYSCOMs and identifying synergies in development, implementation and training o Augmenting both surface and air Mission Planning for requirements traceability. Specific topics include but are not limited to: o Automating Test Framework for Operations Centers or Service Oriented Architectures o Continuing advanced Combat System development/enhancements (SSDS and AEGIS) o Testing of shipboard navigation or mechanical systems and tactical data links analysis (Link-16) o Integrating test and analyses among various Strike Force Interoperability platforms o Implementing test planning/manager improvements					
FY 2021 Base Plans: ATA projects will be selected based on their impact towards achieving the Navy's digital transformation and digital engineering strategy goals. This will continue to improve upon and leverage previous automated test and analysis investments while also pursuing system virtualization projects similar to Aegis Virtual Twin. Project will reevaluate selected ATA FY 2019 proposals for improving technologies in FY 2020 and potential collaboration in development. FY 2020 plans will also build upon the results and lessons learned from the FY 2018 and FY 2019 selection process for improved ATA program planning, selection, execution and analysis. The Navy intends to continue improvements in the quality of end products, reducing the time to plan, evaluate, analyze and/or report testing requirements, identify cost avoidance and determine the reduction in total ownership costs for each ATA project. The Navy will also determine enterprise solutions that significantly reduce test and evaluation man-hours, positively impact fleet training, and improve test plans and procedures. The Navy will continue: o Assessing undersea warfare capabilities or fleet modernization and future Navy testing competencies o Evaluating best practices and research capabilities for platform network resiliency and system function validation o Determining common elements through ATA analysis and reporting across multiple SYSCOMs and identifying synergies in development, implementation and training o Augmenting both surface and air Mission Planning for requirements traceability. Specific topics include but are not limited to: o Automating Test Framework for Operations Centers or Service Oriented Architectures o Continuing advanced Combat System development/enhancements (SSDS and AEGIS) o Testing of shipboard navigation or mechanical systems and tactical data links analysis (Link-16)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
o Integrating test and analyses among various Strike Force Interoperability platforms o Implementing test planning/manager improvements ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to rate adjustments.					
Accomplishments/Planned Programs Subtotals	7.621	7.653	4.797	0.000	4.797

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The ATA program solicits automated test tool projects from all qualified sources that show the potential to significantly reduce the time to complete critical testing, increase productivity or system robustness, improve and speed test analysis, and identify commonalities for reuse in testing of Naval acquisition programs. All valid submitted projects will be evaluated for potential funding. Projects selected will typically be funded for one year, in which time they must demonstrate their ability to significantly reduce the time to complete critical testing, improve and speed test analysis, or find and correct critical design flaws in testing of Naval acquisition programs. Successful funded projects and artifacts will be advertised and made available across the Naval enterprise for acquisition program consideration, funding, and use.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Automated Test & Analysis	C/CPFF	Innovative Defense Technologies (IDT) : Ballston, VA	31.989	4.078	Jun 2019	3.951	Dec 2019	2.434	Dec 2020	-		2.434	0.000	42.452	-
Automated Test & Analysis	WR	SPAWAR Pacific : San Diego, CA	5.753	3.174	Jan 2019	2.070	Nov 2019	1.500	Nov 2020	-		1.500	0.000	12.497	-
Automated Test & Analysis	WR	Marine Corp : Not Specified	0.833	0.000		0.000		0.000		-		0.000	0.000	0.833	-
Automated Test & Analysis	WR	NAVAIR : Lakehurst NJ	2.669	0.000		1.003	Nov 2019	0.350	Nov 2020	-		0.350	0.000	4.022	-
Automated Test & Analysis	WR	Various NSWCs : NSWC DD	0.845	0.246	Dec 2018	0.220	Nov 2019	0.230	Nov 2020	-		0.230	0.000	1.541	-
Automated Test & Analysis	C/CPFF	AFIT : Wright-Patterson AFB, OH	0.500	0.043	Jul 2019	0.073	Nov 2019	0.040	Nov 2020	-		0.040	0.000	0.656	-
		Subtotal	42.589	7.541		7.317		4.554		-		4.554	0.000	62.001	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Automated Test & Analysis	C/CPFF	DELTA Resources, Inc. : Washington, DC	1.835	0.080	Jan 2019	0.336	Jan 2020	0.243	Jan 2021	-		0.243	Continuing	Continuing	Continuing
		Subtotal	1.835	0.080		0.336		0.243		-		0.243	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	44.424	7.621		7.653		4.797		-		4.797	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9B88				
FY19 Project 1:ATA Library:	3	2019	4	2020
FY19 Project 2: Collaborative Software Armory (CSA) Phase II:	1	2019	4	2020
FY19 Project 3: Joint-Communications Engineering, Development, and Integration (JEDI) MUOS Automated Call System (JMACS):	1	2019	4	2020
FY19 Project 4: Common Data Link:	1	2019	4	2020
FY19 Project 5: Aegis Virtual Twin:	3	2019	4	2020
FY19 Project 6: STAT COE:	3	2019	4	2020
Annual Startup Projects for ATA Implementation:	1	2019	4	2025
FY20: Assessing undersea warfare capabilities or fleet modernization and future Navy testing competencies:	1	2020	4	2020
FY20: Evaluating best practices and research capabilities for platform network resiliency and system function validation:	1	2020	4	2020
FY20: Assess common architecture analysis and reporting across SYSCOMS and identify synergies in development, implementation and training:	1	2020	4	2020
FY20: Augment both surface and air Mission Planning for requirements traceability:	1	2020	4	2020
FY21: Assessing undersea warfare capabilities or fleet modernization and future Navy testing competencies:	1	2021	4	2021
FY21: Evaluating best practices and research capabilities for platform network resiliency and system function validation:	1	2021	4	2021
FY21: Assess common architecture analysis and reporting across SYSCOMS and identify synergies in development, implementation and training:	1	2021	4	2021
Digital Transformation - Program Magt/ Governance Process/ Technical Exchanges:	1	2020	4	2025
Digital Transformation- Infrastructure Development:	2	2020	4	2025
Digital Transformation - Capability Enhancements:	2	2020	4	2025

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603597N / *Automated Test & Analysis*	**Project (Number/Name)** 9B88 / *Automated Test and Analysis*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Digital Transformation - Tools/Product Integration:	2	2020	4	2025
Digital Transformation - Capability Demonstrations:	2	2020	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	222.249	119.821	59.007	82.309	-	82.309	69.400	70.655	72.022	73.438	Continuing	Continuing
3086: *Frigate*	222.249	119.821	59.007	82.309	-	82.309	69.400	70.655	72.022	73.438	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): P606

A. Mission Description and Budget Item Justification

In FY 2014, the Navy established the requirements for a lethal and survivable small surface combatant ship (later redesignated as Frigate (FF)), above that of Littoral Combat Ship (LCS) to meet future missions. Based upon the Navy's 2016 Force Structure Assessment resulting in validation of the need for 52 small surface combatants and the need to address increasingly complex threats in the global maritime environment, the Navy reassessed the capabilities required to ensure the Frigate paces future threats. With Guided Missile Frigate (FFG(X)), the Navy desires to maximize the small surface combatant capabilities in the Anti-Surface Warfare (SUW), Anti-Submarine Warfare (ASW), Electromagnetic Maneuver Warfare (EMW), and Air Warfare (AW) mission areas, while keeping the ship affordable and as a part of a "high-low" mix of surface ships. The updated assessment was completed to support establishment of top-level FFG(X) requirements in Summer 2017 and resulted in a Navy-approved Capability Development Document (CDD). The CDD entered the Joint Requirement Oversight Council (JROC) Staffing in August 2018 and was approved in February 2019. The Frigate program completed Gate 5 in June 2019.

The FFG(X) program completed a Component Cost Position (CCP) in support of MS B and the FY 2020 Detail Design and Construction (DD&C) contract award. FY 2019 focused on refining the system SPEC and continued to mature the FFG(X) Government Furnished Equipment (GFE) baseline; continued Frigate-unique AEGIS Weapons System (AWS, formally FWS) design development, coding, and test; acquisition documentation development; C4I systems development; and continued system engineering efforts to ensure mature Government Furnished Information (GFI) deliveries. Conceptual Design contracts completed in 3rd QTR FY2019. FY 2020 marked the shift to SCN after the award of the DD&C for efforts in systems engineering, cost estimating, and ship design management. Remaining FY 2020 funds focused on the continuation of DD&C source selection, AWS design development, coding, and test; acquisition documentation approval for MS B; Combat System and C4I Element Integration; and test and evaluation efforts. FY 2021 funds will continue focus on AWS design development, coding, and test; Combat System and C4I Element Integration; and test and evaluation activities including Live Fire Test and Evaluation (LFT&E) and cyber table top (#2).

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	132.775	59.007	85.341	-	85.341
Current President's Budget	119.821	59.007	82.309	-	82.309
Total Adjustments	-12.954	0.000	-3.032	-	-3.032
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-9.400	0.000			
• SBIR/STTR Transfer	-3.554	0.000			
• Program Adjustments	0.000	0.000	-3.600	-	-3.600
• Rate/Misc Adjustments	0.000	0.000	0.568	-	0.568

Change Summary Explanation

FY 2019 decrease of $12.954M: -$3.554M due to SBIR transfer and -$9.400M OMNIBUS reprogramming to fund higher Departmental priorities.
FY 2021 decrease of $3.032M: -$3.6M due to updated program execution adjustment ahead of component cost position and +$0.568M for NWCF rate adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603599N / *FRIGATE Development*				Project (Number/Name) 3086 / *Frigate*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3086: *Frigate*	222.249	119.821	59.007	82.309	-	82.309	69.400	70.655	72.022	73.438	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: P606												

A. Mission Description and Budget Item Justification

Frigate (FFG(X)) efforts are composed of the design and development for a more lethal and survivable multi-mission warship focused on Anti-Surface Warfare (SUW) and Anti-Submarine Warfare capabilities (ASW), local air defense and enhanced survivability features. FFG(X) design modifications for added capability over LCS include an Over-the-Horizon (OTH) surface-to-surface missile system, upgraded air defense weapons and sensors, advanced electronic warfare system and improved decoys, local air defense, and enhanced survivability features. This effort will encompass design, development, and technical issue resolution to support design maturity for DD&C FY 2020 contract award. Certification and testing efforts are also required to support the FFG(X) delivery, operations, and introduction to the fleet.

The FFG(X) design and development phases include platform design, development and risk reduction; combat system element integration; total ship system engineering and integration; combat systems and warfare systems certification; and planning and conduct of system testing. These efforts include procurement of combat and warfare system equipment and/or simulators to support production representative testing in support of design, development, and certification efforts and ordnance in support of testing.

This funding will also include efforts and activities required for formal Developmental and Operational testing of the FFG(X). Test and Evaluation (T&E) will concentrate on verifying integration and interoperability of employed technologies and systems in the FFG(X) design to achieve the mission capabilities and performance requirements as defined in the FFG(X) Capability Development Document (CDD). Funding will also be for the execution of DT, C4I integration & test, cyber test and certification, warfare system integration & test and certification, aviation (manned and unmanned) integration & test and certification. T&E functions will include the evaluation of Critical Technical Parameters (CTP), Measures of Effectiveness (MOE), Measures of Suitability (MOS), and Key Performance Parameters (KPP).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Test & Evaluation	5.500	8.828	12.504	0.000	12.504
Articles:	-	-	-	-	-
Description: Conduct FFG(X) test planning in support of Developmental Testing (DT) and Operational Testing (OT). Plan for and begin testing in support of Live Fire Test and Evaluation (LFT&E) modeling and small-scale empirical testing to support initiation of efforts to model FFG(X) survivability. Plan for and begin aligning resources to conduct future Early Integration Tests and Cybersecurity Tests as risk reductions for ship construction industrial stage testing. Refine testing schedules and testing resource requirements timelines to support later integration and certification testing. Complete high-level plans such as Test and Evaluation Master Plan (TEMP) and LFT&E Management Plan, and begin review and refinement of more detailed test plans					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and procedures. Plan for and execute DT, C4I integration & test, cyber test and certification, warfare system integration & test and certification, aviation (manned and unmanned) integration & test and certification. ***FY 2020 Plans:*** Complete collaborative development of FFG(X) TEMP and obtain approvals from stakeholder organizations. Complete approvals process and obtain required waiver for the LFT&E alternative to full-up system level live-fire survivability testing. Develop DT and OT scenarios and detailed test planning. Continue execution of LFT&E; SIM/STIM modeling; Verification, Validation and Accreditation (VV&A) and test efforts. Continue work to refine for FFG(X) the various survivability models that will be used in place of live-fire survivability testing. Plan and conduct small scale live-fire tests on ship-representative materials to create empirical test data that will support accrediting some of the survivability models. Begin test planning for Early Integration Testing and Cybersecurity Table Top 2 (CTT-2). Continue alignment and pursuing options for early cybersecurity risk-reduction testing. Review warfare system planning and test requirements. Participate in source selection activities for DD&C contract award. ***FY 2021 Base Plans:*** Complete planning and conduct CTT-2. Execute additional live-fire tests in support of generating empirical LFT&E survivability data to continue the verification, validation, and accreditation of multiple LFT&E survivability models. Continue test planning and resources coordination for the multi-site land based Early Integration Testing. Begin developing schedules and identifying resource requirements timing to support testing and certifications that will be required for the first FFG(X) ship. Review Test Procedures submitted for Government Furnished Equipment (GFE) to confirm suitability for shipyard stage testing. Continue to identify data from previously conducted testing and assess relevance for use as FFG(X) DT and OT data to reduce future at-sea testing requirements. Continue combat system planning and test requirements review. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase in FY2021 will support Cyber Table Top 2 testing and additional Cyber/Weapons Testing in support of DD&C phase.					
Title: Ship Systems / C4I / Warfare Systems Engineering	114.321	50.179	69.805	0.000	69.805
Articles:	-	-	-	-	-
Description: The Frigate (FFG(X)) is a multi-mission ship that focuses on Anti-Surface Warfare (SUW), Anti-Submarine Warfare (ASW) capabilities and local air defense. Specific capabilities include Over-the-Horizon					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(OTH), upgraded Air Defense weapons and sensors, advanced electronic warfare system and improved decoys, towed array, torpedo defense, and enhanced survivability features.					
FY 2020 Plans: Ship Systems Engineering Continue system engineering efforts related to naval architecture, machinery engineering, Frigate Architecture Framework (FAF). Emphasis was placed on the structural and stability disciplines, and incorporation of lethality and survivability enhancements to include the flow-down impacts to the supporting machinery and electrical systems. Continue development of the documentation to support Milestone B in FY 2020. Complete MS B for 2nd QTR approval. Participated in source selection for DD&C Award, including technical and cost evaluation. C4I / Warfare Systems Engineering Continue system engineering efforts related to C4I and warfare systems specifications. Continue OTH systems engineering and testing efforts for integration of OTH missile. Continued AWS development efforts to ensure full ship integration aligned with total ship design efforts and integrated additional FFG(X) required capabilities. Continue integration of other CS and C4I elements into total ship design. Implement additional cyber security/ Information Assurance (IA) measures on the warfare system and C4I suite to pace the current and future threats. Continue development of the Milestone B documentation for approval in 2nd QTR. Participate in Source Selection for DD&C Award, including technical and cost evaluation. Continue product development and planning for warfare system, C4I, Hull, Mechanical & Engineering (HM&E), and training/ facility requirement efforts.					
FY 2021 Base Plans: C4I / Warfare Systems Engineering Continue system engineering efforts related to C4I and warfare systems specifications. Continue OTH systems engineering and testing efforts for integration of OTH missile. Continue AWS development efforts to ensure full ship integration aligns with total ship design efforts and integrate additional FFG(X) required capabilities. Continue integration of other CS, HM&E and C4I elements into total ship design. Implement additional cyber security/information assurance (IA) measures on the warfare system and C4I suite to pace the current and future threats. Continue product development and planning for warfare system, C4I, and HM&E.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase in FY 2021 will support AEGIS combat system integration with GFE systems, most notably, the Enterprise Air Surveillance Radar (EASR) and Rolling Airframe Missile (RAM).					
Accomplishments/Planned Programs Subtotals	119.821	59.007	82.309	0.000	82.309

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/2128: *FFG-Frigate*	0.000	1,281.177	1,053.123	-	1,053.123	954.513	1,865.908	1,868.826	2,817.264	9,973.959	19,814.770

Remarks

D. Acquisition Strategy

The FFG(X) acquisition strategy was signed in 1st QTR FY 2019 to support a full and open competitive contract award in FY 2020. The DD&C RFP was released on 20 June 2019.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Conceptual Design Contracts	C/FFP	Various : Various	74.000	38.247	Feb 2019	0.000		0.000		-		0.000	0.000	112.247	-
System SPEC Development	WR	Government Activities : Various	7.080	1.375	Jan 2019	0.000		0.000		-		0.000	0.000	8.455	-
System SPEC Development	C/CPAF	Various Contractors : Various	5.000	1.225	Jan 2019	0.000		0.000		-		0.000	0.000	6.225	-
Over the Horizon (OTH) Missile Integration	WR	NAWC, China Lake : China Lake, CA	1.210	0.645	Feb 2019	0.054	Feb 2020	0.854	Feb 2021	-		0.854	Continuing	Continuing	Continuing
Over the Horizon (OTH) Missile Integration	WR	Various : Various	2.649	0.656	Feb 2019	0.061	Feb 2020	2.088	Feb 2021	-		2.088	Continuing	Continuing	Continuing
FFG Architecture Framework/ Cyber	C/CPAF	Engility : San Diego, CA	2.614	1.178	Jan 2019	0.400	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
C4I Development	WR	NIWC : Charleston, SC	4.880	1.831	Nov 2018	1.100	Nov 2019	1.996	Nov 2020	-		1.996	Continuing	Continuing	Continuing
C4I Development	WR	NIWC : San Diego, CA	3.297	1.686	Nov 2018	1.516	Nov 2019	2.609	Nov 2020	-		2.609	Continuing	Continuing	Continuing
AEGIS Weapons System Development (AWS)	C/CPIF	Lockheed Martin : Various	29.732	9.166	Jan 2019	12.949	Jan 2020	21.098	Jan 2021	-		21.098	Continuing	Continuing	Continuing
AEGIS Weapons System Development (AWS)	Various	Various Contractors : Various	2.323	1.000	Nov 2018	1.400	Nov 2019	4.280	Nov 2020	-		4.280	Continuing	Continuing	Continuing
AEGIS Weapons System Development (AWS)	WR	Government Activities : Various	3.288	3.348	Nov 2018	3.530	Nov 2019	3.971	Nov 2020	-		3.971	Continuing	Continuing	Continuing
Warfare Systems Development	WR	NUWC, Newport : Newport, RI	2.910	1.740	Nov 2018	0.554	Nov 2019	0.521	Nov 2020	-		0.521	Continuing	Continuing	Continuing
Warfare Systems Development	WR	NSWC, DD : Dahlgren, VA	6.539	1.307	Nov 2018	0.900	Nov 2019	3.545	Nov 2020	-		3.545	Continuing	Continuing	Continuing
Warfare Systems Development	WR	NSWC, CD : Carderock, MD	1.016	0.555	Nov 2018	0.554	Nov 2019	2.593	Nov 2020	-		2.593	Continuing	Continuing	Continuing
Warfare Systems Development	C/CPIF	Lockheed Martin : Various	2.512	9.104	Dec 2018	3.194	Dec 2019	5.865	Dec 2020	-		5.865	Continuing	Continuing	Continuing
Warfare Systems Development	Various	Various : Various	8.408	8.133	Nov 2018	3.200	Nov 2019	4.135	Nov 2020	-		4.135	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Warfare Systems Development	WR	Government Activities : Various	4.105	2.245	Nov 2018	1.811	Nov 2019	3.665	Nov 2020	-		3.665	Continuing	Continuing	Continuing
Aviation Integration Development	WR	NAWC, AD : Patuxent River, MD	2.698	1.615	Dec 2018	1.150	Dec 2019	0.975	Dec 2020	-		0.975	Continuing	Continuing	Continuing
Aviation Integration Development	WR	NSWC, DD : Dahlgren, VA	0.557	0.686	Nov 2018	0.586	Nov 2019	0.300	Nov 2020	-		0.300	Continuing	Continuing	Continuing
Product Development Support	WR	Various : Various	0.000	1.052	Nov 2018	1.776	Nov 2019	1.875	Nov 2020	-		1.875	Continuing	Continuing	Continuing
		Subtotal	164.818	86.794		34.735		60.370		-		60.370	Continuing	Continuing	N/A

Remarks

Beginning in FY 2020, most efforts are realigned to SCN Line Item 2128 after ship contract award. Additional funds were needed for Warfare system integration efforts for systems including ASW, EASR and CEC since FY 2020 President's Budget Request. Funds were realigned from Support efforts.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NSWC, CD : Carderock, MD	7.549	7.077	Nov 2018	2.962	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC, PD : Philadelphia, PA	4.394	1.749	Nov 2018	1.625	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC, DD : Dahlgren, VA	6.270	3.704	Nov 2018	0.934	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC, PHD : Port Hueneme, CA	1.032	0.348	Nov 2018	0.270	Nov 2019	0.401	Nov 2020	-		0.401	Continuing	Continuing	Continuing
Government Engineering Support	WR	Government Activities : Various	2.601	1.356	Nov 2018	0.714	Nov 2019	0.550	Nov 2020	-		0.550	Continuing	Continuing	Continuing
Contractor Engineering Support	C/CPAF	Booz Allen Hamilton : McLean, VA	1.606	1.563	Feb 2019	1.101	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Contractor Engineering Support	C/CPAF	Gryphon : Arlington, VA	1.175	0.300	Nov 2018	0.000	Nov 2019	0.000		-		0.000	0.000	1.475	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	C/CPIF	Alion : Arlington, VA	3.476	2.666	Feb 2019	2.470	Feb 2020	2.417	Feb 2021	-		2.417	Continuing	Continuing	Continuing
Contractor Engineering Support	Various	Various : Various	3.212	2.000	Jan 2019	0.400	Jan 2020	1.000	Jan 2021	-		1.000	Continuing	Continuing	Continuing
		Subtotal	31.315	20.763		10.476		4.368		-		4.368	Continuing	Continuing	N/A

Remarks

Beginning in FY 2020, a portion of the Support costs related to HM&E/ detail design engineering support are realigned to SCN Line Item 2128.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Model Development	WR	NSWC, CD : Carderock, MD	6.293	1.237	Dec 2018	2.846	Dec 2019	1.525	Dec 2020	-		1.525	Continuing	Continuing	Continuing
Test and Evaluation Master Plan (TEMP) Development	WR	Government Activities : Various	2.200	0.754	Dec 2018	0.210	Dec 2019	0.152	Dec 2020	-		0.152	Continuing	Continuing	Continuing
Test and Evaluation Mast Plan (TEMP) and Cyber Support	C/CPAF	Engility : San Diego	0.300	2.872	Dec 2018	1.010	Dec 2019	4.451	Dec 2020	-		4.451	Continuing	Continuing	Continuing
Land Based Integration & Test	WR	Government Activities : Various	0.172	0.100	Nov 2018	3.728	Nov 2019	1.725	Nov 2020	-		1.725	Continuing	Continuing	Continuing
Life Fire Test and Evaluation	WR	NSWC, CD : Carderock, MD	0.000	0.537	Feb 2019	1.034	Dec 2019	4.651	Dec 2020	-		4.651	Continuing	Continuing	Continuing
		Subtotal	8.965	5.500		8.828		12.504		-		12.504	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPIF	Alion : Arlington, VA	3.580	2.752	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	Various : Various	13.571	4.012	Dec 2018	4.968	Dec 2019	5.067	Dec 2020	-		5.067	Continuing	Continuing	Continuing
		Subtotal	17.151	6.764		4.968		5.067		-		5.067	Continuing	Continuing	N/A

Remarks

Program Management Support includes Program Office support, Cost Estimation support, Acquisition Documentation Support, and Program Office travel. Beginning in FY 2020, a portion of the PM Support costs are realigned to SCN Line Item 2128.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	222.249	119.821		59.007		82.309		-		82.309	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Guided Missile Frigate (FFG(X)) Program Schedule

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3086				
Ship Design: System SPEC Development	1	2019	2	2019
Ship Design: Conceptual Design (Contractor Led Design)	1	2019	3	2019
Ship Design: Final System SPEC Approval	2	2019	2	2019
Ship Design: Program Technical Review	3	2019	3	2019
Ship Design: Production (Ship) Proposal Review	4	2019	3	2020
Ship Design: Detail Design Phase	4	2020	4	2022
GFE Systems: Updated GFI	1	2019	1	2019
GFE Systems: Final GFI	3	2019	3	2019
GFE Systems: Production (Ship) Proposal Review	4	2019	3	2020
GFE Systems: System Qualification Testing	2	2021	2	2021
GFE Systems: CS Integration and Testing	2	2021	4	2025
GFE Systems: CS Software Technical Readiness Review (TRR)	1	2025	1	2025
GFE Systems: FCS SW Delivery	4	2025	4	2025
Program Acquisition/Logistics Reviews: Component Cost Position (CCP) Development	1	2019	1	2020
Program Acquisition/Logistics Reviews: Final CCP	1	2020	1	2020
Program Acquisition/Logistics Reviews: Independent Cost Estimate (ICE)	2	2020	2	2020
Program Acquisition/Logistics Reviews: Gate 4 Review	2	2019	2	2019
Program Acquisition/Logistics Reviews: Gate 5 Review	3	2019	3	2019
Program Acquisition/Logistics Reviews: Independent Cost Analysis Assessment (ILA) Development	2	2019	1	2020
Program Acquisition/Logistics Reviews: Milestone B	2	2020	2	2020
Program Acquisition/Logistics Reviews: Gate 6 Review	2	2021	2	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603599N / *FRIGATE Development*	**Project (Number/Name)** 3086 / *Frigate*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Program Acquisition/Logistics Reviews: Independent Logistics Assessment (ILA) Development	4	2023	3	2024
Program Acquisition/Logistics Reviews: Milestone Decision Authority (MDA) IPR #1	2	2022	2	2022
Program Acquisition/Logistics Reviews: Milestone Decision Authority (MDA) IPR #2	2	2023	2	2023
Program Acquisition/Logistics Reviews: Milestone Decision Authority (MDA) IPR #3	2	2024	2	2024
Program Acquisition/Logistics Reviews: Milestone Decision Authority (MDA) IPR #4	2	2025	2	2025
Procurement: Detail Design & Construction (DD&C) Contract Development	1	2019	3	2019
Procurement: Production (Ship) Draft RFP Release	2	2019	2	2019
Procurement: Production (Ship) RFP Release	4	2019	4	2019
Procurement: Production (Ship) Proposal Review	4	2019	3	2020
Procurement: Ship Integration and Testing (SI&T) Award	4	2019	4	2019
Procurement: Production (Ship) Award	4	2020	4	2020
Testing: Test and Evaluation Master Plan (TEMP) Development	1	2019	1	2020
Testing: Live Fire Test & Evaluation (LFT&E) #1	1	2020	2	2021
Testing: Cyber Table Top (CTT)-2	2	2021	2	2021
Testing: Land Based SIM/STIM Testing/Early Integration Risk Reduction Test	1	2019	3	2024
Testing: Shock Qualification Testing	2	2022	4	2023
Testing: Cyber Table Top (CTT-3)	4	2023	4	2023
Testing: Integration and Test Efforts	1	2019	4	2025
Testing: Live Fire Test & Evaluation (LFT&E) #2	2	2025	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	247.627	8.942	9.988	9.922	-	9.922	9.263	9.269	9.113	9.295	Continuing	Continuing
0363: *Insensitive Munitions Adv. Development*	247.627	8.084	8.434	7.788	-	7.788	9.263	9.269	9.113	9.295	Continuing	Continuing
3436: *AN/BST-1 Buoy Component Re-Design*	0.000	0.858	1.554	2.134	-	2.134	0.000	0.000	0.000	0.000	0.000	4.546

A. Mission Description and Budget Item Justification

Proj 0363- Most Navy munitions react violently when exposed to unplanned stimuli such as fire, shock and bullet or fragment impact, thus presenting a great hazard to ships, aircraft, and personnel. The Insensitive Munitions Advanced Development (IMAD) program will provide, validate, and transition technology to all new weapon developments and priority weapon systems and enable production of munitions insensitive to these stimuli with no reduction in combat performance. Insensitive Munitions (IM) is the Navy's focused effort on propellants, propulsion units, explosives, warheads, fuses, and pyrotechnics to reduce the severity of cook-off and bullet/ fragment impact reactions, minimizing the probability for sympathetic detonation, both in normal storage and in use, increasing ship and platform survivability and satisfying performance and readiness requirements.

Proj 3436- The AN/BST-1 Submarine Emergency Communication Transmitter informs Navy leadership when a ballistic missile submarine is in extremis. When activated, a buoy is released from the submarine, floats to the surface and transmits an emergency signal. The energetic components in the system release the buoy from the submarine, separate protective covers and actuate an antenna for communication. The AN/BST-1 Buoy energetic component re-design will replace two antenna related explosive components that utilize explosive formulations that are no longer produced due to environmental impact. The re-design will support future procurements for OHIO and COLUMBIA class deployments. The energetic component re-design includes design, prototyping, design verification testing, environmental qualification, hazard classification, insensitive munitions and developmental testing. The two re-designed energetic components will be qualified for USN use at the conclusion of the program.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	9.307	9.988	10.761	-	10.761
Current President's Budget	8.942	9.988	9.922	-	9.922
Total Adjustments	-0.365	0.000	-0.839	-	-0.839
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.365	0.000			
• Program Adjustments	0.000	0.000	-0.834	-	-0.834
• Rate/Misc Adjustments	0.000	0.000	-0.005	-	-0.005

Change Summary Explanation

The FY 2021 funding request was reduced by $0.834 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0363: *Insensitive Munitions Adv. Development*	247.627	8.084	8.434	7.788	-	7.788	9.263	9.269	9.113	9.295	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Energetic materials producibility is demonstrated to assure national capability to produce and load munitions systems. The program leverages are being closely coordinated with other military departments, North Atlantic Treaty Organization (NATO) and allied countries to eliminate redundant efforts and maximize efficiency. A joint service IM requirement has been developed and through the IM strategic planning process, all Program Executive Offices (PEO) are implementing IM in their priority munitions. IM are identified as a Department of Defense (DoD) critical technology requirement and considered as part of a weapon design. The IMAD program matures the technology developed by a variety of Science and Technology (S&T) sources for program management integration into weapons systems to meet the IM technical deficiencies documented in the PEO IM Strategic Plans. IMAD provides the link between S&T programs and the program managers (PM) by optimizing IM technologies to meet Navy requirements. IMAD offers risk mitigation for the PMs in terms of IM technical knowledge, expertise and manpower with the state of the art expertise across IM products. Each technology area is divided into subtasks addressing specific munition and munition class IM deficiencies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Insensitive Munitions Adv. Development	8.084	8.434	7.788	0.000	7.788
Articles:	-	-	-	-	-

Description: Validate and assess weapon systems plan of action and milestones for IM compliance. Review Insensitive Munitions Strategic Plan (IMSP) for Navy compile and analyze weapon system, energetic material and generic technology IM test data. Perform Threat Hazard Assessments (THAs). Perform analysis of energetic material properties logistic process. Review IM certification and waivers. Support Insensitive Munitions Council (IMC), Insensitive Munitions Coordination Group (IMCG), and IMC Working Group. Support and develop Insensitive Munitions Technology Tool (IMT2). Support North Atlantic Treaty Organization Standardization Agreement (NATO STANAG) and Advanced Operations (AOP) development. Support IMAD program briefs. Support all Navy Joint Services Insensitive Munitions Technical Panel (JSIMTP) meetings. Support Explosive Safety Working Group (ESWG) meetings. Provide task management support for financial management, review of programmatic deliverables and overall task coordination.

FY 2020 Plans:
Evaluate and demonstrate improved solid propellant for Insensitive Munitions (IM) compliant rocket motor systems and container cook off mitigation. Evaluate and demonstrate new rocket motor case technology that

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
can significantly reduce reaction violence of missile and rocket propulsion systems exposed to unplanned stimuli. Develop, demonstrate, and qualify new rocket propellant formulations that meet and/or improve system performance for air launched weapons and meet and/or improve IM goals. Evaluate and demonstrate solid rocket propellant using Highly Loaded Grain technology. Investigate distribute fiber optic sensing for in-situ propellant health monitoring. Develop, demonstrate, and qualify a Reduced Sensitivity Solventless Gun Propellant. Develop, demonstrate, and qualify an enhanced extended range propelling charge for 5" Gun. Evaluate new ordnance and container concepts. Qualify next generation area attack weapon fragment impact evaluation. Evaluation of IM improvement of high density reactive material. Evaluate and demonstrate shape memory alloy rock splitting technology for case venting. Demonstrate effects of slow heating munitions test heating rate changes. Demonstrate IM Improvement through Integral Rocket Solid Fuel Ramjet Technology. Evaluation, demonstration, and qualification of new explosives that reduce collateral damage when bombs are exposed to thermal and impact threats. Develop and demonstrate new and improved stowage and container materials that achieve compliance with IM criteria while significantly reducing the logistics footprint by lowering system weight. Develop and demonstrate ballistic barrier concepts to improve or eliminate IM impact threats in logistical transportation and storage conditions. Develop and demonstrate new and improved explosive initiation systems that improve IM and reliably initiate IM explosives. Evaluate qualification potential of explosives using new resonant acoustic mixing (RAM) of explosive ingredients. Develop and demonstrate new and improved explosive initiation systems that improve IM and reliably initiate IM explosives. Evaluate qualification potential of explosives using new resonant acoustic mixing (RAM) of explosive ingredients. ***FY 2021 Base Plans:*** Evaluate and demonstrate improved solid propellant for Insensitive Munitions (IM) compliant rocket motor systems and container cook off mitigation. Evaluate and demonstrate new rocket motor case technology that can significantly reduce reaction violence of missile and rocket propulsion systems exposed to unplanned stimuli. Develop, demonstrate, and qualify new rocket propellant formulations that meet and/or improve system performance for air launched weapons and meet and/or improve IM goals. Evaluate and demonstrate solid rocket propellant using Highly Loaded Grain technology. Investigate distribute fiber optic sensing for in-situ propellant health monitoring. Develop, demonstrate, and qualify a Reduced Sensitivity Solventless Gun Propellant. Develop, demonstrate, and qualify an enhanced extended range propelling charge for 5" Gun. Evaluate new ordnance and container concepts. Qualify next generation area attack weapon fragment impact evaluation. Evaluation of IM improvement of high density reactive material. Evaluate and demonstrate shape memory alloy rock splitting technology for case venting. Demonstrate effects of slow heating munitions test heating rate changes. Demonstrate IM Improvement through Integral Rocket Solid Fuel Ramjet Technology.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Evaluation, demonstration, and qualification of new explosives that reduce collateral damage when bombs are exposed to thermal and impact threats. Develop and demonstrate new and improved stowage and container materials that achieve compliance with IM criteria while significantly reducing the logistics footprint by lowering system weight. Develop and demonstrate ballistic barrier concepts to improve or eliminate IM impact threats in logistical transportation and storage conditions. Develop and demonstrate new and improved explosive initiation systems that improve IM and reliably initiate IM explosives. Evaluate qualification potential of explosives using new resonant acoustic mixing (RAM) of explosive ingredients. Develop and demonstrate new and improved explosive initiation systems that improve IM and reliably initiate IM explosives. Evaluate qualification potential of explosives using new resonant acoustic mixing (RAM) of explosive ingredients. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to Rate Adjustments.					
Accomplishments/Planned Programs Subtotals	8.084	8.434	7.788	0.000	7.788

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

IMAD is assigned as a non-ACAT program and therefore does not have program milestones like the ACAT I to IV programs. IMAD develops and evaluates IM technologies for use in Navy weapon systems and is not part of a particular weapon acquisition program

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PROPULSION DEV. AND EVAL.	WR	NAWC DIV/CHINA LAKE : CA	106.152	2.987	Nov 2018	3.373	Nov 2019	3.055	Nov 2020	-		3.055	Continuing	Continuing	Continuing
EXPLOSIVES DEV. AND EVAL.	WR	NSWC/INDIAN HEAD DIV. : MD	88.531	2.002	Nov 2018	2.022	Nov 2019	1.640	Nov 2020	-		1.640	Continuing	Continuing	Continuing
ORDNANCE DEV. AND EVAL.	WR	NSWC/DAHLGREN : VA	28.609	1.025	Nov 2018	1.025	Nov 2019	1.052	Nov 2020	-		1.052	Continuing	Continuing	Continuing
GUN PROPULSION AND EVAL.	WR	NSWC/INDIAN HEAD DIV. : MD	11.962	1.015	Nov 2018	1.015	Nov 2019	1.042	Nov 2020	-		1.042	Continuing	Continuing	Continuing
		Subtotal	235.254	7.029		7.435		6.789		-		6.789	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PROGRAM MANAGEMENT SUPT	WR	NOSSA : IN HEAD MD	6.486	0.265	Nov 2018	0.209	Nov 2019	0.209	Nov 2020	-		0.209	Continuing	Continuing	Continuing
PROGRAM MANAGEMENT SUPPORT	MIPR	DTIC : FT BELVOIR VA	5.887	0.790	Nov 2018	0.790	Nov 2019	0.790	Nov 2020	-		0.790	Continuing	Continuing	Continuing
		Subtotal	12.373	1.055		0.999		0.999		-		0.999	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	247.627	8.084		8.434		7.788		-		7.788	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 0363																												
Insensitive Munitions Adv. Development: TBD																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 0363 / *Insensitive Munitions Adv. Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0363				
Insensitive Munitions Adv. Development: TBD	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 3436 / *AN/BST-1 Buoy Component Re-Design*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3436: *AN/BST-1 Buoy Component Re-Design*	0.000	0.858	1.554	2.134	-	2.134	0.000	0.000	0.000	0.000	0.000	4.546
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The AN/BST-1 Submarine Emergency Communication Transmitter informs Navy leadership when a ballistic missile submarine is in extremis. When activated, a buoy is released from the submarine, floats to the surface and transmits an emergency signal. The energetic components in the system release the buoy from the submarine, separate protective covers and actuate an antenna for communication. The AN/BST-1 Buoy energetic component re-design will replace two antenna related explosive components that utilize explosive formulations that are no longer produced due to environmental impact. The re-design will support future procurements for OHIO and COLUMBIA class deployments. The energetic component re-design includes design, prototyping, design verification testing, environmental qualification, hazard classification, insensitive munitions and developmental testing. The two re-designed energetic components will be qualified for Navy use at the conclusion of the program.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Systems Engineering and Testing	0.858	1.554	2.134	0.000	2.134
Articles:	-	-	-	-	-
FY 2020 Plans: -Complete design feasibility testing. -Conduct preliminary design review. -Procure long lead materials. -Build design verification test units. -Conduct design verification testing.					
FY 2021 Base Plans: -Conduct qualification hardware build. -Conduct hazard classification testing. -Conduct qualification testing.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 3436 / *AN/BST-1 Buoy Component Re-Design*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase due to qualification, hardware build, classification and qualification testing.					
Accomplishments/Planned Programs Subtotals	0.858	1.554	2.134	0.000	2.134

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The AN/BST-1 Buoy energetic component re-design will be directed by government activities teaming with industry for design and production support. The re-designed components will be qualified for Navy use in FY2022.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 3436 / *AN/BST-1 Buoy Component Re-Design*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Produce Drawings, Prototypes, Verification, Qualification and Test	MIPR	DOTC : Picatinny, NJ	0.000	0.647	Mar 2019	1.144	Mar 2020	1.557	Mar 2021	-		1.557	3.200	6.548	4.400
		Subtotal	0.000	0.647		1.144		1.557		-		1.557	3.200	6.548	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Services	WR	NSWC, IHEODTD : Indian Head, MD	0.000	0.211	Nov 2018	0.360	Nov 2019	0.527	Nov 2020	-		0.527	0.500	1.598	-
Government Engineering Services	WR	NSWC, Crane : Crane, IN	0.000	0.000	Nov 2018	0.050	Nov 2019	0.050	Nov 2020	-		0.050	0.100	0.200	-
		Subtotal	0.000	0.211		0.410		0.577		-		0.577	0.600	1.798	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.858		1.554		2.134		-		2.134	3.800	8.346	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 3436 / *AN/BST-1 Buoy Component Re-Design*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603609N / *Conventional Munitions*	**Project (Number/Name)** 3436 / *AN/BST-1 Buoy Component Re-Design*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3436				
Design Drawings/Specifications	2	2019	1	2020
Prototype Build/Testing	3	2019	2	2020
Procure Long Lead Hardware	1	2020	2	2020
Build Design Verification Test Units	3	2020	3	2020
Conduct Design Verification Testing	4	2020	1	2021
Build Qualification Hardware	1	2021	3	2021
Environmental Qualification Testing	3	2021	4	2021
System Testing	4	2021	4	2021
Hazard Classification/Insensitive Munitions Testing	4	2021	4	2021

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/Supt Sys*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	23.100	0.000	51.997	189.603	-	189.603	203.265	206.773	101.691	103.730	Continuing	Continuing
1558: *Armored Reconnaissance Vehicle*	0.000	0.000	7.700	20.199	-	20.199	36.313	76.499	78.046	79.610	Continuing	Continuing
2614: *SMAW Follow-On*	23.100	0.000	0.000	0.500	-	0.500	0.500	0.500	2.000	2.040	Continuing	Continuing
6637: *Ground Based Anti-Ship Missile*	0.000	0.000	0.000	64.207	-	64.207	29.768	29.774	21.645	22.080	Continuing	Continuing
6638: *Long Range Fires*	0.000	0.000	0.000	75.000	-	75.000	100.000	100.000	0.000	0.000	0.000	275.000
7400: *Combat Capability Development Transition*	0.000	0.000	44.297	29.697	-	29.697	36.684	0.000	0.000	0.000	0.000	110.678

Note

Starting in FY20, the Navy/Marine Expeditionary Ship Interdiction System (NMESIS) and Remotely Operated Ground Unit Expeditionary (ROGUE) effort was moved from BA07/PE 0206623M/Project 2928 to BA04/PE 0603635M/Project 7400 in order to align the program to a BA more appropriate for its current acquisition phase. These efforts are a continuation of the High Mobility Artillery Rocket Systems (HIMARS) Anti-Ship Capabilities initiated in FY19 within Project 2928, and are now referred to as Ground Based Anti-Ship Missile (GBASM).

Beginning in FY21, the GBASM effort is moved from Project 7400 to Project 6637 (Ground Based Anti-Ship Missile) within BA04/PE 0603635M.

A. Mission Description and Budget Item Justification

This PE supports the demonstration and validation of Marine Corps Ground/Supporting Arms Systems for utilization in Marine Air-Ground Expeditionary Force amphibious operations. This program is funded under Demonstration & Validation because it develops and integrates hardware for experimental tests related to specific ground weapon systems.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/Supt Sys*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	86.464	127.998	-	127.998
Current President's Budget	0.000	51.997	189.603	-	189.603
Total Adjustments	0.000	-34.467	61.605	-	61.605
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-34.467			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	-63.657	-	-63.657
• Rate/Misc Adjustments	0.000	0.000	125.262	-	125.262

Change Summary Explanation

The net increase of $137.606M from FY 2020 to FY 2021 is primarily due to the following program adjustments within the PE:

1) Long Range Unmanned Service Vessel (LRUSV) increase of $28.697M from FY 2020 to FY 2021 supports the procurement of three improved LRUSV prototype vessels, launchers, and development and operational testing.

2) NMESIS/GBASM increase of $20.910M from FY 2020 to FY 2021 supports mobility testing, user evaluations, and fire control system development. Increase also purchases missile qualification hardware, weapons sled and a ground launched guided flight test with the Navy against a simulated surface target.

3) Proj 6638 details held at a higher classification level.

4) Armored Reconnaissance Vehicle (ARV) increase of $12.499M from FY20 to FY21 supports efforts to initiate ARV competitive prototype development and associated engineering support.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1558: *Armored Reconnaissance Vehicle*	0.000	0.000	7.700	20.199	-	20.199	36.313	76.499	78.046	79.610	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Starting in FY20, the Armored Reconnaissance Vehicle (ARV) program moved from BA07/PE 0206623M/Project 1557 to BA04/PE 0603635M/Project 1558 in order to align the program to a BA more appropriate for its current acquisition phase.

A. Mission Description and Budget Item Justification

The ARV is designed to replace the Light Armored Vehicle (LAV) as the core of next generation advanced reconnaissance capability, with a purpose built, transformational vehicle system that balances competing capability demands to sense, shoot, move, communicate, and remain transportable as part of the future naval expeditionary force. It will be a modern combat vehicle system, capable of fighting for information in all weather conditions, using on board and remote autonomous systems (RAS) to conduct reconnaissance and counter reconnaissance in both the physical and information domains.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Armored Reconnaissance Vehicle	0.000	7.700	20.199	0.000	20.199
Articles:	-	-	-	-	-
FY 2020 Plans: -Initiate cost sharing with the Office of Naval Research (ONR) for two science and technology (S&T) demonstrator platforms. These demonstrators will inform what technologies can be incorporated onto ARV and will be tested and evaluated with all knowledge and technology transferred to the program office upon completion. -Complete analysis of alternatives (AoA) and AoA report. -Complete request for information #2 (RFI) for competitive prototyping. -Complete Industry Market Research for EMD contract development. -Hold Industry Day for EMD contract development.					
FY 2021 Base Plans: -Release Competitive Prototype Request for Proposals -Initiate Test on Tech Demonstrator -Complete RFI #3 for Competitive Prototypes					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Release RFP for competitive prototypes -Award Competitive prototype contracts -Release RFI #2 for EMD contract -Hold Industry Day for EMD contract ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase of $12.499M from FY 2020 to FY 2021 leverages the Office of Naval Research's (ONR) technology demonstration efforts to initiate ARV competitive prototype development and associated engineering support. The increased funding will facilitate attracting a wider range of vendors, to include non-traditional defense contractors. This will help increase competition early on in the program lifecycle allowing the program to evaluate emerging technologies ready for incorporation into a system-level platform going in to the Engineering and Manufacturing Development (EMD) phase.					
Accomplishments/Planned Programs Subtotals	0.000	7.700	20.199	0.000	20.199

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0603640M/2223: *Marine Corps Advanced Tech. Demo.*	19.650	13.050	1.500	-	1.500	0.000	0.000	0.000	0.000	0.000	41.287
• RDTEN/0206623M/1557: *ARV*	1.760	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.760

Remarks

D. Acquisition Strategy

The Armored Reconnaissance Vehicle (ARV) program will be focused on providing a base combat vehicle capable of meeting evolving threats via open systems architecture and sufficient size, weight, & power (SWAP) to accommodate future growth. Subsequent programs of record will expand the ARV capability to other mission roles and integrate capabilities that emerge from other programs to further develop and enhance Light Armored Reconnaissance (LAR) operations.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Development & Demo.	C/FFP	ONR : Arlington, VA	0.000	0.000		4.700	Jan 2020	2.000	Jan 2021	-		2.000	Continuing	Continuing	Continuing
Prototype Manufacturing	C/FFP	TBD : TBD	0.000	0.000		0.000		13.000	Aug 2021	-		13.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		4.700		15.000		-		15.000	Continuing	Continuing	N/A

Remarks

The Office of Naval Research (ONR) supports the next generation Armored Reconnaissance Vehicle (ARV) project utilizing the Future Naval Capability (FNC) process in order to develop and demonstrate viable and mature technologies befitting the program's envisioned operational employment. In FY21, $2M is allocated to cost share in the development of technology demonstrators. $13M initial prototype manufacturing investment provides for contractors to order raw materials, labor, and to initiate procurement of vehicle subsystems.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Mgmt - LAV	MIPR	TACOM : Warren, MI	0.000	0.000		2.250	Dec 2019	5.199	Dec 2020	-		5.199	Continuing	Continuing	Continuing
Analysis of Alternatives	MIPR	TACOM : Warren, MI	0.000	0.000		0.400	Nov 2019	0.000		-		0.000	0.000	0.400	-
		Subtotal	0.000	0.000		2.650		5.199		-		5.199	Continuing	Continuing	N/A

Remarks

The additional funding for program management provides for increased support required for prototyping vendors & associated engineering support. It also funds support necessary to develop milestone documentation.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AOA Support Contract	C/FFP	HII-MDIS : Huntsville, AL	0.000	0.000		0.350	Nov 2019	0.000		-		0.000	0.000	0.350	-
		Subtotal	0.000	0.000		0.350		0.000		-		0.000	0.000	0.350	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*	

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		7.700		20.199		-		20.199	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 1558 / *Armored Reconnaissance Vehicle*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Project C1558 ARV				
Material Development Decision	4	2019	4	2019
ARV Analysis of Alternatives	4	2019	3	2020
Competitve Prototype Award	4	2021	4	2021
Competitive Prototype Dev and Testing	1	2022	3	2023
RFP Release for EMD	4	2023	4	2023
Source Selection	1	2024	2	2024
MS B and EMD Contract Award	3	2024	3	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 2614 / *SMAW Follow-On*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2614: *SMAW Follow-On*	23.100	0.000	0.000	0.500	-	0.500	0.500	0.500	2.000	2.040	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Follow on to Shoulder-Launched Multipurpose Assault Weapon (SMAW) (FOTS):
The solution to the Follow on to SMAW (FOTS) capability requirement is a Family of Marine-portable Rocket Systems. This Family of Systems is composed of separate lightweight, short-range, and fire-and-forget weapons. The Family of Systems will be deployed to Marine Infantry Squads and Combat Engineer Battalions across the spectrum of conflict, under all environmental conditions, to neutralize or destroy a variety of ground targets including personnel, thin-skinned vehicles, and positions. The Family of Systems include the SMAW MK-153 Mod 0, SMAW MK-153 Mod 2, and the Multi-purpose Anti-Armor Weapon System (MAAWS) M3A1.

SMAW Mod 2 integrated a laser range finder and thermal weapon sight onto the improved SMAW launcher. The improved system is a lighter, more accurate, easier to maintain, and more reliable replacement to the SMAW Mod 0 launcher.

The MAAWS M3A1 is a multipurpose, man-portable, line-of-sight, reloadable, recoilless, anti-armor and anti-personnel weapon system. It is a revision of the 84mm Carl Gustaf (M3) man-portable, recoilless rifle produced by Saab Bofors Dynamics. This system will enable the Marine Infantry Squads and Combat Engineer Battalions to engage in offensive and defensive operations with anti-armor, anti-personnel, anti-material, and assault capabilities. The MAAWS consists of the M3A1 Carl Gustaf Recoilless Rifle, Fire Control System and MeOpta red dot back up sight. Munitions include two Sub-caliber Adapter Training Devices and a suite of 84mm ammunition with greater capabilities than the SMAW Mod 2 system. The suite of 84mm ammunition provides obscuration, illumination, personnel denial, armored vehicle denial and penetration, bunker and hardened facility penetration, and soft target destruction capabilities to meet various mission requirements.

The MAAWS M3A1 is a joint Army and USMC program managed by the US Army's Program Executive Office Soldier. A Joint Operational Requirements Document (JORD) set forth the performance specifications for the system for both the Army and the USMC. The Army conducted test and evaluation of the system based on the performance specifications in the JORD.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: MAAWS Test and Evaluation	0.000	0.000	0.500	0.000	0.500
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 2614 / *SMAW Follow-On*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete the qualification testing of the 20mm training round to obtain a full material release and type certification for USMC procurement and fielding. - Complete the USMC test and evaluation of a programmable MAAWS round being developed by the Army. - Complete the USMC test and evaluation of the replacement red dot back-up sight for the MAAWS being developed by the Army. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $500k in FY21 funds the test and evaluation of new ammunition and replacement red dot back-up sight for the MAAWS M3A1 to meet Marine Corps requirements due to limited Army test data for ruggedness, range performance, and squad integration.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	0.500	0.000	0.500

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• PMC/3016: *Multi-role Anti-Armor Anti-personnel Weapon System (MAAWS)*	13.590	21.913	21.891	-	21.891	21.885	21.894	21.892	22.330	0.000	252.969

Remarks

D. Acquisition Strategy

The acquisition strategy is to complete required Marine Corps test and evaluation of replacement red dot back-up sight for the MAAWS M3A1 from the original configuration of the Iron Sights. This includes MAAWS Qualification and Performance testing of 20mm Training Sub-Cal Adapter round, testing of Programmable MAAWS Round, Testing of Red Dot Back up Sight and Engineering and Technical Support. The Marine Corps will leverage a U.S. Army sole source, three year, Firm Fixed Price, Indefinite Delivery and Indefinite Quantity contract to procure the M3A1 Rifle from Saab Dynamics, and the Army's three year, order dependent, Basic Ordering Agreement for the Sub Caliber Adapter, and the FCS13RE through a US Special Operations Command's three year, sole source, Firm Fixed Price contract, and the ammunition through a five year, sole source, Firm Fixed Price, Indefinite Delivery Indefinite Quantity contract for the MAAWS M3A1.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 2614 / *SMAW Follow-On*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Year Cumulative Funding	Various	Various : Various	17.685	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	17.685	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MAAWS Testing	WR	NSWC : Crane, IN	0.000	0.000		0.000		0.360	Jan 2021	-		0.360	0.000	0.360	-
		Subtotal	0.000	0.000		0.000		0.360		-		0.360	0.000	0.360	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Office Engineering Support	C/FFP	MCSC : Quantico, VA	0.000	0.000		0.000		0.140	Nov 2020	-		0.140	0.000	0.140	-
Prior Year Cumulative Funding	Various	Various : Various	5.415	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	5.415	0.000		0.000		0.140		-		0.140	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	23.100	0.000		0.000		0.500		-		0.500	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 2614 / *SMAW Follow-On*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 2614																												
MAAWS Qualification and Performance Testing: 20mm Training Round																												
MAAWS Qualification and Performance Testing: Programmable MAAWS Round																												
MAAWS Qualification and Performance Testing: Red Dot Back up Sight																												
MAAWS ECP Developmemt: Engineering and Technical Support																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 2614 / *SMAW Follow-On*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2614				
MAAWS Qualification and Performance Testing: 20mm Training Round	2	2021	1	2022
MAAWS Qualification and Performance Testing: Programmable MAAWS Round	2	2021	1	2022
MAAWS Qualification and Performance Testing: Red Dot Back up Sight	2	2021	1	2022
MAAWS ECP Developmemt: Engineering and Technical Support	1	2022	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6637 / *Ground Based Anti-Ship Missile*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
6637: *Ground Based Anti-Ship Missile*	0.000	0.000	0.000	64.207	-	64.207	29.768	29.774	21.645	22.080	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

In FY21, the Navy/Marine Expeditionary Ship Interdiction System (NMESIS)/Ground Based Anti-Ship Missile (GBASM) effort was moved from BA04/PE 0603635M/ Project 7400 into BA04/PE 0603635M/Project 6637 and is now referred to as GBASM.

A. Mission Description and Budget Item Justification

A RDT&E effort to develop long term and short term solutions for a GBASM to be integrated within a USMC Artillery Battalion and sustain a Joint Force military advantage. This capability is in support of the Marine Corps Expeditionary Advanced Base Operations (EABO) and the National Defense Strategy (NDS) approach to build a more lethal Joint Force. GBASM will prototype a USMC system using other Service-developed missiles to provide a ground based anti-access/area denial, anti-ship capability. The prototyping effort will include the development, design, build, and testing of a Remotely Operated Ground Unit Expeditionary-Fires (ROGUE-Fires) vehicle. ROGUE-Fires is an unmanned ground vehicle based on a Joint Light Tactical Vehicle (JLTV) chassis, capable of mounting a wide range of missile systems for dynamic force employment and supports the National Defense Strategy (NDS) objective to evolve innovative operational concepts.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: 6637: Ground Based Anti-Ship Missile	0.000	0.000	64.207	0.000	64.207
Articles:	-	-	-	-	-
FY 2020 Plans: Executed under Project 7400					
FY 2021 Base Plans: Integrate an existing ASM capability onto USMC ground platforms. Activities include: - Deliver a prototype weapon sled and finalize Fire Control System design - Conduct full system user evaluations with vehicle, launcher and Fire Control System - Procure qualification launcher hardware - Procure qualification Fire Control systems hardware - Procure missiles for qualification and user evaluation testing - Conduct USN/USMC guided flight test - Test and refine tactics, techniques, and procedures (TTPs) with Marine operators - Conduct mobility testing with vehicle and launcher systems					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6637 / *Ground Based Anti-Ship Missile*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Update ROGUE-F design - Deploy Early Capability Release (ECR) launchers to a USMC High Mobility Artillery Rocket System (HIMARS) Battery for unit experimentation and evaluation ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $64.207M from FY20 to FY21 supports the realignment of $43.297M from the NMESIS/GBASM program in BA04/PE 0603635M/Project 7400 to BA04/PE 0603635M/Project 6637 and $20.91M supports the purchase of test missiles and updated ROGUE-F design.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	64.207	0.000	64.207

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• PMC/ BLI 2212: *High Mobility Artillery Rocket System*	130.981	95.686	174.687	-	174.687	96.458	81.802	69.457	70.668	0.000	719.739

Remarks

BLI 2212 includes procurement efforts in support of Ground Based Anti-Ship Missile and High Mobility Artillery Rocket System (HIMARS).

D. Acquisition Strategy

GBASM RDT&E efforts for USMC support the EABO and NDS to employ High Mobility Artillery Rocket System (HIMARS) as a Sea Control capability from distributed locations to support distributed maneuver. Support the continued development of long-range precision fire capabilities from austere and expeditionary bases. Development will consist of the design integration and support from a combination of Army/Navy labs and multiple DoD contractors.

GBASM uses an existing missile contract with the Navy to acquire test missiles. Launcher and Fire Control Systems use two Other Transaction Agreements (OTA) competitively awarded in FY18 and FY19 with a phased approach to integrate missile and fire control systems (FCS) with a USMC vehicle. The ROGUE-Fires project ranges from using off-the-shelf systems, modifications to existing developmental items and integration and support from a combination of Army/Navy labs and multiple DOD contractors. The ROGUE-Fires vehicle and weapon sled have a government controlled Initial Capabilities Document (ICD) that allows separate competitive procurement which is planned after completion of the initial deployment and user evaluation.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	Project (Number/Name) 6637 / *Ground Based Anti-Ship Missile*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
GBASM Development	C/CPFF	Raytheon Company : Tucson, AZ	0.000	0.000		0.000		31.000	Dec 2020	-		31.000	23.000	54.000	54.000
ROGUE-Fires Development	C/CPFF	Osh Kosh : Osh Kosh, WI	0.000	0.000		0.000		9.000	Dec 2020	-		9.000	17.000	26.000	26.000
		Subtotal	0.000	0.000		0.000		40.000		-		40.000	40.000	80.000	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
GBASM Safety	WR	NSWC-IH : Indian Head, MD	0.000	0.000		0.000		0.500	Dec 2020	-		0.500	1.000	1.500	-
GBASM Cybersecurity/IA	MIPR	PFRMS/AMRDEC : Redstone, AL	0.000	0.000		0.000		0.030	Dec 2020	-		0.030	0.060	0.090	-
		Subtotal	0.000	0.000		0.000		0.530		-		0.530	1.060	1.590	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
GBASM Flight Test	WR	NAS : Point Mugu, CA	0.000	0.000		0.000		4.000	Feb 2021	-		4.000	3.000	7.000	-
GBASM Missile Procurement for Testing	C/FFP	Raytheon : Tuscon, AZ	0.000	0.000		0.000		16.100	Dec 2020	-		16.100	1.200	17.300	17.300
GBASM Engineer	MIPR	NSWC-WD : China Lake, CA	0.000	0.000		0.000		1.621	Dec 2020	-		1.621	3.200	4.821	-
ROGUE Engineer	MIPR	NSWC-DD : Dahlgren, VA	0.000	0.000		0.000		1.379	Dec 2020	-		1.379	2.800	4.179	-
User Eval & Mobility Test	MIPR	NATC : Carson City, NV	0.000	0.000		0.000		0.500	Dec 2020	-		0.500	4.000	4.500	-
		Subtotal	0.000	0.000		0.000		23.600		-		23.600	14.200	37.800	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6637 / *Ground Based Anti-Ship Missile*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
GBASM Travel	Various	Various : Various	0.000	0.000		0.000		0.077	Oct 2020	-		0.077	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		0.077		-		0.077	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		64.207		-		64.207	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6637 / *Ground Based Anti-Ship Missile*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6637 / *Ground Based Anti-Ship Missile*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 6637				
Ballistic Test	1	2020	1	2020
Guided Flight Test	3	2020	3	2020
User Evaluation/TTP	1	2021	3	2021
NATC Mobility Testing	1	2021	3	2021
USN/USMC Guided Flight Test	2	2021	2	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6638 / *Long Range Fires*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
6638: *Long Range Fires*	0.000	0.000	0.000	75.000	-	75.000	100.000	100.000	0.000	0.000	0.000	275.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project details held at a higher classification level.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: 6638 Classified	0.000	0.000	75.000	0.000	75.000
Articles:	-	-	-	-	-
FY 2020 Plans: Project details held at a higher classification level. ***FY 2021 Base Plans:*** Project details held at a higher classification level. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Project details held at a higher classification level.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	75.000	0.000	75.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Project details held at a higher classification level.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6638 / *Long Range Fires*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Classified	Various	Not Specified : Not Specified	0.000	0.000		0.000		75.000	Oct 2020	-		75.000	0.000	75.000	-
		Subtotal	0.000	0.000		0.000		75.000		-		75.000	0.000	75.000	N/A

Remarks

Details held at a higher classification level.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		75.000		-		75.000	0.000	75.000	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6638 / *Long Range Fires*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 6638																												
Details held at a higher classification					[redacted]																							

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 6638 / *Long Range Fires*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 6638				
Details held at a higher classification	1	2020	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
7400: *Combat Capability Development Transition*	0.000	0.000	44.297	29.697	-	29.697	36.684	0.000	0.000	0.000	0.000	110.678
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

In FY21, the Navy/Marine Expeditionary Ship Interdiction System (NMESIS)/Ground Based Anti-Ship Missile (GBASM) effort was moved from BA04/PE 0603635M/ Project 7400 into BA04/PE 0603635M/Project 6637.

A. Mission Description and Budget Item Justification

NMESIS/GBASM is a RDT&E effort to develop long term and short term solutions for an Anti-Ship Missile (ASM) to be integrated within a High Mobility Artillery Rocket System (HIMARS) Battalion and sustain a Joint Force military advantage. This capability is in support of the Marine Corps Expeditionary Advanced Base Operations (EABO) and the National Defense Strategy (NDS) approach to build a more lethal Joint Force. NMESIS/GBASM will prototype a USMC system while leveraging other Service-developed missiles to provide ground based anti-access/area denial, anti-ship capability. The prototyping effort will include the development, design, build, and initial testing of a Remotely Operated Ground Unit Expeditionary-Fires (ROGUE-Fires) vehicle. ROGUE-Fires is an unmanned ground vehicle based on a Joint Light Tactical Vehicle (JLTV) chassis, capable of mounting a wide range of missile systems for dynamic force employment and supports the National Defense Strategy (NDS) objective to evolve innovative operational concepts.

The Long Range Unmanned Surface Vessel (LRUSV), formerly SEAMOB, is critical to future operations within the Joint Force Operating Scenario (JFOS) and Littoral Operations in a Contested Environment (LOCE). The LRUSV incorporates advanced Command and Control (C2) and targeting capabilities resulting in a Long Range Precision Fires (LRPF) system complimenting future Navy and Marine Corps operational concepts. The LRUSV will transition from a Science and Technology effort to a fielded capability providing an unmanned autonomous platform for the Organic Precision Fires (OPF) system. The LRUSV will be deployed in multiple phases. Phase 1 includes transition of the 11 meter RIB from the Strategic Capabilities Office (SCO) to the Marine Corps for initial development and transition to extended user evaluation patform. Phase 2 will be procurement of an improved hull solution for increased seakeeping capability and integration of OPF down selected in PE 0604657M. This phase will also integrate lessons learned from the 11 meter RIB evaluations. Phase 3 will be deployment of the extended user evaluation (EUE) system. Phase 4 will be production and sustainment of the LRUSV capability. When employed with the OPF, the LRUSV will provide an initial lethal capability with planned incremental enhancements that will incorporate swarming and providing new capabilities supporting naval expeditionary forces.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Navy/Marine Expeditionary Ship Interdiction System (NMESIS)	0.000	43.297	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue integration of an existing ASM capability onto USMC ground platforms. Activities include: - Develop initial prototype design and testing - Integrate ASM sled on a ROGUE vehicle - Develop and build ROGUE-Fires fire control and test ASM command and control concept - Build ROGUE vehicles and conduct off road testing - Conduct initial firing tests of NMESIS/GBASM capability - Conduct inert ballistic missile firing tests - Conduct user evaluations with vehicles - Test existing C2 kill chain with various sensors and Naval platforms for GBASM sea based targets - Develop tactics, techniques, and procedures (TTPs) with Marine operators - Procure inert missiles for testing and live fire events - Conduct design analysis on longer range capability ***FY 2021 Base Plans:*** NMESIS/GBASM program was realigned in FY21 from BA04/PE 0603635M Project 7400 to BA04/PE 0603635M/Project 6637. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $43.297M from FY20 to FY21 supports the realignment of the NMESIS/GBASM program from BA04/PE 0603635M/Project 7400 to BA04/PE 0603635M/Project 6637.					
Title: Long Range Unmanned Service Vessel (LRUSV)	0.000	1.000	29.697	0.000	29.697
Articles:	-	-	3	-	3
FY 2020 Plans: In FY20, an emerging LRUSV capability transitioned from the Strategic Capabilities Office (SCO) to the Marine Corps for continued development and deployment. FY20 efforts include the following objectives: - Begin HW/SW improvements to the 11 meter RIB - Assess and implement SCO lessons learned to LRUSV platform and weapons deck ***FY 2021 Base Plans:*** - Procure three LRUSV vessels with improved hulls for increased seakeeping capability					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete HW/SW improvements (autonomy and C2 capabilities) to the 11 meter RIB for transition to prototype vessels - Conduct HW/SW and OPF-M integration testing on the 11 meter RIB - Procure three launchers for 11 meter RIBs consisting of OPF weapons platform and limited munitions - Conduct live fire demonstration off 11 meter RIB - Procure three launchers for prototype vessels consisting of weapons platform and limited munitions ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase of $28.697M from FY20 to FY21 is a result of the procurement of three improved LRUSV prototype vessels, launchers, and development and operational testing.					
Accomplishments/Planned Programs Subtotals	0.000	44.297	29.697	0.000	29.697

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/ Proj 6637: *Ground Based Anti-Ship Missile*	0.000	0.000	64.207	-	64.207	29.768	29.774	21.645	22.080	Continuing	Continuing
• PMC/ BLI 2212: *High Mobility Artillery Rocket System*	130.981	95.686	176.687	-	176.687	96.458	81.802	69.457	70.668	0.000	721.739
• PMC/0206211M/6518: *Long Range Unmanned Surface Vessels*	0.000	0.000	0.000	-	0.000	0.000	37.760	30.400	31.008	0.000	99.168
• RDTEN/0604657M: *Organic Precision Fires*	0.000	20.085	33.784	-	33.784	4.986	0.000	0.000	0.000	0.000	58.855

Remarks

1) FY23 initiates LRUSV procurement funding line within BLI 6518
2) BLI 2212 includes procurement efforts in support of Ground Based Anti-Ship Missile and High Mobility Artillery Rocket System.

D. Acquisition Strategy

NMESIS/GBASM uses an existing missile contract with the Navy to acquire test missiles. Launcher and Fire Control Systems use two competitively awarded Other Transaction Agreements (OTA) with a phased approach to integrate missile and fire control systems (FCS) with a USMC vehicle. The ROGUE-Fires project ranges

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

from using off-the-shelf systems, modifications to existing developmental items and integration and support from a combination of Army/Navy labs and multiple DOD contractors.

The LRUSV capability will transition from SCO to the Marine Corps in FY20. In FY21, three baseline prototype vessels will be procured using an existing Navy contract. These vessels will be integrated with the competitively selected Organic Precisions Fires (OPF) munition which is being matured under PE 0604657M/BA05. Logistical support for the LRUSV will initially be commercially procured using an existing naval contract and will transition to a combination of contracted and organic support as the program matures.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NMESIS ASM OTA	C/CPFF	Raytheon Company : Tucson, AZ	0.000	0.000		31.350	Jan 2020	0.000		-		0.000	0.000	31.350	-
NMESIS Rogue Fires Development	C/CPFF	Osh Kosh : Osh Kosh, WI	0.000	0.000		6.600	Feb 2020	0.000		-		0.000	0.000	6.600	-
LRUSV HW/SW Improvements	WR	NSWC : Carterock, Det Norfolk	0.000	0.000		0.914	Apr 2020	0.000		-		0.000	0.000	0.914	-
LRUSV HW/SW Improvements	WR	NSWC : various	0.000	0.000		0.000		3.473	Oct 2020	-		3.473	0.000	3.473	-
LRUSV Prototype Vessel	C/CPFF	Navy PM S406 : Washington DC	0.000	0.000		0.000		18.014	Mar 2021	-		18.014	0.000	18.014	-
LRUSV 11m RIB Launcher	C/FFP	TBD : TBD	0.000	0.000		0.000		1.200	Jan 2021	-		1.200	0.000	1.200	-
LRUSV Prototype Vessel Launcher	C/FFP	TBD : TBD	0.000	0.000		0.000		1.200	Aug 2021	-		1.200	0.000	1.200	-
		Subtotal	0.000	0.000		38.864		23.887		-		23.887	0.000	62.751	N/A

Remarks

LRUSV - $18.014M procures the Early Deployment systems that will includes the vessel and launcher.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LRUSV Engineering Support	WR	NSWC : Various	0.000	0.000		0.000		2.485	Oct 2020	-		2.485	0.000	2.485	-
NMESIS Engineering Support - ASM	WR	NSWC : China Lake, CA	0.000	0.000		0.497	Jan 2020	0.000		-		0.000	0.000	0.497	-
NMESIS Safety	WR	NSWC : Indian Head, MD	0.000	0.000		0.247	Jan 2020	0.000		-		0.000	0.000	0.247	-
NMESIS Engineering - ROGUE	WR	NSWC : Dahlgren, VA	0.000	0.000		1.503	Jan 2020	0.000		-		0.000	0.000	1.503	-
		Subtotal	0.000	0.000		2.247		2.485		-		2.485	0.000	4.732	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract

Remarks

NMESIS/GBASM (Long Range Precision Fires, Sea Control) engineering effort will support weapons sled development and vehicle integration to include system and requirements development and evaluation activities. Evaluation activities include booster vehicle test and system demonstration at Point Mugu.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NMESIS ASM Missile Testing	WR	NAS : Point Mugu, CA	0.000	0.000		1.983	Apr 2020	0.000		-		0.000	0.000	1.983	-
NMESIS Vehicle/Booster Testing	WR	NSWC : China Lake, CA	0.000	0.000		0.967	Oct 2019	0.000		-		0.000	0.000	0.967	-
LRUSV Testing	Various	Various : Various	0.000	0.000		0.000		3.139	Oct 2020	-		3.139	0.000	3.139	-
		Subtotal	0.000	0.000		2.950		3.139		-		3.139	0.000	6.089	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LRUSV Travel	Various	Various : Various	0.000	0.000		0.086	Oct 2019	0.186	Oct 2020	-		0.186	0.000	0.272	-
NMESIS Travel	Various	Various : Various	0.000	0.000		0.150	Feb 2020	0.000		-		0.000	0.000	0.150	-
		Subtotal	0.000	0.000		0.236		0.186		-		0.186	0.000	0.422	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		44.297		29.697		-		29.697	0.000	73.994	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

Long Range Unmanned Surface Vessel

Legend
- MDA Decision Approval (non-MS)
- Review
- Documentation
- Milestone / Key Acquisition Event
- Assessments, Proposals

Hardware & Software
HW / SW Improvement 1: 11m RIB suite with upgrades to incorporate UMAA and CCS, existing Launchers, Coyote Blk III re-use

Prototype
Improved hull for operational environment with integrated OPF-M launcher and munition.

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603635M / *Marine Corps Grnd Cmbt/ Supt Sys*	**Project (Number/Name)** 7400 / *Combat Capability Development Transition*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 7400				
LRUSV HW/SW Improvements	3	2020	2	2021
LRUSV HW/SW Development and Testing 11m RIB	1	2021	4	2021
LRUSV 11m RIB Launcher Procurement	2	2021	2	2021
LRUSV Prototype Vessel Procurement	3	2021	3	2021
LRUSV Prototype Vessel Launcher Procurement	4	2021	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	708.860	60.316	47.656	43.084	14.461	57.545	52.033	54.930	52.929	51.365	Continuing	Continuing
0377: *JT Service Expl Ord Disp System*	392.085	7.532	9.780	11.239	-	11.239	9.874	11.370	11.598	11.830	Continuing	Continuing
1317: *Expeditionary Diving Systems*	119.008	4.323	2.533	2.754	-	2.754	2.655	2.815	2.584	2.438	Continuing	Continuing
3177: *Joint Counter Radio-Controlled IED Elec Warfare*	56.847	26.867	19.222	5.224	14.461	19.685	15.831	16.074	16.304	16.552	Continuing	Continuing
4023: *Expeditionary Underwater Systems*	140.920	16.770	16.121	23.867	-	23.867	23.673	24.671	22.443	20.545	Continuing	Continuing
9999: *Congressional Adds*	0.000	4.824	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.824

Note

The FY 2021 funding request was reduced by $0.933 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

This is a Joint Service Program.

This program provides for the development of Explosive Ordnance Disposal tools and equipment aimed at meeting National Defense Strategy guidance to build a more lethal force. The responsibility is assigned to the Navy as single service manager, per Department of Defense Directive 5160.62 of 15 May, 2017, for management of the Joint Service Explosive Ordnance Disposal Research and Development Program.

Proliferation of sophisticated types of foreign and domestic ordnance and Improvised Explosive Devices necessitate a continuing development program to provide Explosive Ordnance Disposal personnel of all military services with the tools and equipment designed for modularity, scalability, and flexibility, while maintaining readiness to respond to contingencies and ensure long-term warfighting readiness.

This program also provides life support related equipment necessary to support the performance of Navy Explosive Ordnance Disposal tasks underwater. This equipment must have inherently low acoustic and magnetic signatures in order to allow the Explosive Ordnance Disposal technician to safely approach, render-safe and dispose of sea mines and other underwater ordnance.

This program also supports the National Defense Strategy's objective of preventing terrorist and near peer operations against the US, allies, and partners by providing for the research and development of Electronic Warfare (EW) systems, equipment, procedures, and tactical aids for all military services against the threat posed by Radio-Controlled Improvised Explosive Devices (RCIEDs) and to prevent initiation of RCIEDs across the spectrum of Joint military operations. It utilizes Joint

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*

requirements to provide a system of systems approach for a suite of equipment for mounted, dismounted, and fixed site operations; provides a Joint Counter RCIED EW (CREW) development of equipment, procedures, and tactical aids to make rapid improvements to performance, supportability and affordability, while maintaining pace with the evolving RCIED global threat.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	61.757	33.478	48.523	-	48.523
Current President's Budget	60.316	47.656	43.084	14.461	57.545
Total Adjustments	-1.441	14.178	-5.439	14.461	9.022
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.005	0.000			
• SBIR/STTR Transfer	-1.437	0.000			
• Program Adjustments	0.001	14.178	-4.474	14.461	9.987
• Rate/Misc Adjustments	0.000	0.000	-0.965	-	-0.965

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Breathing Apparatus for EOD Divers*	4.824	0.000
Congressional Add Subtotals for Project: 9999	4.824	0.000
Congressional Add Totals for all Projects	4.824	0.000

Change Summary Explanation

FY2020: OCO Request +$14.178M

FY 2021: Other Program Adjustments -$4.474M, Rate adjustments -$0.965M

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0377: *JT Service Expl Ord Disp System*	392.085	7.532	9.780	11.239	-	11.239	9.874	11.370	11.598	11.830	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Program Element (PE) Project (0377) provides funding for the detailed design, development, risk mitigation, issue resolution, integrations, test, test equipment, simulations and technology insertion of specialized equipment, tools and assessment of accessories that expand range of military operations required to support DoD's only Joint Explosive Ordnance Disposal (EOD) programs.

EOD exclusively executes world-wide missions for detection/location, identification, render-safe, recovery, field and laboratory evaluation, and disposal of hazards and unexploded ordnance (UXO) that is a threat to military operations, installations, personnel, or material. UXO includes foreign and domestic, both conventional and non-conventional, including Improvised Explosive Devices (IEDs) and devices using radiological and biological means with or without explosives.

The responsibility is assigned to the Navy as single service manager, by Department of Defense Directive 5160.62 for management of the Joint Service Explosive Ordnance Disposal Research and Development Program. EOD programs are designed to reduce the EOD operator's exposure to explosive hazards or limit the risk to an acceptable level. EOD operations range from hand entry of explosive devices by EOD technicians to robotic actions and sensing capabilities that provide a safe distance of the explosive hazard at a greatly reduced cost to trained and experienced EOD operators.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS)	1.258	4.900	1.500	0.000	1.500
Articles:	-	-	-	-	-
FY 2020 Plans: Develop EOD specific mobile applications and design interfaces to existing EOD approved mobile software applications. Conduct operation test and evaluation for prior to entry of Full Deployment Decision Review. In addition, develop a Learning Management System (LMS) with mobile application to support Joint Service EOD common skills training. Provides required Certification and Accreditations of the mobile applications as well as cloud hosting of apps and data for download by the EOD warfighter.					
FY 2021 Base Plans: Develop EOD specific mobile applications in Android, iOS, and Windows Operating Systems providing the EOD Warfighter with real-time technical manuals to aid in the interrogation of explosive threat devices and					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
decision-aid tools to counter those threats. Integration and testing of transitions mobile applications for ordnance recognition and senor compatibility for graphical user interface. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease is due to scheduled delivery and transition to sustainment.					
Title: ANALYSIS OF ALTERNATIVES/ EOD MODERNIZATION	0.337	4.130	8.939	0.000	8.939
Articles:	-	-	-	-	-
FY 2020 Plans: Implement Analysis of Alternatives (AOA) to assess warfighter identified capability gaps, specific to operational environments including threats and scenarios, alternative development approaches, operational concept development for technology maturity and insertion readiness. Conduct evaluation of technology readiness and technology transition Science and Technology relevant solutions for minimal development and prototype tools and equipment prior to fielding Joint EOD endorsed Statement of Operational Needs. ***FY 2021 Base Plans:*** Conduct the development of a suite of tools providing the capability for increased standoff distances for Explosives Ordnance Disposal (EOD) render Safe of Unexploded Ordnance and disruptor of complex and sophisticated threats while reducing risk of injury to the EOD warfighter and enhancing mission success. This effort will be accomplished through evaluation of commercial non-developmental items, analysis of alternatives, and maximized transition of ongoing Science and technology opportunities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increased funding addresses EOD mission threats through the implementation of technology advances, test and evaluation of new and transitioned technology for EOD tools, and equipment modernization replacing outdated and obsolete technology.					
Title: EOD ROBOTICS	5.937	0.750	0.800	0.000	0.800
Articles:	-	-	-	-	-
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continued development for EOD specific modules and tech insertion for technology enhancements and Robotics continuous Improvements. ***FY 2021 Base Plans:*** Integration of sensors and Weapon Systems Explosive Safety Review Board (WSERB) safety approvals prior to fielding. Conduct test and evaluation for compatibility and integration for technology capability advancements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Technology insertion for EOD Specific Modules and Senor capabilities on approved robotics platforms.					
Accomplishments/Planned Programs Subtotals	7.532	9.780	11.239	0.000	11.239

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Joint Service acquisition strategies maximize, to the greatest extent, evolutionary open architecture and modular strategy for rapid acquisition of mature technology for the user. The evolutionary approach delivers baseline capability and subsequent increments, recognizing up front the need for future capability improvements. Each increment is a militarily useful and supportable operational capability that can be developed, produced, deployed, and sustained. The evolutionary strategy allows for rapid block upgrades, pre-planned product improvements, new accessories that expand range of military operations that provide a significant increase in operational capability and improvements at the modular level and encourages competition and second sources to lower life cycle costs. Modeling and simulation can verify system level compliance in a laboratory, greatly reducing the cost to conduct expensive range testing. EOD Modernization increases technology advances for more capable diagnostics and render-safe systems and EOD tools. Analysis of Alternatives (AOA) studies and evaluations commercial and non-development items are conducted prior to the initiation of new subprojects. The AOA addresses and emphasizes acquisition strategies of the most cost-effective solution over the life-cycle. Contracting for RDT&E, if required, is always competitive and when feasible, production options are included.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	WR	NSWCIHEODTD : Indian Head, MD	196.055	0.000	Oct 2018	1.627	Nov 2019	4.039	Nov 2020	-		4.039	Continuing	Continuing	Continuing
Primary Hardware Development	C/FFP	Northrop Grumman : Herndon, VA	15.144	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Primary Hardware Development	C/FFP	John Hopkins, MD : Laurel, MD	5.700	4.583	Nov 2018	0.315	Nov 2019	0.750	Nov 2020	-		0.750	0.000	11.348	-
ILS	WR	NSWCIHEODTD : Indian Head, MD	49.490	0.300	Nov 2018	0.400	Nov 2019	0.450	Nov 2020	-		0.450	Continuing	Continuing	Continuing
Primary Hardware Development	C/FPIF	TBD : TBD	0.000	0.000		1.938	Nov 2019	0.000		-		0.000	0.000	1.938	-
Primary Software Development	WR	ARL/Army : Aberdeen Proving Ground	0.000	1.000	Dec 2018	2.500	Nov 2019	1.500	Nov 2020	-		1.500	0.000	5.000	-
Primary Hardware Development	MIPR	Dept of Energy : Albuquerque, NM	0.000	0.000		1.200	Jan 2020	1.700	Nov 2020	-		1.700	0.000	2.900	-
		Subtotal	266.389	5.883		7.980		8.439		-		8.439	Continuing	Continuing	N/A

Remarks

Primary Hardware and Software Development increases to address EOD mission threats and implements technology advances and complete evaluation and test of new and transitioned technology for EOD tools, equipment modernization, and Technology insertion for increases system modularity in response to reconnaissance and execution of tactical unmanned robotics requirements. Increased funds to incorporate sensors and technology transition against multiple platforms.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPFF	Peraton : Herndon, VA	8.683	0.367	Dec 2018	0.400	Nov 2019	0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
		Subtotal	8.683	0.367		0.400		0.400		-		0.400	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWCIHEODTD : Indian Head, MD	78.219	0.900	Dec 2018	0.900	Nov 2019	0.800	Nov 2020	-		0.800	Continuing	Continuing	Continuing
Operation Test & Evaluation	WR	NSWCIHEODTD : Indian Head, MD	11.533	0.025	Nov 2018	0.025	Nov 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
Operation Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.000		0.125	Nov 2019	0.500	Nov 2020	-		0.500	0.000	0.625	-
Developmental Test & Evaluation	C/FFP	NRL : Washington, DC	0.000	0.000		0.100	Jan 2020	0.350	Nov 2020	-		0.350	0.000	0.450	-
		Subtotal	89.752	0.925		1.150		1.900		-		1.900	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NSWCIHEODTD : Indian Head, MD	10.809	0.357	Oct 2018	0.250	Oct 2019	0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
Miscellaneous	WR	NSWCIHEODTD : Indian Head, MD	16.452	0.000		0.000		0.300	Oct 2020	-		0.300	Continuing	Continuing	Continuing
		Subtotal	27.261	0.357		0.250		0.500		-		0.500	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	392.085	7.532		9.780		11.239		-		11.239	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0377				
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Continuous Improvement (Inc 1)	1	2019	4	2025
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 1 (Inc 1)	1	2019	1	2019
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 2 (Inc 1)	2	2019	2	2019
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 3 (Inc 1)	4	2019	4	2019
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 4 (Inc 1)	2	2020	2	2020
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 5 (Inc 1)	4	2020	4	2020
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 6 (Inc 1)	2	2021	2	2021
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 7 (Inc 1)	4	2021	4	2021
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 8 (Inc 1)	2	2022	2	2022
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 9 (Inc 1)	4	2022	4	2022
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 10 (Inc 1)	2	2023	2	2023
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 11 (Inc 1)	4	2023	4	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 0377 / *JT Service Expl Ord Disp System*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 12 (Inc 1)	2	2024	2	2024
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 13 (Inc 1)	4	2024	4	2024
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 14 (Inc 1)	2	2025	2	2025
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 15 (Inc 1)	4	2025	4	2025
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Software Production & Development (Inc 2)	1	2020	4	2021
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Deployment and Sustainment	1	2022	4	2025
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 1 (Inc 2)	3	2022	3	2022
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 2 (Inc 2)	1	2023	1	2023
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 3 (Inc 2)	3	2023	3	2023
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 4 (Inc 2)	1	2024	1	2024
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 5 (Inc 2)	3	2024	3	2024
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 6 (Inc 2)	1	2025	1	2025
JOINT EXPLOSIVE ORDNANCE DISPOSAL DECISION SUPPORT SYSTEM (JEOD DSS): Engineering Change Proposal 7 (Inc 2)	3	2025	3	2025
EOD MODERIZATION: Technology Development	2	2020	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1317: *Expeditionary Diving Systems*	119.008	4.323	2.533	2.754	-	2.754	2.655	2.815	2.584	2.438	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

These resources support the development of equipment for the Navy's only comprehensive expeditionary detect to engage MCM capability. Specifically, it provides for development of Diver Safety/Life Support Equipment, Advanced Diver Integrated Sensors and Advanced Firing Systems to support Navy Explosive Ordnance Disposal (EOD) underwater operations, expeditionary salvage, and Expeditionary MCM Company operations by US Fleet Forces Command. The equipment must have inherently low acoustic and magnetic signatures in order to allow the EOD divers to safely reaquire, approach, render-safe, recover, exploit, and dispose of underwater explosive threats to include sea mines, limpet mines, underwater improvised explosive devices, and unexploded ordnance.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: DIVER SAFETY & LIFE SUPPORT SYSTEMS	2.000	2.150	1.765	0.000	1.765
Articles:	-	-	-	-	-

Description: Diver Safety & Life Support Systems: Develop diving equipment and diver safety tools to include life support systems for Explosive Ordnance Disposal (EOD), Expeditionary Mine Countermeasures (ExMCM), and Mobile Diving & Salvage Units (MDSU) operations. Specific tools include but are not limited to Underwater Breathing Apparatus (UBA), underwater handheld sonar, specialized dive masks, heads-up displays, emergency life support systems, and the capability to train divers and to evaluate ExMCM tools, tactics and procedures including control of signatures with regard to influence fired ordnance.

FY 2020 Plans:
Unmanned testing at Navy Experimental Dive Unit(NEDU) will commence leading to determination of suitability of candidate rigs prior to initiation of manned in-water testing. Efforts will continue the unmanned and manned testing needed to ensure that the UBAs selected in FY19 to address the capabilities defined by the approved Capability Definition Document (CDD) meet all required performance, safety, and user suitability thresholds. NEDU commercial environmental test chambers will be used to verify that applicable MIL-STD-810 environmental test conditions are met. The combined efforts are designed to ultimately support a source selection and NAVSEA 00C Certification of the selected UBA.

FY 2021 Base Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 efforts will be focused on completion of the user evaluations of the candidate system selected. These evaluations will determine the operational effectiveness and suitability characteristics of the Multi Mission Underwater Breathing Apparatus (MMUBA). Preparations for certification and production will ensue leading to a production decision this fiscal year. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $0.385M from FY2020 due to completion of Multi Mission Underwater Breathing Apparatus (MMUBA) developmental T&E and testing events at Navy Experimental Dive Unit (NEDU) as part of the required life support safety certification program prior to fielding any life support systems.					
Title: ADVANCED DIVER INTEGRATED SENSORS	1.958	0.293	0.864	0.000	0.864
Articles:	-	-	-	-	-
Description: Develop Advanced Diver Integrated Sensors equipment to enable EOD and MDSU ability to detect, access, neutralize and gather intelligence on underwater targets of interest in support of Expeditionary Mine Countermeasures (ExMCM) and Diving and Salvage missions. Requirements include the forthcoming STRIDENT (Diver held integrated navigation/sonar capability) CDD. ***FY 2020 Plans:*** ACAT designation and CDD will be approved. Initial candidate user evaluations conducted in FY19 will inform the development of the performance specification and source selection criteria to ensure that the candidate EDMs fully meet the required performance thresholds. ***FY 2021 Base Plans:*** FY21 efforts will focus on award of candidate Engineering Development Model (EDM) contracts and initiation of test and evaluation of the candidate EDMs against system performance specifications. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase of $0.571 from FY2020 due to purchase of initial STRIDENT prototypes and beginning of the developmental Test & Evaluation necessary to demonstrate capability of the systems to meet system performance specification and CDD thresholds.					
Title: ADVANCED FIRING SYSTEM	0.365	0.090	0.125	0.000	0.125
Articles:	-	-	-	-	-
Description: Develops next generation of remote underwater firing device to enable EOD technicians to neutralize or otherwise mitigate underwater ordnance hazards from a safe standoff distance. This capability enables an acoustic signal to travel from the surface to an in-water receiver to detonate explosive tools ISO ExMCM missions. Improvements from previous underwater firing systems include the ability to encrypt the acoustic signal to avoid inadvertent firing of other firing systems in the vicinity. ***FY 2020 Plans:*** Continue the development of the Mk 58 Mod 3 improved receiver subsystem. Test and evaluation of the initial prototypes will occur and preliminary Weapon System Safety Review Board (WSESRB) engagement will ensue to evaluate the design from a safety certification perspective. These new receivers will address existing capability shortcoming in the legacy MK 58 Mod 2 AFDs. ***FY 2021 Base Plans:*** Continue testing of the enhanced Acoustic Firing System (AFS) receiver subsystems. Pursue initial WSESRB certification to proceed to explosive testing in FY22. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant changes from FY2020.					
Accomplishments/Planned Programs Subtotals	4.323	2.533	2.754	0.000	2.754

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/0977a: *Underwater EOD Program (Cost Code UQ034)*	1.125	1.350	3.619	-	3.619	15.577	23.084	11.060	9.314	0.000	94.704
• OPN/0977b: *UW EOD (UQ038)*	6.700	2.450	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.574

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

Remarks

D. Acquisition Strategy

Analysis of Alternatives (AOA) studies are always conducted prior to the initiation of new sub-projects. The AOA addresses and emphasizes acquisition strategies of the most cost-effective solution over the sub-projects life-cycle. The acquisition strategies observe the following hierarchy of alternatives: commercial item (including modification), nondevelopmental item (including modification), and lastly, developmental programs. Contracting for RDT&E, if required, is always competitive and when feasible, production options are included. Maximum use of innovative contracting mechanisms will be assessed and pursued where applicable and in the best interest of the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	WR	Multiple Activities : Not Specified	45.100	0.850	Nov 2018	0.455	Nov 2019	0.345	Nov 2020	-		0.345	Continuing	Continuing	Continuing
Software Development	WR	Multiple Activites : Not Specified	6.741	0.170	Nov 2018	0.065	Nov 2019	0.180	Nov 2020	-		0.180	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWCIHEODTD : Indian Head, MD	8.228	0.000		0.000		0.100	Nov 2020	-		0.100	0.000	8.328	-
ILS	WR	Multiple Activities : Not Specified	11.916	0.000		0.000		0.000		-		0.000	0.000	11.916	-
Systems Engineering	WR	NSWC : Panama City	3.724	0.702	Nov 2018	0.502	Nov 2019	0.655	Nov 2020	-		0.655	Continuing	Continuing	Continuing
Systems Engineering	WR	NIWC : San Diego	5.199	0.970	Nov 2018	0.581	Nov 2019	0.564	Nov 2020	-		0.564	Continuing	Continuing	Continuing
		Subtotal	80.908	2.692		1.603		1.844		-		1.844	Continuing	Continuing	N/A

Remarks

Increase in system engineering from FY20 to FY21 due to the delivery of initial STRIDENT prototypes and beginning of the developmental T&E necessary to demonstrate capability of the systems to meet system performance specification and CDD thresholds that will be managed by system engineers at NIWC San Diego; also, the increased volume of UBA testing events at Navy Experimental Dive Unit (NEDU) that is supported by system engineers at NSWC PCD and is part of the required life support safety certification program prior to fielding any life support systems.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support2	C/CPFF	PERATON : Herndon VA	8.448	0.450	Nov 2018	0.307	Nov 2019	0.310	Nov 2020	-		0.310	Continuing	Continuing	Continuing
		Subtotal	8.448	0.450		0.307		0.310		-		0.310	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	Multiple Activities : Not Specified	9.562	0.585	Nov 2018	0.289	Nov 2019	0.300	Nov 2020	-		0.300	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	Multiple Activities : Not Specified	1.560	0.000		0.000		0.000		-		0.000	0.000	1.560	-
		Subtotal	11.122	0.585		0.289		0.300		-		0.300	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NSWCIHEODTD : Indian Head, MD	11.531	0.577	Nov 2018	0.334	Nov 2019	0.300	Nov 2020	-		0.300	0.000	12.742	-
Miscellaneous	WR	NSWC, Activities : Not Specified	6.986	0.019	Nov 2018	0.000	Nov 2019	0.000	Nov 2020	-		0.000	0.000	7.005	-
Acquisition Workforce Fund	Various	Various : Various	0.013	0.000		0.000		0.000		-		0.000	0.000	0.013	-
		Subtotal	18.530	0.596		0.334		0.300		-		0.300	0.000	19.760	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	119.008	4.323		2.533		2.754		-		2.754	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 1317 / *Expeditionary Diving Systems*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 1317				
TITLE: DIVER SAFETY LIFE SUPPORT	1	2019	4	2025
---Engineering & Manufacturing (Multi-Mission UBA)	1	2019	2	2021
---Testing (Multi-Mission UBA)	3	2019	2	2021
---Dive Table Development (Multi-Mission UBA)	2	2021	4	2021
---Production Decision MS C (Multi-Mission UBA)	2	2021	2	2021
---Continuous Improvement_	3	2022	4	2025
TITLE: ADVANCED FIRING SYSTEMS	1	2019	4	2025
---Continuous Improvement.	1	2019	4	2025
---AFS Reduced Profile Transmitter Outfitting	1	2019	4	2019
TITLE: ADVANCED INTEGRATED DIVER SENSORS	1	2019	4	2025
--Candidate Characterization (STRIDENT)	1	2019	1	2019
---CDD and Acquisition Strategy Development (STRIDENT)	1	2019	4	2019
---Program Initiation (STRIDENT)	4	2019	4	2019
---Engineering & Manufacturing (STRIDENT)	2	2020	3	2022
---Testing (STRIDENT)	3	2020	3	2022
---Limited Production Decision	3	2022	3	2022
---Limited Production	4	2022	4	2023
---Full Rate Production Decision MS C (STRIDENT)	4	2023	4	2023
---Production and Deployment (STRIDENT)	4	2023	4	2025
---Continuous Improvement	3	2022	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 3177 / *Joint Counter Radio-Controlled IED Elec Warfare*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3177: *Joint Counter Radio-Controlled IED Elec Warfare*	56.847	26.867	19.222	5.224	14.461	19.685	15.831	16.074	16.304	16.552	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports the defense objective of preventing terrorist and near peer operations against the US, allies, and partners. It provides for the research and development of Electronic Warfare (EW) systems, equipment, procedures, and tactical aids for all military services to counter the threat posed by Radio-Controlled Improvised Explosive Devices (RCIEDs) and to prevent initiation of RCIEDs across the spectrum of Joint military operations. It utilizes Joint requirements to provide a system of systems approach for a suite of equipment for mounted, dismounted, and fixed site operations, and develops; equipment, procedures, and tactical aids to make rapid improvements to performance, supportability and affordability, while maintaining pace with the evolving global RCIED threat.

Joint Counter RCIED electronic Warfare (JCREW), Increment 1 Block 1 (I1B1) is the next generation of counter RCIED system of systems. JCREW includes fixed site, mounted and dismounted units, which provide countermeasures against the global RCIED threat. Key system design features include significant performance increases over current legacy systems, a modular open architecture system design to facilitate improvements to address current and future advanced threats, robust information assurance and security, and is net-capable for improved Communications and Control (C2). JCREW I1B1 supports global deployment and sustainment for all combatant commands providing increased protection to Warfighter against the evolving worldwide RCIED threats.

This project also provides for continued development and testing of JCREW Counter-Unmanned Aerial System (C-UAS) capabilities to support Joint Urgent Operational Need Statement(JUONS) CC-0558 and Fleet Forces Command C-UAS requirements. This includes the modification of JCREW hardware, software, threat loads, and advanced techniques, integration into JCREW systems, lab verification, and open air testing. Fielded JCREW systems will be upgraded with modified hardware, software and threat loads to keep pace with the evolving
C-UAS threat.

The EOD CREW project provides for the research, development, and systems engineering of EOD-specific CREW systems (AN/PLT-4 and AN/PLT-5). These systems are developed to meet unique CREW requirements established by the Joint EOD community. The funding also provides for capability improvements to both systems based on ever-changing RCIED threats against EOD technicians.

The Hemlock project provides for research, development, and systems engineering of electronic forensic capabilities related to the technical exploitation of asymmetric threats, including RCIEDs, unmanned systems, and underwater mines. The information generated is used to increase the performance of CREW and other counter-IED systems, as well as enable development of new countermeasure capabilities.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 3177 / *Joint Counter Radio-Controlled IED Elec Warfare*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Joint Counter Radio-Controlled IED Elec Warfare	24.973	17.293	3.234	14.461	17.695
Articles:	-	-	-	-	-

Description: Supports the development, integration and test of Tech Insertion hardware, software, and advanced techniques into JCREW systems. Tech Insertion candidates include Office of Naval Research (ONR) sponsored technologies ready for transition to JCREW including the ENabling Dynamic Operational RF (ENDOR) Full Naval Capability (FNC); and techniques, hardware and software performance improvements developed by United States Government (USG) laboratories, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), and the JCREW prime contractor. Analysis of Alternatives (AoA) will be conducted to evaluate and select Tech Insertion candidates based on technical maturity, cost, and performance. Hardware and software updates will be integrated, tested, and implemented into JCREW through Engineering Change Proposals (ECPs).

FY 2020 Plans:
Development specifications, program plan, and contract vehicles for execution of development and integration of Tech Insertion 3 technologies in FY21. Tech Insertion 3 includes the refresh of the Software Defined Radio (SDR) module design that is required to enable software capabilities that are necessary for over 1,500 Navy JCREW I1B1 system to defeat emerging global RCIED threats, endangering US service personnel. Continue development and testing of threat loads, software, and hardware and processing associated ECPs.

$13.158M OCO funding supports Tech Insertion/Tech Refresh on JCREW systems to improve the C-UAS detect, identify, track, and defeat capabilities for JCREW systems deployed in support of JUON CC-0558 and Fleet Forces Command requirements. Continue development and testing of threat loads, software, and hardware and processing the associated ECPs to incorporate into JCREW systems.

FY 2021 Base Plans:
Begin and perform development and integration of Tech insertion 3 technologies, including the new SDR and several C-IED and C-UAS advanced threat techniques for dismounted, mounted, and fixed site JCREW I1B1 systems. Prepare for implementation and test of new SDR and advanced C-IED techniques in FY22. Develop analysis of alternatives, specifications, program plan, and contract vehicles for development and integration of Tech Insertion 4 technologies in FY22.

FY 2021 OCO Plans:

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Begin and perform development and integration of Tech insertion 3 technologies, including the new SDR and several C-IED and C-UAS advanced threat techniques for dismounted, mounted, and fixed site JCREW I1B1 systems. Prepare for implementation and test of new SDR and advanced C-IED techniques in FY22. Develop analysis of alternatives, specifications, program plan, and contract vehicles for development and integration of Tech Insertion 4 technologies in FY22. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to inadvertent FY 2020 Enacted add when Enduring Operations funding was moved from OCO to Base creating a positive wedge. Remaining funding supports the continued development of software load sets to keep pace with evolving C-sUAS threats.					
Title: EOD CREW	0.920	0.909	0.950	0.000	0.950
Articles:	-	-	-	-	-
FY 2020 Plans: Provide systems engineering support for EOD CREW systems. Develop AN/PLT-5 load sets to remain current with continually changing CONUS and OCONUS threats. Develop and validate AN/PLT-4 replacement requirements. ***FY 2021 Base Plans:*** Provide systems engineering support for EOD CREW systems. Develop AN/PLT-5 load sets to remain current with continually changing CONUS and OCONUS threats. Develop and validate AN/PLT-4 replacement requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change.					
Title: HEMLOCK	0.974	1.020	1.040	0.000	1.040
Articles:	-	-	-	-	-
FY 2020 Plans: OCO:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Develop hardware and software capabilities to enable enhanced cyber and electronics forensics and exploitation of evolving RCIED threats. Further information available at a higher classification. ***FY 2021 Base Plans:*** Develop hardware and software capabilities to enable enhanced cyber and electronics forensics and exploitation of evolving RCIED threats. Further information available at a higher classification. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change.					
Accomplishments/Planned Programs Subtotals	26.867	19.222	5.224	14.461	19.685

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/5509(b): *Explosive Ordnance Disposal Equip*	25.736	0.868	0.877	-	0.877	0.894	20.912	20.931	0.950	0.000	206.567

Remarks

D. Acquisition Strategy

Develop, integrate, test, and field hardware and software upgrades, and advanced techniques into JCREW systems through the JCREW Tech Insertion / Tech Refresh process. Tech Insertion candidates include Office of Naval Research (ONR) sponsored technologies ready for transition to JCREW including the ENabling Dynamic Operational RF (ENDOR) Full Naval Capability (FNC); and techniques, hardware and software performance improvements developed by United States Government (USG) laboratories, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), and the JCREW prime contractor. Analysis of Alternatives (AoA) will be conducted to evaluate and select Tech Insertion candidates based on technical maturity, cost, and performance. Hardware and software updates will be integrated, tested, and implemented into JCREW through Engineering Change Proposals (ECPs). Also supports rapid development and testing of JCREW Counter-Unmanned Aerial System (C-UAS) for Joint Urgent Operational Need (JUON) CC-0558.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	C/CPFF	Northrop Grumman : San Diego, CA	10.544	5.232	Jan 2019	3.354	Jan 2020	0.648	Jan 2021	2.870	Jan 2021	3.518	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	Northrop Grumman : San Diego, CA	6.916	2.553	Jan 2019	1.724	Jan 2020	0.384	Jan 2021	1.330	Jan 2021	1.714	Continuing	Continuing	Continuing
Software Development	C/CPFF	Northrop Grumman : San Diego, CA	7.459	2.682	Jan 2019	1.714	Jan 2020	0.538	Jan 2021	1.647	Jan 2021	2.185	Continuing	Continuing	Continuing
System Integration	C/CPFF	Northrop Grumman : San Diego, CA	2.916	2.405	Jan 2019	1.525	Jan 2020	0.292	Jan 2021	1.296	Jan 2021	1.588	Continuing	Continuing	Continuing
		Subtotal	27.835	12.872		8.317		1.862		7.143		9.005	Continuing	Continuing	N/A

Remarks

FY20 to FY21 increase for the primary hardware and software development to support complex technical refresh of the software defined radio (SDR) module, while continuing CIED/CUAS advanced threat technique development for current threats and development of technical insertion 4 analysis of alternatives.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Loadset Development	FFRDC	JHU/APL, MITRE : Laurel, MD	5.096	1.858	Nov 2018	1.542	Nov 2019	0.345	Nov 2020	1.080	Nov 2020	1.425	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC : Various	9.421	6.834	Nov 2018	4.314	Nov 2019	1.333	Nov 2020	2.133	Nov 2020	3.466	Continuing	Continuing	Continuing
Program Management Support	WR	IHEODTD : Indian Head, MD	1.572	0.645	Nov 2018	0.636	Nov 2019	0.257	Nov 2020	0.364	Nov 2020	0.621	Continuing	Continuing	Continuing
Loadset Development	WR	IHEODTD : Indian Head, MD	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	16.089	9.337		6.492		1.935		3.577		5.512	Continuing	Continuing	N/A

Remarks

FY20 to FY21 increase for the systems engineering necessary to support complex technical refresh of the software defined radio (SDR) module, while continuing CIED/CUAS advanced threat technique development for current threats and development of technical insertion 4 analysis of alternatives.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation	WR	NSWC : Various	6.666	1.927	Nov 2018	2.014	Nov 2019	0.810	Nov 2020	1.312	Nov 2020	2.122	Continuing	Continuing	Continuing
Test & Evaluation	MIPR	YPG : Yuma, Arizona	4.025	2.407	Nov 2018	1.726	Nov 2019	0.379	Nov 2020	1.622	Nov 2020	2.001	Continuing	Continuing	Continuing
		Subtotal	10.691	4.334		3.740		1.189		2.934		4.123	Continuing	Continuing	N/A

Remarks

FY20 to FY21 increase for the additional test and evaluation necessary to support complex technical refresh of the software defined radio (SDR) module, while continuing CIED/ CUAS advanced threat technique development for current threats and development of technical insertion 4 analysis of alternatives.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPFF	Cydecor : Various	1.015	0.000		0.350	Nov 2019	0.109	Nov 2020	0.321	Nov 2020	0.430	Continuing	Continuing	Continuing
Miscellaneous	WR	NSWC : Various	1.217	0.324	Nov 2018	0.323	Nov 2019	0.129	Nov 2020	0.486	Nov 2020	0.615	Continuing	Continuing	Continuing
		Subtotal	2.232	0.324		0.673		0.238		0.807		1.045	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	56.847	26.867		19.222		5.224		14.461		19.685	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 3177 / *Joint Counter Radio-Controlled IED Elec Warfare*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 3177 / *Joint Counter Radio-Controlled IED Elec Warfare*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 3177 / *Joint Counter Radio-Controlled IED Elec Warfare*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3177				
JCREW I1B1: Full Rate Production	1	2019	1	2021
JCREW I1B1: TECH INSERTION 2	1	2019	3	2019
JCREW I1B1: Tech Refresh Development (2)	1	2019	2	2019
JCREW I1B1: Tech Refresh Implementation and Test (2)	3	2019	3	2019
JCREW I1B1: TECH INSERTION 3	2	2019	1	2022
JCREW I1B1: Tech Refresh Analysis of Alternatives (3)	2	2019	4	2019
JCREW I1B1: Tech Refresh Development (3)	1	2020	4	2021
JCREW I1B1: Tech Refresh Implementation and Test (3)	1	2022	1	2022
JCREW I1B1: TECH INSERTION 4	2	2021	1	2023
JCREW I1B1: Tech Refresh Analysis of Alternatives (4)	2	2021	4	2021
JCREW I1B1: Tech Refresh Development (4)	1	2022	4	2022
JCREW I1B1: Tech Refresh Implementation and Test (4)	1	2023	1	2023
JCREW I1B1: Counter Unmanned Aerial System Development	1	2019	4	2019
JCREW I1B1: C-UAS Improvement Program	1	2019	4	2025
EOD CREW: Continuous Improvement	1	2019	4	2025
EOD CREW: HEMLOCK	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603654N / *JNT Service EOD Development*				Project (Number/Name) 4023 / *Expeditionary Underwater Systems*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4023: *Expeditionary Underwater Systems*	140.920	16.770	16.121	23.867	-	23.867	23.673	24.671	22.443	20.545	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Funding supports the development of unmanned systems for the Navy's expeditionary unmanned underwater Explosive Ordnance Disposal (EOD) and Mine Countermeasures (MCM) capability. Specifically, it provides for development of affordable expeditionary, unmanned underwater systems to support Navy Expeditionary forces including EOD, Mobile Diving and Salvage, Very Shallow Water (VSW), and Expeditionary Mine Countermeasures (ExMCM) mission operations. The equipment must be highly portable in order to support the Navy EOD technician to safely approach, render safe, recover, exploit, and dispose of underwater explosive threats to include sea mines, limpet mines, and unexploded ordnance. Provides support for the Navy's high priority missions of Maritime Homeland Defense and MCM, including clandestine reconnaissance and mine clearance in support of amphibious operations. Development of Expeditionary UUV systems to support localization render-safe and detailed intelligence gathering of unexploded ordnance (UXO) including Underwater Improvised Explosive Devices (IEDs). This project directly supports Department of the Navy Strategic Roadmap for Unmanned Systems promulgated in March 2018.

This budget provides the resources needed to execute two formal MK 18 Family of Systems acquisition programs as well as three major engineering change proposals and the enhancement to the MK 18 Family of Systems to provide an underwater threat interdiction capability. These efforts require prototype development as well as initiating the development and evaluation of the Next Generation competitive Small and Medium Class UUVs in response to requirements defined by the Maritime Expeditionary MCM UUV (MEMUUV) CDD.

FY21 will focus on continuation of the development and testing of advanced technologies that will allow warfighters to detect, classify, and localize high priority threats in meeting mine warfare missions. For example, the MK 18 Mod 2 Increment II upgrade will provide improved Automated Target Recognition (ATR) algorithms, more advanced autonomy architecture and continue to enhance electro-optic sensor performance. Increment II development and testing will focus on improving MCM performance and reducing the tactical timeline through development of a Reacquire, Identify and Mark capability for a Medium class UUV system. Concurrently with these efforts, the MK18 Mod 1 is undergoing a configuration change that will provide a higher area coverage rate, inclusion of vehicle autonomy, and Automated Target Recognition. Also, resources will continue to be used to expand deployability of the MK 18 Family of Systems (FoS) aboard a higher number of shipboard platforms and also to deploy the FoS from additional small boats and platforms other than the current 11 meter Rigid Hull Inflatable Boat (RHIB). These efforts will significantly improve the capabilities of the projected inventory of Small and Medium Class UUV systems for fleet Expeditionary MCM forces. Currently, the MK 18 Family of Systems are being employed in multiple theater of operations (5th, 6th, and 7th Fleet) and have been employed in multiple CONUS based port survey and maritime homeland defense operations as well.

Additional efforts will continue to execute the open competition process necessary to acquire and verify an EOD Response ROV capability focusing on user effectiveness and operational suitability to provide a ROV based target interdiction capability to address the capability gaps assessed in the previously conducted

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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Expeditionary UUV Neutralization System (EUNS) AoA. This next generation capability (i.e. modified-off-the-shelf (MOTS) ROV) is developed to decrease risk when reacquiring/investigating a potential threat (i.e. sea mine or Underwater IED).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: MK18 UUV Family of Systems	12.779	8.142	15.589	0.000	15.589
Articles:	-	-	-	-	-

Description: This program supports development, testing and Fleet approval for evolving generations of affordable,
expeditionary Unmanned Underwater Vehicle (UUVs) systems to address validated requirements in support of Expeditionary SW and VSW UMCM mission areas defined by the Maritime Expeditionary MCM UUV (MEMUUV) Capability Description Document (CDD) approved in September 2017.

FY 2020 Plans:
FY20 will continue the development, testing, and evaluation of MK 18 Family of Systems. FY20 will focus on continuation
of the development and testing of the Increment II program of record during the engineering and manufacturing development phase. In order to meet Fleet capacity and capability requirements, MEMUUV development is being
accelerated to mitigate risk of future obsolescence of the MK18 platform and to take advantage of advances in UUV
technology and modular open systems architecture. The rapid acquisition approach utilized for the development of the
next generation small and medium class UUVs will form a technologically advanced baseline from which to develop future
Increment III capabilities to detect, classify and localize high priority threats in meeting mine warfare missions.

FY 2021 Base Plans:
FY21 development of MEMUUV will focus on purchase and evaluation of prototype candidates and the delivery and initial engineering evaluation of the engineering development model of the Medium class UUV system. Additionally, the engineering and manufacturing development phase will continue to evaluate the operational effectiveness and suitability of the Increment II baseline. The technologies developed in Increment II will provide capability for both the legacy MK 18 platform and the MEMUUV Increment III systems. Events in FY21 will focus on demonstrating performance in operationally realistic environments with significant fleet user engagement.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Additionally, environmental testing will commence to demonstrate compliance with the system performance specification requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $7.447M from FY2020 due to continuation of post-MS B Mk 18 Mod 2 Increment II developmental T&E as part of the engineering and manufacturing development (E&MD) phase and initiation of environmental testing of the EDM baseline configuration and development and testing of the prototype Medium Class MEMUUV Next Generation vehicles.					
Title: EOD Response ROVs and Maritime Expeditionary Standoff Response System of Systems	3.991	7.979	8.278	0.000	8.278
Articles:	-	-	-	-	-
Description: This program supports development, testing and evaluation of technologies and commercial systems that will provide needed capabilities to EOD and Expeditionary forces in responding to the wide range of underwater threats and operational environments encountered in assigned mission areas to include: confined areas, hulls, piers and pilings to search, classify, map, re-acquire, identify, and neutralize sea and limpet mines and underwater improvised explosive devices. ***FY 2020 Plans:*** FY20 will investigate and develop, test and evaluate enhancements to the selected MOTS ROV leading to an ECP decision regarding production and fielding of this interim EOD Response capability. Additionally, development and testing of the first generation MESR systems will continue. Component technologies will be integrated into three specific capability sets: Response Vehicle (RV) systems; standoff command and control modules; Task-Specialized Response Payloads. ***FY 2021 Base Plans:*** FY21 efforts will continue to evaluate the operational effectiveness and suitability of the MESR prototypes. Events in FY21 will focus on demonstrating performance in operationally realistic environments to demonstrate					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
compliance with the system performance specification requirements as well as testing emergent technologies and components that will reduce the system's magnetic, acoustic, or other influence signatures. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $299K from FY2020 due to resources aligned to test and reduce MESR influence.					
Accomplishments/Planned Programs Subtotals	16.770	16.121	23.867	0.000	23.867

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/0977(a): *Underwater EOD Program (Cost Code UQ034)*	1.850	0.000	4.715	-	4.715	1.939	0.546	0.000	4.200	0.000	157.498
• OPN/0977(b): *Expeditionary Mine Countermeasures (ExMCM) (Cost Code UQ038)*	32.515	32.310	3.903	-	3.903	5.163	10.723	2.175	0.000	0.000	98.185
• OPN/0977 (c): *MK18 Unmanned Underwater Vehicle (MK UUV) (Cost Code UQ040)*	19.440	25.746	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	67.236
• OPN/1611: *Expeditionary UUV (Cost Code MU002)*	0.000	0.000	29.604	2.946	32.550	17.116	9.530	9.721	9.915	0.000	78.832
• OPN/1611 MU003: *Expeditionary UUV (Cost Code MU003)*	0.000	0.000	0.000	-	0.000	0.000	8.358	12.006	14.553	0.000	34.917

Remarks

D. Acquisition Strategy

Analysis of Alternatives (AOA) studies are conducted prior to the initiation of new sub-projects. The AOA addresses and emphasizes acquisitions strategies of the most cost effective solution over the sub-projects' life -cycle. The acquisition strategies observe the following hierarchy of alternatives: commercial item (including modifications), non-developmental item (including modifications), and lastly, developmental programs. Contracting for RDT&E, if required is competitive and when feasible, production options are included. This ongoing program capitalizes on a User Operational Evaluation System (UOES) effort involving Fleet operators engaged in tactical experimentation with prototype UUVs prior to fielding baseline systems and capability improvement package increments. These UUV operators also participate

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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in detailed requirements analyses and definition. Operational capabilities with UUVs have been realized at designated operational units, with a competitive acquisition strategy. The addition of enhanced capabilities through an evolutionary acquisition approach to the UUV toolbox is programmed for delivery in accordance with approved CNO requirements and ONR Technology Transition Agreements (TTAs) which close capability gaps. Further improvements to the toolbox to add basic mine and underwater explosive threats neutralization capabilities will continue to be pursued, including expansion of EOD Response capabilities employing Remotely Operated Vehicles (ROVs) in areas where current UUVs cannot operate. Streamlined acquisition initiatives are in place to quickly evaluate candidate EOD response capabilities while the longer term Maritime Expeditionary Response System of Systems is developed. A key attribute for these systems is minefield suitability and control of system signatures to counter influence fired ordnance. Influence signatures of subject UUVs and ROVs will be characterized as a vital component of the acquisition initiatives. Maximum use of innovative contracting mechanisms will be assessed and pursued where applicable and in the best interest of the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	WR	Multiple Activities : Not Specified	26.862	3.588	Nov 2018	3.397	Nov 2019	5.465	Nov 2020	-		5.465	0.000	39.312	-
Systems Engineering	WR	NSWC Activities : Not Specified	17.656	2.613	Nov 2018	2.363	Nov 2019	4.410	Nov 2020	-		4.410	0.000	27.042	-
Primary Hardware Development	WR	NSWCIHEODTD : Indian Head, MD	16.238	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC, Activities : Not Specified	25.997	2.761	Nov 2018	2.524	Nov 2019	3.574	Nov 2020	-		3.574	Continuing	Continuing	Continuing
		Subtotal	86.753	8.962		8.284		13.449		-		13.449	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technical Support	C/CPFF	PERATON : Herndon, VA	6.834	0.583	Nov 2018	0.528	Nov 2019	0.519	Nov 2020	-		0.519	Continuing	Continuing	Continuing
		Subtotal	6.834	0.583		0.528		0.519		-		0.519	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation-WR	WR	NSWC Activities : Not Specified	20.815	3.681	Nov 2018	3.604	Nov 2019	4.676	Nov 2020	-		4.676	0.000	32.776	-
Independent T&E	WR	NSWC Activities : Not Specified	6.096	1.763	Nov 2018	1.784	Nov 2019	1.820	Nov 2020	-		1.820	0.000	11.463	-
Developmental Test & Evaluation	WR	NSWC Activities : Not Specified	11.429	1.269	Nov 2018	1.272	Nov 2019	2.837	Nov 2020	-		2.837	Continuing	Continuing	Continuing
Independent T&E	WR	NSWCIHEODTD : Indian Head, MD	1.424	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	39.764	6.713		6.660		9.333		-		9.333	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NSWCIHEODTD : Indian Head, MD	4.996	0.354	Nov 2018	0.528	Nov 2019	0.344	Nov 2020	-		0.344	Continuing	Continuing	Continuing
Miscellaneous	WR	NSWC Activities : Not Specified	2.555	0.158	Nov 2018	0.121	Nov 2019	0.222	Nov 2020	-		0.222	Continuing	Continuing	Continuing
DAWDF	Various	Not Specified : Not Specified	0.018	0.000		0.000		0.000		-		0.000	0.000	0.018	-
		Subtotal	7.569	0.512		0.649		0.566		-		0.566	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	140.920	16.770		16.121		23.867		-		23.867	Continuing	Continuing	N/A

Remarks

FY19 and FY20 efforts include use of Defense Innovation Unit (DIU) Other Transactional Agreements (OTAs) to support rapid fielding of MOTS EOD response ROVS and Small UUV Next Generation
systems

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4023				
TITLE: MK 18 MOD 2 UUV	1	2019	4	2025
---Production and Deployment (Inc 1)	1	2019	3	2020
---Engineering Change Proposal (Advanced Sensors #1)	1	2019	1	2019
---Engineering Change Proposal (Advanced Sensors #2)	2	2019	2	2019
---Production and Deployment Advanced Sensors)	2	2019	4	2023
---MS B (Inc II)	1	2019	1	2019
---Engineering & Manufacturing (Inc II)	2	2019	4	2022
---Testing (Inc II)	2	2019	4	2022
---Production Decision (Inc II)	4	2022	4	2022
---Engineering Change & System Integration (Inc II)	1	2023	4	2025
---Increment III Technology Development	2	2021	2	2023
---MS B (Inc III)	3	2023	3	2023
---Engineering & Manufacturing (Inc III)	3	2023	4	2025
---Testing (Inc III)	4	2023	4	2025
TITLE: MK 18 MOD 1 UUV	1	2019	4	2021
---Engineering Change Proposal (Block C)	2	2019	2	2019
---Testing (Block C)	1	2019	2	2019
---Production and Deployment (Block C)	2	2019	4	2021
-TITLE: Medium Class MEMUUV	1	2020	4	2024
----Medium Class MEMUUV Design and Development	4	2020	2	2022
----Medium Class MEMUUV Testing	3	2022	2	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 4023 / *Expeditionary Underwater Systems*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
----Medium Class MEMUUV ECP Decision	3	2023	3	2023
----Medium Class MEMUUV Production and Deployment	3	2023	4	2024
TITLE: EOD RESPONSE (ROV)	1	2019	4	2025
---MOTS ROV EOD Response Testing	1	2019	2	2020
---MOTS ROV EOD Response ECP Decision	3	2020	3	2020
---MOTS ROV EOD Response Production and Deployment	3	2020	4	2025
---MESR Program Initiation	4	2019	4	2019
---MESR FoS Testing	3	2020	4	2025
---MESR Inc I Production and Deployment	2	2024	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	4.824	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.824
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Develop, acquire, test, and evaluate diver life support systems and diving safety tools and equipment to provide more effective and suitable capabilities to conduct EOD, and Mobile Diving & Salvage Units (MDSU) operations in emergent, high priority underwater missions. Specific tools and equipment include but are not limited to Underwater Breathing Apparatus (UBAs), specialized dive masks, heads-up displays, emergency life support systems and the ability to train divers and to evaluate Mine Countermeasures (MCM)/Explosive Ordnance Disposal (EOD) tools, tactics and procedures including control of signatures with regard to influence fired ordnance both in homeland waters and in controlled threat areas.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Breathing Apparatus for EOD Divers	4.824	0.000
FY 2019 Accomplishments: Efforts will focus on acceleration of the MMUBA acquisition program (MOTS UBA, MK 16 PIP) and diver safety life support enhancements through acquisition of additional prototypes, more rapid acquisition of long lead components for MK 16 UBA PIP and acceleration of bench testing, field demonstrations and environmental evaluation. This funding will significantly enhance the ability to deliver the capabilities defined by the CNO approved MMUBA Capability Definition Document (CDD) of May 2018. ***FY 2020 Plans:*** N/A		
Congressional Adds Subtotals	4.824	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Analysis of Alternatives (AOA) studies are always conducted prior to the initiation of new sub-projects. The AOA addresses and emphasizes acquisition strategies of the most cost-effective solution over the sub-projects life-cycle. The acquisition strategies observe the following hierarchy of alternatives: commercial item (including modification), non- developmental item (including modification), and lastly, developmental programs. Contracting for RDT&E, if required, is always competitive and when feasible, production options are included. Maximum use of innovative contracting mechanisms will be assessed and pursued where applicable and in the best interest of the Navy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technical Support	C/CPFF	PERATON : Herndon, VA	0.000	0.828	Nov 2018	0.000		0.000		-		0.000	0.000	0.828	-
		Subtotal	0.000	0.828		0.000		0.000		-		0.000	0.000	0.828	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	NSWC : Panama City	0.000	3.996	Nov 2018	0.000		0.000		-		0.000	0.000	3.996	-
		Subtotal	0.000	3.996		0.000		0.000		-		0.000	0.000	3.996	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	WR	NSWCIHEODTD : Indian Head, MD	0.000	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	0.000	-
Miscellaneous	WR	NSWCIHEODTD : Indian Head, MD	0.000	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	4.824		0.000		0.000		-		0.000	0.000	4.824	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9999																												
DIVER SAFETY LIFE SUPPORT																												
-----Engineering & Manufacturing (Mul																												
-----Prototype/EDM Deliveries																												
-----Testing (Multi-Mission UBA)																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603654N / *JNT Service EOD Development*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
DIVER SAFETY LIFE SUPPORT	1	2019	4	2019
-----Engineering & Manufacturing (Mul	1	2019	4	2019
-----Prototype/EDM Deliveries	2	2019	2	2019
-----Testing (Multi-Mission UBA)	3	2019	4	2019

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	70.516	5.697	5.619	6.346	-	6.346	6.874	6.322	6.295	6.421	Continuing	Continuing
0099: *Deep Submergence Bio Med Dev*	39.511	4.311	4.360	4.441	-	4.441	4.531	4.625	4.719	4.814	Continuing	Continuing
0394: *Shallow Depth Diving EQ*	31.005	1.386	1.259	1.905	-	1.905	2.343	1.697	1.576	1.607	Continuing	Continuing

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $0.381 million to account for the availability of prior year execution balances.

Developments in this program will enable the U.S. Navy to overcome deficiencies that constrain manned diving operations in several critical areas such as submarine rescue, recovery, salvage, underwater ship husbandry, underwater construction and naval special operations. This program develops biomedical technology, diver life support equipment, and the systems, tools, and procedures to permit manned underwater operations and enhance diver performance and safety.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	5.915	5.619	5.731	-	5.731
Current President's Budget	5.697	5.619	6.346	-	6.346
Total Adjustments	-0.218	0.000	0.615	-	0.615
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.218	0.000			
• Program Adjustments	0.000	0.000	0.619	-	0.619
• Rate/Misc Adjustments	0.000	0.000	-0.004	-	-0.004

Change Summary Explanation

FY2021:

The FY 2021 funding request was reduced by $0.381 million to account for the availability of prior year execution balances. $1.000 million in program increases are: $0.200 million to fund Navy Diving COTS Equipment and $0.800 million in order to design and develop an improved pressurized shallow water capable submarine transfer skirt.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0099: *Deep Submergence Bio Med Dev*	39.511	4.311	4.360	4.441	-	4.441	4.531	4.625	4.719	4.814	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project:
1) Develops advanced biomedical and bioengineering technology for medical and life support enhancement to decrease submariner deaths and permanent injury in a disabled submarine (DISSUB) and during submarine escape and rescue;
2) Conducts research for diver health, safety, and effectiveness to increase understanding of human performance and enhanced diver stress management and survivability in high stress environments such as in cold/warm water and at altitude. This project also validates and improves the accuracy of assumptions associated with equipment testing and certification, diving procedures, and diver biomedical physiology.

Deliverables for DISSUB include: medical guidance/procedures increasing submariner survivability for submarine escape and rescue (including new Submarine Rescue Diving and Recompression System (SRDRS)), life support parameters, medical procedures for life support; exposure and mitigation guidance for atmospheric contaminants, high levels of oxygen and/or carbon dioxide; prevention and treatment of decompression sickness and pulmonary oxygen toxicity; and senior survivor expert decision system.

Deliverables for diver health and safety include: decompression guidance in extreme environment diving with various breathing mixtures, temperatures, durations, and altitudes; exposure guidance for oxygen breathing; diver performance guidance based on physiological effects of diving; enhanced underwater swimming efficiency; enhanced diver thermal protection; collection of operational diving depth/time profiles to predict decompression risk, and exposure and mitigation guidance for divers experiencing underwater continuous noise, impulse noise, or underwater blast.

Requirements:
OPNAVINST 3150.27C, Navy Diving Policy and Joint Military Diving Technology and Training Program, 24 Jun 2016
Navy Salvage and Navy Diving Capabilities-Based Assessment (CBA) Report, 19 Dec 2013
NAPDD #587-873, Deep Submergence Biomedical Development, 23 Nov 1999
NAVSEA Instruction 3900.10A, Management of the Deep Submergence Biomedical Research and Development Program, 6 Nov 2018
Navy Diving Initial Capabilities Document (ICD)

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Deep Submergence Bio Med Dev - Diver Health and Safety	2.663	2.247	2.220	0.000	2.220
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Diver Health and Safety Research: Novel methods for decompression safety and treatment of decompression sickness/arterial gas embolism. Advanced decompression models for extreme environments, including thermally challenging, long duration, multi-gas, and/or diving at altitude. Diving physiology advances in exercise, thermal exposure, oxygen/carbon dioxide alterations, other gas mixture alternations, hydration, and sustained operations. Develop pulmonary oxygen toxicity exposure limits. Provide pulmonary and Central Nervous System (CNS) oxygen toxicity mitigation strategies. Develop an advanced diver thermal model. Develop advanced insulation garments for diver thermal protection. Develop guidance for optimizing thermal control during decompression. Develop guidelines for conduct of diving operations at altitude. Develop guidance for infra- and ultra-sound diver exposure. Continue collection of operational and research dive data for inclusion in advanced probabilistic decompression models. Investigate diver in-water maladies. Develop/ improve real-time decompression guidance and dive planning. Research procedures for assessing and mitigating risk for diving in contaminated water.					
FY 2020 Plans: * Multi-Year Project Support: Completion of projects initiated in prior fiscal years will be supported where progress is deemed acceptable and project goals remain valid and attainable.					
* Improve Safety of Rebreather Diving: Rebreather diving entails the highest risk diving performed by Navy personnel. Work is ongoing in this area of focus for the program and projects addressing these concerns will also be solicited in future Broad Agency Announcements. This work is planned to continue into FY-21 and FY-22.					
* Improve Diver Safety Through Innovative Monitoring Techniques: Technological advances are accelerating enabling broad physiologic monitoring of warfighters. We will pursue methods to translate these technologies into the undersea environment. We will also develop programs and procedures to monitor diver health longitudinally, to assess long-term health impacts of Navy diving. This work is planned to continue into FY-21 and FY-22.					
* Improve Thermoregulation and Thermal Monitoring: Thermal control for divers remains a top priority and a long-term area of focus for the program due to the mission-limiting nature of this challenge. This work is planned to continue into FY-21 and FY-22.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
* Improve Naval Special Operations Training Safety: Understanding and preventing Immersion Pulmonary Edema will help develop novel approaches to improving special operations training safety. * Develop Real-Time Decompression Calculation Capability for Next Generation Navy Dive Computer: Current advances in computing power are enabling embedded real-time probabilistic decompression models into diver computers. This will be the next significant leap forward in decompression dive planning and is expected to enable risk-based decompression planning. This work is planned to continue into FY-21 and FY-22.					
FY 2021 Base Plans: * Multi-Year Project Support: Completion of projects initiated in prior fiscal years will be supported where progress is deemed acceptable and project goals remain valid and attainable. * Pursue Approval of Medication Use to Prevent O2 Toxicity: Cutting edge approaches using medications and supplements to mitigate all forms of oxygen toxicity will be pursued, to include defining the FDA approval process. Work will be sponsored to streamline this important aspect of future research and establish the organizational connections to ensure success. * Diver Hearing Conservation: Continue work to quantify acoustic exposures to divers and thus support hearing loss risk mitigation. * Improve Contaminated Water Diving Risk Assessment: Develop real-time water sampling and analysis methods to determine risk and inform diver protection levels. * Optimize Understanding of Hydration Status Impact on Divers: Develop validated models and guidance related to optimizing hydration and rehydration in divers. * Develop Mitigation and Counter-Measures to Whole Body Oxygen Toxicity: Support effort to identify operationally useful solutions to counter the performance decrements associated with whole body oxygen toxicity.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
There is a minimal decrease in the funding allocated for Diver Health between FY20 and FY21. This 1% decline can be explained by small differences in the total labor costs associated with planned projects across these two fiscal years. Both budget allocations reflect continued strong interest in addressing challenging physiologic problems related to enhancing diver performance and range of operations.					
Title: Deep Submergence Bio Med Dev - Submarine Escape & Rescue	1.648	2.113	2.221	0.000	2.221
Articles:	-	-	-	-	-
Description: Submarine Rescue/Escape Research: Provide decompression procedures for pressurized Submarine Rescue Diving and Recompression System (SRDRS) operators. Investigate adjunctive therapies for treating Disabled Submarine (DISSUB) survivors. Provide updated guidance for food, water, clothing, medical supplies, to enhance survival of submarine crews awaiting rescue. Develop/provide flexible computer-generated decompression schedules for wide range of conditions in a DISSUB. Develop DISSUB medical triage procedures and support DISSUB survival trials. Develop mitigation strategies to reduce hyperbaric oxygen exposures in closed vehicles/compartments. Develop treatment guidance for decompression sickness and arterial gas embolism in submarine escape and rescue. Investigate the use of novel pharmacologic agents to reduce decompression risk and/or oxygen toxicity in submarine rescues. Develop/deploy toxic gas analyzer for use in pressurized DISSUB rescue. Investigate interventions for toxicological problems in DISSUB survivors. Develop strategies to minimize decompression sickness and arterial gas embolism with Submarine Escape and Surface Survival Personnel Equipment (SESSPE) training.					
FY 2020 Plans: * Multi-Year Project Support: Completion of projects initiated in prior fiscal years will be supported where progress is deemed acceptable and project goals remain valid and attainable.					
* Development of a New Simplified Toxic Gas Detector for DISSUB: New technology has been identified which has the potential to simplify detection and quantification of toxic gas presence in a disabled submarine situation, allowing rapid atmosphere contamination assessment by rescue forces. This work is planned to continue into FY-21 and FY-22.					
* Improve Guidance in the Submarine Rescue System Decompression Plan: The Submarine Rescue Submersible (SRS) Decompression Plan (SH420-AA-PRO-010) is a living document which will be updated based on results from relevant studies completed in prior years. As procedural testing proceeds in efforts to					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
certify the rescue system, additional biomedical concerns are expected to arise and will be addressed. This work is planned to continue into FY-21 and FY-22. * Optimize Submariner Cognition and Decision-Making in DISSUB: This will remain an area of focus for the program in an effort to mitigate factors which are expected to diminish effectiveness of personnel, particularly leaders, onboard a DISSUB. This work is planned to continue into FY-21 and FY-22. * Update DISSUB Rescue Planner: As with the Navy Dive Planner, a need to update and upgrade the DISSUB Rescue Planner is anticipated as Fleet use expands. This work is planned to continue into FY-21 and FY-22. ***FY 2021 Base Plans:*** * Multi-Year Project Support: Completion of projects initiated in prior fiscal years will be supported where progress is deemed acceptable and project goals remain valid and attainable. * Explore Utility of Ketone Esters in DISSUB Scenario: Sponsor research looking at the effectiveness of ketone esters and/or salts to induce ketosis and mitigate risk of O2 Toxicity when oxygen prebreathe is indicated to improve survival during pressurized DISSUB rescue. * Assess Impact of CO2 on Pressurized DISSUB survival: We will sponsor animal research to answer the question regarding whether elevated CO2 levels will accelerate onset of Pulmonary O2 Toxicity and increase mortality during high internal pressure DISSUB scenarios. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** There is a small increase in the funding allocated for Submarine Rescue between FY20 and FY21. This reflects increasing interest in and demand for answers related to improving the survival of submariners at the most extreme depth/time profiles for submarine rescue.					
Accomplishments/Planned Programs Subtotals	4.311	4.360	4.441	0.000	4.441

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

Integrated thrust area teams (e.g., decompression research) are established with university, commercial, and in-house Navy labs to jointly execute biomedical Research and Development (R&D). Peer review of research proposals accomplished by independent Technical Advisory Board. Annual review of progress by Executive Review Board (CNO/NAVSEA/ONR/BUMED). Program management by 0-6 Undersea Medical Officer. Contracting by competitive process using Business Area Analysis (BAA) and leveraging Office of Naval Research (ONR) capabilities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	NEDU : Panama City, FL	24.093	0.622	Nov 2018	0.548	Nov 2019	0.797	Nov 2020	-		0.797	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NMRC : Silver Spring, MD	9.701	1.135	Nov 2018	0.689	Nov 2019	0.939	Nov 2020	-		0.939	Continuing	Continuing	Continuing
Development Test & Evaluation	Various	DUKE UNIV : Durham, NC	2.121	1.311	Jan 2019	0.802	Nov 2019	0.700	Jan 2021	-		0.700	Continuing	Continuing	Continuing
Development Test & Evaluation	C/CPFF	ROH : Arlington, VA	0.282	0.030	May 2019	0.030	Nov 2019	0.030	Nov 2020	-		0.030	Continuing	Continuing	Continuing
Development Test & Evaluation	C/FFP	WISCONSIN : Madison, WI	1.336	0.335	Feb 2019	0.461	Nov 2019	0.457	Nov 2020	-		0.457	Continuing	Continuing	Continuing
Development Test & Evaluation	C/FFP	SUNY : Buffalo, NY	1.273	0.608	Apr 2019	0.880	Nov 2019	0.616	Nov 2020	-		0.616	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NSWC : Panama City, FL	0.159	0.041	Nov 2018	0.000		0.000		-		0.000	0.000	0.200	-
Development Test & Evaluation	C/CPFF	JHU APL : Laurel, MD	0.000	0.179	Jan 2019	0.497	Nov 2019	0.300	Nov 2020	-		0.300	0.000	0.976	-
Development Test & Evaluation	WR	NAVWAR : San Diego, CA	0.000	0.000	Jul 2019	0.403	Nov 2019	0.555	Nov 2020	-		0.555	0.000	0.958	-
		Subtotal	38.965	4.261		4.310		4.394		-		4.394	Continuing	Continuing	N/A

Remarks

1. There is a notable increase in the program funding allocation to NEDU in FY21 (increase from 0.548 to 0.797). This relates to the planned funding of an expensive two-year effort entitled '21st Century Surface Supplied Heliox Decompression Tables' which will entail intensive human subject testing using divers on higher risk dive profiles. This study received strong support from the Technical Advisory Board for advancing US Navy diving capabilities.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Various	Various : Various	0.546	0.050	Oct 2018	0.050	Oct 2019	0.047	Nov 2020	-		0.047	Continuing	Continuing	Continuing
		Subtotal	0.546	0.050		0.050		0.047		-		0.047	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
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	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	39.511	4.311		4.360		4.441		-		4.441	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0099				
Diver Health & Safety (DH&S): FY19 DH&S Projects: Modernization of the Navy Dive Planner	1	2019	4	2020
Diver Health & Safety (DH&S): FY19 DH&S Projects: Development of 21st Century He-O2 Decompression Tables	1	2019	4	2022
Diver Health & Safety (DH&S): FY19 DH&S Projects: Prevention of Swimming-Induced Pulmonary Edema	1	2019	4	2020
Diver Health & Safety (DH&S): FY19 DH&S Projects: Assessment of Ketone Esters for Prevention of CNS O2 Tox	1	2019	4	2021
Diver Health & Safety (DH&S): FY19 DH&S Projects: Assess Heart Rate Variability for Predicting Diver Impairment	1	2019	4	2019
Diver Health & Safety (DH&S): FY19 DH&S Projects: Applied Systems Engineering for Warm Water Diving Guidance	1	2019	4	2020
Diver Health & Safety (DH&S): FY19 DH&S Projects: 'Epi Analysis of Navy Diver Separation Health Assessments	1	2019	4	2019
Diver Health & Safety (DH&S): FY20 Pre-Proposals Due	1	2019	1	2019
Diver Health & Safety (DH&S): FY20 New Full Proposals Due	2	2019	3	2019
Diver Health & Safety (DH&S): FY20 New Proposals Selected	3	2019	3	2019
Diver Health & Safety (DH&S): FY20 DH&S Projects: Acoustic Attenuation of Underwater Noise in Dive Helmet	1	2020	4	2021
Diver Health & Safety (DH&S): FY20 DH&S Projects: Diver Health and Epidemiology Project	1	2020	4	2022
Diver Health & Safety (DH&S): FY20 DH&S Projects: Rehydration Strategies Post-Immersion in Warm Environment	1	2020	4	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Diver Health & Safety (DH&S): FY20 DH&S Projects: Aerobic Exercise Performance Following Cold Water Immersion	1	2020	4	2022
Diver Health & Safety (DH&S): FY20 DH&S Projects: Marine-Environment-Optimized Technologies to Assess Biologics	1	2020	4	2021
Diver Health & Safety (DH&S): FY21 Pre-Proposals Due	1	2020	1	2020
Diver Health & Safety (DH&S): FY21 New Full Proposals Due	2	2020	3	2020
Diver Health & Safety (DH&S): FY21 New Proposals Selected	3	2020	3	2020
Diver Health & Safety (DH&S): 'FY21 DH&S Projects: 'FY21 Diver Health and Safety Execution (various projects)	1	2021	4	2023
Diver Health & Safety (DH&S): FY22 Pre-Proposals Due	1	2021	1	2021
Diver Health & Safety (DH&S): FY22 New Full Proposals Due	2	2021	3	2021
Diver Health & Safety (DH&S): FY22 New Proposals Selected	3	2021	3	2021
Diver Health & Safety (DH&S): 'FY22 DH&S Projects: 'FY22 Diver Health and Safety Execution (various projects)	1	2022	4	2024
Diver Health & Safety (DH&S): FY23 Pre-Proposals Due	1	2022	1	2022
Diver Health & Safety (DH&S): FY23 New Full Proposals Due	2	2022	3	2022
Diver Health & Safety (DH&S): FY23 New Proposals Selected	3	2022	3	2022
Diver Health & Safety (DH&S): 'FY23 DH&S Projects: 'FY23 Diver Health and Safety Execution (various projects)	1	2023	4	2025
Diver Health & Safety (DH&S): FY24 Pre-Proposals Due	1	2023	1	2023
Diver Health & Safety (DH&S): FY24 New Full Proposals Due	2	2023	3	2023
Diver Health & Safety (DH&S): FY24 New Proposals Selected	3	2023	3	2023
Diver Health & Safety (DH&S): 'FY24 DH&S Projects: 'FY24 Diver Health and Safety Execution (various projects)	1	2024	4	2025
Diver Health & Safety (DH&S): FY25 Pre-Proposals Due	1	2024	1	2024
Diver Health & Safety (DH&S): FY25 New Full Proposals Due	2	2024	3	2024
Diver Health & Safety (DH&S): FY25 New Proposals Selected	3	2024	3	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Diver Health & Safety (DH&S): 'FY25 DH&S Projects: 'FY25 Diver Health and Safety Execution (various projects)	1	2025	1	2025
Diver Health & Safety (DH&S): FY26 Pre-Proposals Due	1	2025	1	2025
Diver Health & Safety (DH&S): FY26 New Full Proposals Due	2	2025	3	2025
Diver Health & Safety (DH&S): FY26 New Proposals Selected	3	2025	3	2025
Submarine Escape & Rescue (SE&R): 'FY19 SE&R Projects: Assessment of Tiotripium for Prevention of Pulmonary O2 Tox	1	2019	4	2019
Submarine Escape & Rescue (SE&R): 'FY19 SE&R Projects: Medical Response Strategies for DISSUB Escapees	1	2019	4	2019
Submarine Escape & Rescue (SE&R): 'FY19 SE&R Projects: Complete Development and Integration of DISSUB Dive Planner	1	2019	4	2020
Submarine Escape & Rescue (SE&R): FY20 Pre-Proposals Due	1	2019	1	2019
Submarine Escape & Rescue (SE&R): FY20 New Full Proposals Due	2	2019	3	2019
Submarine Escape & Rescue (SE&R): FY20 New Proposals Selected	3	2019	3	2019
Submarine Escape & Rescue (SE&R): 'FY20 SE&R Projects: 'Man-testing of Specialized Surface Deco Procedures for DISSUB	1	2020	4	2022
Submarine Escape & Rescue (SE&R): 'FY20 SE&R Projects: DISSUB Toxic Gas Dosimeter	1	2020	4	2022
Submarine Escape & Rescue (SE&R): 'FY20 SE&R Projects: Handheld Sensor for SEAL Gas Detection	1	2020	4	2021
Submarine Escape & Rescue (SE&R): 'FY20 SE&R Projects: Determine Role of CO2 in Pressurized DISSUB Survival	1	2020	4	2021
Submarine Escape & Rescue (SE&R): 'FY20 SE&R Projects: Submarine Rescue System Decompression Plan Web Application	1	2020	4	2021
Submarine Escape & Rescue (SE&R): FY21 Pre-Proposals Due	1	2020	1	2020
Submarine Escape & Rescue (SE&R): FY21 New Full Proposals Due	2	2020	3	2020
Submarine Escape & Rescue (SE&R): FY21 New Proposals Selected	3	2020	3	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0099 / *Deep Submergence Bio Med Dev*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Submarine Escape & Rescue (SE&R): FY21 SE&R Projects: FY21 Submarine Escape & Rescue Execution (various projects)	1	2021	4	2023
Submarine Escape & Rescue (SE&R): FY22 Pre-Proposals Due	1	2021	1	2021
Submarine Escape & Rescue (SE&R): FY22 New Full Proposals Due	2	2021	3	2021
Submarine Escape & Rescue (SE&R): FY22 New Proposals Selected	3	2021	3	2021
Submarine Escape & Rescue (SE&R): FY22 SE&R Projects: FY22 Submarine Escape & Rescue Execution (various projects)	1	2022	4	2024
Submarine Escape & Rescue (SE&R): FY23 Pre-Proposals Due	1	2022	1	2022
Submarine Escape & Rescue (SE&R): FY23 New Full Proposals Due	2	2022	3	2022
Submarine Escape & Rescue (SE&R): FY23 New Proposals Selected	3	2022	3	2022
Submarine Escape & Rescue (SE&R): FY23 SE&R Projects: FY23 Submarine Escape & Rescue Execution (various projects)	1	2023	4	2025
Submarine Escape & Rescue (SE&R): FY24 Pre-Proposals Due	1	2023	1	2023
Submarine Escape & Rescue (SE&R): FY24 New Full Proposals Due	2	2023	3	2023
Submarine Escape & Rescue (SE&R): FY24 New Proposals Selected	3	2023	3	2023
Submarine Escape & Rescue (SE&R): FY24 SE&R Projects: FY24 Submarine Escape & Rescue Execution (various projects)	1	2024	4	2025
Submarine Escape & Rescue (SE&R): FY25 Pre-Proposals Due	1	2024	1	2024
Submarine Escape & Rescue (SE&R): FY25 New Full Proposals Due	2	2024	3	2024
Submarine Escape & Rescue (SE&R): FY25 New Proposals Selected	3	2024	3	2024
Submarine Escape & Rescue (SE&R): FY25 SE&R Projects: FY25 Submarine Escape & Rescue Execution (various projects)	1	2025	4	2025
Submarine Escape & Rescue (SE&R): FY26 Pre-Proposals Due	1	2025	1	2025
Submarine Escape & Rescue (SE&R): FY26 New Full Proposals Due	2	2025	3	2025
Submarine Escape & Rescue (SE&R): FY26 New Proposals Selected	3	2025	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0394: *Shallow Depth Diving EQ*	31.005	1.386	1.259	1.905	-	1.905	2.343	1.697	1.576	1.607	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops systems to support submarine escape and rescue missions, and conventional diver operations. Diver operations include ship husbandry, salvage/recovery, and submarine rescue operations to support national, as well as Navy, needs around the world. Modern certifiable diving systems that ensure diver safety and allow maximum work efficiency will replace currently antiquated systems. R&D will be performed in the areas of diver efficiency, visual enhancement, contaminated water diving, diver thermal protection, and recompression chamber technology.

FY2021 funding in project 0394 increased by $1.028M. $0.8M of the FY21 increase is under Submarine Rescue Diving and Recompression System (SRDRS) in order to design and develop an improved pressurized shallow water capable submarine transfer skirt.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Shallow Depth Diving EQ - Diving	1.338	1.209	1.054	0.000	1.054
Articles:	-	-	-	-	-

Description: Continued research into all engineering and equipment design aspects of manned diving, to include: life support, contaminated water, SCUBA, gas analysis, thermal protection, saturation diving, and divers tools.

FY 2020 Plans:

* Diver Augmented Visual Display - Hi Resolution Sonar: Continue design and testing of a high resolution, high frequency, short range visualization system (Close in Visualization System, CIVS) that will integrate with the DAVD. This will allow accurate, real time visualization for use when conducting underwater search, salvage, ship husbandry, or construction in low visibility waters.

* FLEX Chamber Development: Complete the design and fabrication of the prototype flexible, double lock, recompression chamber. This year will see the completion of all developmental work for the system. The full prototype model will be built, tested and delivered to the US Navy for follow-on independent testing.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
* KM-97 Cold Water Testing - Phase 2: Develop and prove the effectiveness of countermeasures that can be implemented to enhance the KM-97's cold water performance. ***FY 2021 Base Plans:*** * Diver Augmented Visual Display - Hi Resolution Sonar: Continue design and testing of a high resolution, high frequency, short range visualization system (Close in Visualization System, CIVS) that will integrate with the DAVD. This will allow accurate, real time visualization for use when conducting underwater search, salvage, ship husbandry, or construction in low visibility waters. * DAVD System Improvement: Start work on developing a self contained DAVD that does not rely on surface umbilicals or fixed sonar installations. This will allow HUD systems and onboard spatial awareness without the requirement to be tethered to the surface. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Reduced development for DAVD this year will extend design and testing of Close-In-Visualization System (CIVS) into FY22.					
Title: Shallow Depth Diving EQ - Submarine Rescue	0.048	0.050	0.851	0.000	0.851
Articles:	-	-	-	-	-
Description: Submarine rescue decompression system permits decompression of submarine crew rescued from a pressurized, disabled submarine of pressures up to 6 atmospheres (ATA). ***FY 2020 Plans:*** Engineering evaluation of system capability increases. ***FY 2021 Base Plans:*** Design and development of equipment to improve the pressurized shallow water mating capability of the SRDRS. Pressurized shallow water mating is a critical capability gap. Current capability only covers 60 percent of the world's rescuable waters. The US submarine recue system currently mates to US and Foreign submarine through an articulating transfer skirt. Funding provides for testing and engineering needed to develop a new					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Transfer Skirt mating seal and assistive equipment to allow for shallower submarine mating capability and improve the ability to rescue submariners from a Distressed Submarine (DISSUB). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Design and development of an improved pressurized shallow water capable transfer skirt.					
Accomplishments/Planned Programs Subtotals	1.386	1.259	1.905	0.000	1.905

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/0955: *Deep Subm Sys Proj (DSSP) Equip*	3.629	2.909	2.918	-	2.918	10.450	3.108	3.149	3.210	Continuing	Continuing
• OPN/1130: *Diving and Salvage Equipment*	10.706	11.854	11.143	-	11.143	11.201	11.448	11.603	11.832	0.000	140.507

Remarks

D. Acquisition Strategy

Diving Program acquisitions are executed and managed by SEA00C. Acquisitions are made for both COTS and developmental items as required to ensure adequate operational availability and safety of the diver. R&D projects are selected in March for a November award using a Broad Area Announcement.
Submarine Rescue Systems - SBIR contract is in place to support development and design.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering - Design, Integration (PMS-391 TUP)	C/CPFF	Oceaneering : Hanover, MD	26.933	0.048	Jan 2019	0.000		0.000		-		0.000	0.000	26.981	-
Systems Engineering - Design, Integration (PMS-391)	WR	NUWC : Newport, RI	0.000	0.000		0.050	Dec 2019	0.201	Nov 2020	-		0.201	0.000	0.251	-
Systems Engineering - Design, Integration (PMS-391)	Various	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Systems Engineering - Design, Integration (PMS-391)	C/CPFF	Physical Optics : Los Angeles, CA	0.000	0.000		0.000		0.650	Jan 2021	-		0.650	0.000	0.650	-
Diving Equipment Product Development (00C)	C/CPFF	Phoenix : Largo, MD	0.430	0.000		0.000		0.000		-		0.000	0.000	0.430	-
Diving Equipment Product Development (00C)	C/CPFF	Vanderbilt Unversity : Nashville, TN	0.000	0.503	Oct 2018	0.589	Oct 2019	0.374	Oct 2020	-		0.374	0.000	1.466	-
Diving Equipment Product Development (00C)	C/FFP	Coda Octopus : Orlando, FL	0.000	0.000		0.000		0.527	Oct 2020	-		0.527	Continuing	Continuing	Continuing
Diving Equipment Product Development (00C)	C/CPFF	PCCI : Alexandria, VA	1.209	0.621	Jan 2019	0.463	Jan 2020	0.000		-		0.000	0.000	2.293	-
Diving Equipment Product Development (00C)	C/CPFF	Penn state UARC : Not Specified	0.600	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Diving Equipment Product Development (00C)	WR	NSWC-PC : Panama City, FL	0.624	0.033	Mar 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	29.796	1.205		1.102		1.752		-		1.752	Continuing	Continuing	N/A

Remarks

Funding of $.650M in FY21 is planned to be placed on the SBIR Phase II contract with Physical Optics.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test and Evaluation (00C)	WR	NEDU : Panama City, FL	0.526	0.147	Jan 2019	0.057	Jan 2020	0.064	Jan 2021	-		0.064	0.000	0.794	-
		Subtotal	0.526	0.147		0.057		0.064		-		0.064	0.000	0.794	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel (00C)	Various	NAVSEA : Washington, DC	0.153	0.006	Oct 2018	0.020	Oct 2019	0.015	Oct 2020	-		0.015	Continuing	Continuing	Continuing
SBIR Assessment	Various	Various : Various	0.513	0.000		0.051	Oct 2019	0.045	Oct 2020	-		0.045	0.000	0.609	-
Program Management Support (00C)	C/CPFF	Unknown : Not Specified	0.017	0.028	Mar 2019	0.029	Mar 2020	0.029	Mar 2021	-		0.029	Continuing	Continuing	Continuing
		Subtotal	0.683	0.034		0.100		0.089		-		0.089	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	31.005	1.386		1.259		1.905		-		1.905	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0394				
FY19 Shallow Depth Diving Equipment Execution: Diver Augmented Visual Display - Hi Res Sonar	2	2019	1	2020
FY19 Shallow Depth Diving Equipment Execution: FLEX Chamber Development	2	2019	1	2020
FY19 Shallow Depth Diving Equipment Execution: Modernized SCUBA Regulator Testing	2	2019	4	2019
FY19 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) Rescue Skirt Analysis	2	2019	1	2020
FY20 Pre-Proposals Due	1	2019	1	2019
FY20 New Full Proposals Due	2	2019	3	2019
FY20 New Proposals Selected	3	2019	3	2019
FY20 Shallow Depth Diving Equipment Execution: Diver Augmented Visual Display - Hi Res Sonar	2	2020	1	2021
FY20 Shallow Depth Diving Equipment Execution: FLEX Chamber Development	2	2020	1	2021
FY20 Shallow Depth Diving Equipment Execution: KM-97 Cold Water Testing - Phase 2	1	2020	4	2020
FY20 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) System Capability Evaluation	2	2020	1	2021
FY20 Shallow Depth Diving Equipment Execution: FY21 Pre-Proposals Due	1	2020	1	2020
FY20 Shallow Depth Diving Equipment Execution: FY21 New Full Proposals Due	2	2020	3	2020
FY20 Shallow Depth Diving Equipment Execution: FY21 New Proposals Selected	3	2020	3	2020
FY21 Shallow Depth Diving Equipment Execution: Diver Augmented Visual Display - Hi Res Sonar	2	2021	1	2022
FY21 Shallow Depth Diving Equipment Execution: DAVD System Improvements (MK3)	1	2021	4	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
FY21 Shallow Depth Diving Equipment Execution: ANU Item Testing	1	2021	4	2021
FY21 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) Rescue Skirt Design/Development	1	2021	1	2022
FY21 Shallow Depth Diving Equipment Execution: FY22 Pre-Proposals Due	1	2021	1	2021
FY21 Shallow Depth Diving Equipment Execution: FY22 New Full Proposals Due	2	2021	3	2021
FY21 Shallow Depth Diving Equipment Execution: FY22 New Proposals Selected	3	2021	3	2021
FY22 Shallow Depth Diving Equipment Execution: Diver Augmented Visual Display - Hi Res Sonar	2	2022	1	2023
FY22 Shallow Depth Diving Equipment Execution: 'PAM - Oil Mist & Particulate Sensor	1	2022	1	2023
FY22 Shallow Depth Diving Equipment Execution: DAVD System Improvements (MK3)	2	2022	1	2023
FY22 Shallow Depth Diving Equipment Execution: LADS Development & Testing	1	2022	1	2023
FY22 Shallow Depth Diving Equipment Execution: ANU Item Testing	1	2022	4	2022
FY22 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) Rescue Skirt Design/Procurement	1	2022	1	2023
FY23 Pre-Proposals Due	1	2022	1	2022
FY23 New Full Proposals Due	2	2022	3	2022
FY23 New Proposals Selected	3	2022	3	2022
'FY23 Shallow Depth Diving Equipment Execution: 'PAM - Oil Mist & Particulate Sensor	1	2023	4	2023
'FY23 Shallow Depth Diving Equipment Execution: TRCS/SNDL/FADS/etc Lifespan Evaluation	1	2023	1	2024
'FY23 Shallow Depth Diving Equipment Execution: Contaminated Water Sensor	1	2023	1	2024
'FY23 Shallow Depth Diving Equipment Execution: Dive Side Personnel Reduction Study	1	2023	1	2024
'FY23 Shallow Depth Diving Equipment Execution: ANU Item Testing	1	2023	4	2023
'FY23 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) System Capability Evaluation	2	2023	1	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
FY24 Pre-Proposals Due	1	2023	1	2023
FY24 New Full Proposals Due	2	2023	3	2023
FY24 New Proposals Selected	3	2023	3	2023
'FY24 Shallow Depth Diving Equipment Execution: TRCS/SNDL/FADS/etc Lifespan Evaluation	2	2024	4	2024
'FY24 Shallow Depth Diving Equipment Execution: Solid State Sensor Testing (O2 / CO2)	1	2024	4	2024
'FY24 Shallow Depth Diving Equipment Execution: Contaminated Water Sensor	1	2024	1	2025
'FY24 Shallow Depth Diving Equipment Execution: Dive Side Personnel Reduction Study	1	2024	4	2024
'FY24 Shallow Depth Diving Equipment Execution: ANU Item Testing	1	2024	4	2024
'FY24 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) System Capability Evaluation	2	2024	4	2024
FY25 Pre-Proposals Due	1	2024	1	2024
FY25 New Full Proposals Due	2	2024	3	2024
FY25 New Proposals Selected	3	2024	3	2024
'FY25 Shallow Depth Diving Equipment Execution: Diver Tracking Device Testing	1	2025	4	2025
'FY25 Shallow Depth Diving Equipment Execution: Solid State Sensor Testing (O2 / CO2)	1	2025	4	2025
'FY25 Shallow Depth Diving Equipment Execution: Contaminated Water Sensor	1	2025	4	2025
'FY25 Shallow Depth Diving Equipment Execution: DAVD / MK18 UUV Sensor Integration	1	2025	4	2025
'FY25 Shallow Depth Diving Equipment Execution: ANU Item Testing	1	2025	4	2025
'FY25 Shallow Depth Diving Equipment Execution: Submarine Rescue (SRDRS) System Capability Evauation	2	2025	4	2025
FY26 Pre-Proposals Due	1	2025	1	2025
FY26 New Full Proposals Due	2	2025	3	2025

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603713N / *Ocean Engineering Tech Dev*	**Project (Number/Name)** 0394 / *Shallow Depth Diving EQ*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
FY26 New Proposals Selected	3	2025	3	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	453.110	19.629	20.564	20.601	-	20.601	21.586	22.388	22.822	23.168	Continuing	Continuing
0401: *Shipboard Waste Mgmt*	340.315	7.746	7.979	9.398	-	9.398	10.012	10.607	10.807	10.914	Continuing	Continuing
0817: *Environmental Sustainability Development (NESDI)*	54.699	4.227	4.440	5.939	-	5.939	6.195	6.314	6.442	6.571	Continuing	Continuing
9204: *Marine Mammal Research*	55.096	4.656	5.145	5.264	-	5.264	5.379	5.467	5.573	5.683	Continuing	Continuing
9205: *Marine Mammal Settlement*	3.000	3.000	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.000

A. Mission Description and Budget Item Justification

This program develops and evaluates processes, hardware, systems, operational procedures, scientific methods, and environmental studies that will allow the Navy to operate in U.S., foreign, and international waters, air, space, and land areas while complying with environmental laws, regulations, Executive Orders, policies and international agreements.

Many environmental laws, regulations, and policies impose restrictions on Navy training and testing, vessels, aircraft, and facilities that interfere with operations and/or increase the cost of operations. The Navy must be able to conduct its national security mission in compliance with applicable environmental requirements in the U.S. and abroad without compromising performance, safety, or health, while simultaneously minimizing the cost of compliance. The projects for this Program Element (PE) support the Navy's compliance with the (a) Clean Water Act, (b) Act to Prevent Pollution from Ships, (c) International Convention for the Prevention of Pollution from Ships, (d) DoD Manual 4715.06, "Regulations on Vessels Owned or Operated by the Department of Defense," Vol 1-4, (f) Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, (g) National Invasive Species Act of 1996, (h) Ballast Water Management for Control of Nonindigenous Species in Waters of the United States, (i) Clean Air Act, (j) Federal Insecticide, Fungicide, and Rodenticide Act, (k) Marine Mammal Protection Act, and (l) Endangered Species Act, (m) Comprehensive Environmental Response, Compensation, and Liability Act, and (n) Resource Conservation and Recovery Act. References (a) through (n) establish Level I environmental protection requirements. Project 0401, Shipboard Waste Management, supports efforts that enable Navy ships and submarines to comply with laws, regulations, and policies in six major areas: (1) Liquid Wastes, (2) Uniform National Discharge Standards (UNDS) Rulemaking, (3) Hazardous Materials and Pollution Prevention, (4) Hull Antifouling Paints, (5) Technical Authority, and (6) Ballast Water Exchange Improvements. Project 0817, Environmental Sustainability Development, supports the development and validation of technologies to enable Navy facilities to comply with environmental laws, regulations, and policies in a cost-effective manner.

The Marine Mammal Research (MMR) program is responsible for applied research and works to address the Navy's key research needs and transition the results and technologies for use within the Navy's at-sea environmental compliance and permitting processes in compliance with the Marine Mammal Protection Act and the Endangered Species Act, with the goals of improving marine species impact analysis (including marine mammal take estimates), mitigation measures and monitoring capabilities. Key points of the MMR mission are: (1) Improve the best available science regarding the potential impacts to marine species from Navy activities, (2)

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*

Expand the technology and methods available to the U.S. Navy marine species monitoring program (3) Preserve core Navy readiness capabilities. This funding allows the Navy to avoid or reduce the chances of costly litigation for non-compliance.

$3.000M added in FY 2018 and FY2019 in accordance with settlement agreement under Marine Mammal Protection Act (new project created).

B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	19.811	20.564	20.172	-	20.172
Current President's Budget	19.629	20.564	20.601	-	20.601
Total Adjustments	-0.182	0.000	0.429	-	0.429
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.182	0.000			
• Program Adjustments	0.000	0.000	0.401	-	0.401
• Rate/Misc Adjustments	0.000	0.000	0.028	-	0.028

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0401: *Shipboard Waste Mgmt*	340.315	7.746	7.979	9.398	-	9.398	10.012	10.607	10.807	10.914	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Navy ships and submarines must routinely operate in U.S., international, and foreign waters, and visit numerous U.S. and foreign ports. No body of water is without environmental restrictions that impact the movements and operations of Navy vessels. Environmental requirements tend to be most restrictive in port and in coastal waters, where the Navy's increasing littoral presence places ships and submarines in discharge-restricted waters for longer periods of time. Growing international cooperation in addressing global environmental concerns is resulting in expanding areas of ocean considered environmentally susceptible, where special prohibitions on ship discharges and operations are imposed. Navy vessels must comply with applicable environmental legal requirements while maintaining continued access to all waters for operations, exercises, training, and port access. The large crews and limited on-board space of Navy ships and submarines severely constrain their ability to hold wastes for return to port for shore side disposal.

Project 0401, Shipboard Waste Management, evaluates and develops shipboard environmental equipment, systems, technologies, processes, and practices to comply with environmental laws, regulations, Executive Orders, international agreements, foreign-country requirements, and DoD and Navy policies. The project focuses on providing engineering criteria, design guidance, and performance specifications for selecting, procuring, installing, integrating, and operating environmental equipment and systems on Navy ships and submarines, and on defining and developing processes, procedures and logistics support requirements. Environmental equipment, systems, processes and practices must meet legal and environmental requirements and be reliable, maintainable and achievable at sea, and impose no or low manning burden. Environmental equipment and systems must meet Navy-unique shipboard requirements (performance, space, weight, shock, vibration, electromagnetic compatibility, manning, automation, etc.), incorporate integrated logistics support, minimize life-cycle cost, and include validated acquisition, design, installation, and operating documentation. Shipboard processes and practices must be feasible and must be compatible with ship and submarine operational, maintenance, manning, habitability, health, and safety requirements. It also addresses afloat environmental issues other than shipboard wastes, e.g., access to environmental data for planning Fleet operations and exercises.

The Afloat Environmental Quality Program supports the designated Technical Warrant Holders for Environmental Systems & Materials Engineering, with responsibility and accountability for ensuring that ships and submarines are designed and upgraded, and can be operated, in compliance with existing and anticipated environmental requirements while minimizing total ownership cost and manning. This responsibility encompasses legacy platforms and new vessel designs, as well as Fleet operations exercises, and training.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Technical Authority (TA)	1.470	1.450	1.624	0.000	1.624
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Funding in support of TA is utilized to develop waste stream handling equipment design criteria and guidance. This includes system/technology selection, processing capacity, interfaces, shipboard integration, test and qualification protocols, processes and practices, and performance specifications. ***FY 2020 Plans:*** - Implement DDG oil spill guidance and incorporate feedback from the Fleet. - Select commercial waste management systems for detailed acquisition and evaluation. - Work with Fleet, acquisition programs, and technical authorities to review and provide comments on issues, risks, and opportunities so as minimize the cost and risk to the Navy. - Update the oil spill database by monitoring and documenting ship spills and other oil spill discharge violations. - Analyze oil spill root causes, and prepare policy and/or hardware solutions to reduce future oil spills. - Meet with NATO and foreign Navy data exchange partners to leverage lessons learned on afloat environmental compliance. - Develop environmental equipment/system requirements documentation, design criteria/guidance, standards, and certification protocols based on evolving regulations and policy. - Perform annual assessments of emergent air emission processes and technologies to enable effective compliance at minimal life cycle cost and risk to operations. ***FY 2021 Base Plans:*** - Update the Ship Oil Spill Database, analyze oil spill root causes and identify policy/training/hardware deficiencies to reduce oil discharges/violations. - Draft policy and implement training to reduce ship oil spill discharge violations. - Perform initial assessment and on-site evaluations of commercial waste management systems to determine future system feasibility. - Work with Fleet, acquisition programs, and technical authorities to review and provide comments on issues, risks, and opportunities so as minimize the cost and risk to the Navy. - Meet with NATO and foreign Navy data exchange partners to leverage lessons learned on afloat environmental compliance. - Develop environmental equipment/system requirements documentation, design criteria/guidance, standards, and certification protocols based on evolving regulations and policy. - Perform annual assessments of emergent air emission processes and technologies to enable effective compliance at minimal life cycle cost and risk to operations. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Additional funds for technology identification and assessment for hull cleaning capture and filtration.					
Title: Liquid Wastes	2.275	2.321	2.321	0.000	2.321
Articles:	-	-	-	-	-
Description: This effort addresses liquid wastes in two (2) major areas: Oil Pollution Abatement and Non-oily Waste. ***FY 2020 Plans:*** - Perform assessments of emergent commercial off the shelf Marine Pollution Control processes and technologies that would enable effective compliance at minimal life cycle cost and risk to operations. Identify systems for detailed acquisition and evaluation Oil Pollution Abatement: - Initiate shipboard evaluation of a commercial centrifugal oil water separator (OWS) - Complete development of military performance specification for centrifugal OWS - Conduct shipboard evaluations of revised automated procedures and cleaners for membrane regeneration - Initiate laboratory evaluation of Navy militarized centrifugal OWS with Navy oil content monitor (OCM) Non-Oily Waste (NOW): - Continue long-term assessment of sewage and graywater piping development, prevention and cleaning. - Conduct laboratory evaluation of sewage and graywater sludge treatment technology - Initiate shipboard evaluation of Vacuum Instrumentation Isolation - Develop testing strategy for laboratory evaluation of alternative vacuum pumps. ***FY 2021 Base Plans:*** - Continue assessments of emergent commercial off the shelf Marine Pollution Control processes and technologies that would enable effective compliance at minimal life cycle cost and risk to operations. Identify systems for detailed acquisition and evaluation Oil Pollution Abatement: - Complete shipboard evaluation of a commercial centrifugal oil water separator (OWS) - Complete laboratory evaluation of new Tank Level Indicator technology - Complete laboratory testing of a modified commercial militarized centrifugal OWS.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Non-Oily Waste (NOW): - Continue long-term monitoring and assessment of sewage and graywater piping scale prevention and pipe degradation. - Draft requirements for detergents/cleaners for NOW treatment systems - Complete shipboard evaluation of Vacuum Instrumentation Isolation - Continue laboratory evaluation of alternative vacuum pumps. ***FY 2021 OCO Plans:*** N/A					
Title: Hazardous Material Control and Management	1.015	0.937	1.100	0.000	1.100
Articles:	-	-	-	-	-
Description: A wide variety of Hazardous Materials (HM) are used to construct, operate and maintain Navy ships and submarines. These HMs include cleaning compounds, solvents, adhesives, sealants, corrosion preventive compounds, acids, alkalis, oxidizers, lubricants, functional fluids, and many other products. Hazardous Material Control and Management (HMC&M) addresses environmental, safety and health risks to ship construction workers, Ship's Force (S/F), and shipyard workers. ***FY 2020 Plans:*** - Perform assessments of emergent commercial off the shelf hazardous material management processes and pollution prevention technologies that would enable effective compliance at minimal life cycle cost and risk to operations. - Identify hazardous material control/pollution prevention systems for detailed acquisition and evaluation. - Identify, research, and evaluate less hazardous or non-hazardous substitutes for high-risk hazardous materials. ***FY 2021 Base Plans:*** - Continue assessments of emergent commercial off the shelf hazardous material management processes and pollution prevention technologies that would enable effective compliance at minimal life cycle cost and risk to operations. - Identify hazardous material control/pollution prevention systems for detailed acquisition and evaluation. - Assess less hazardous or non-hazardous substitutes for high-risk hazardous materials. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY20 to FY21 increase of $163K is required to support shipboard evaluation of medical waste handling system.					
Title: Ballast Water Management	1.836	2.021	2.122	0.000	2.122
Articles:	-	-	-	-	-
Description: The National Invasive Species Act (NISA) requires the Secretary of Defense to implement a Ballast Water Management (BWM) program to minimize the risk of introduction of unwanted species and pathogens from releases of ballast water. ***FY 2020 Plans:*** - Continue assessments of emergent commercial off the shelf Ballast Water Treatment System (BWTS) that would enable effective compliance at minimal life cycle cost and risk to operations. - Identify systems for detailed acquisition and evaluation. - Complete full-scale evaluation of two commercial electrochlorination (EC) based BWTSs to assess system performance, reliability, operability and maintainability, and suitability as a Navy shipboard system. - Begin development of modified commercial Ultraviolet (UV) based commercial. - Refine Navy ship installation guidance for meeting ballast water discharge standards considering damage control and stability requirements. - Continue to assess feasibility of a rapid BWTS. ***FY 2021 Base Plans:*** - Continue assessments of emergent commercial off the shelf EC and UV based BWTS that would enable effective compliance at minimal life cycle cost and risk to operations. - Based on the designs developed in FY20, fabricate and begin evaluation of a modified commercial UV BWTS. - Procure and perform initial evaluation of rapid BWTS(s). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 increase of $79K is required to support procurement and fabrication of the modified commercial ballast water system.					
Title: Solid Waste Management	1.050	1.150	2.021	0.000	2.021
Articles:	-	-	-	-	-
Description: Solid Waste Management supports the Act to Prevent Pollution from Ships (APPS) which regulates all garbage discharges from ships at sea.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: - Perform assessments of emergent commercial off the shelf solid waste management processes and technologies that will enable effective compliance at minimal life cycle cost and risk to operations. - Refine Navy ship acquisition requirements for APPS compliant solid waste processing systems and management processes - Complete laboratory testing and Navy environmental testing (shock, vibration, electromagnetic interference) of waste processing equipment for special solid waste (Feminine Hygiene Products, Pilot Urine bags, etc.) - Prepare for shipboard evaluation of waste processing equipment for special solid waste (Feminine Hygiene Products, Pilot Urine bags, etc.). - Conduct Navy environmental testing (shock, vibration, electromagnetic interference) of technology to display equipment documentation to operators and maintainers. ***FY 2021 Base Plans:*** - Continue assessments of solid waste management processes and technologies with emphasis on small ships that would enable effective compliance at minimal life cycle cost and risk to operations. - Evaluate solid waste systems for surface ships and submarines. - Conduct shipboard evaluation and Navy ship environmental testing of innovative solid waste equipment. - Issue Navy ship acquisition requirements for APPS compliant solid waste processing systems. - Perform shipboard evaluation of Medical waste processing equipment for special solid waste. (Feminine Hygiene Products, Pilot Urine bags, etc.) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 increase of $871K is required to support shipboard testing of innovative solid waste handling equipment.					
Title: Non-Copper Antifouling	0.100	0.100	0.210	0.000	0.210
Articles:	-	-	-	-	-
Description: The copper discharges from underwater hull coatings remain a regulatory concern. The effort focuses on characterizing advanced coating systems and their suitability for Navy-unique operational factors such as speed time profiles, drydocking intervals, and maintenance practices.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0401 / *Shipboard Waste Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY20 to FY21 increase of $110K is required to support shipboard testing of advanced commercial antifouling coatings. ***FY 2020 Plans:*** - Prepare and submit final report on Qualified Products List (QPL) testing of the 11 coatings. Results from historical qualification tests, ship patch testing will be included in the evaluation. - Assess installation and coating removal issues with advanced antifoul coating systems. - Initiate Navy assessment of risk in terms of transport of nonindigenous species, underwater hull/niche areas; evaluate historical hull/propeller fouling and cleaning reports; evaluate in context of ship active periods as well as coating type and age; evaluate in context of planned changeover in hull fouling rating evaluation criteria Execute targeted inspections; and evaluate in context of existing and emerging country-specific requirements as well as IMO requirements ***FY 2021 Base Plans:*** - Perform test installations of promising new antifouling coatings on Fleet assets. - Evaluate performance of advanced coating systems. - Assess emergent commercial antifouling coatings. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 increase of $110K is required to support shipboard testing of advanced commercial antifouling coatings.					
Accomplishments/Planned Programs Subtotals	7.746	7.979	9.398	0.000	9.398

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

RDT&E Contracts are Competitive Procurements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Ancillary Hardware Development	Various	Misc. Contracts : Not Specified	19.149	0.000		0.000		0.000		-		0.000	0.000	19.149	Continuing
Primary Hardware Development	C/CPFF	Oceaneering : Not Specified	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	Continuing
Systems Engineering	C/CPFF	John J. McMullen & Son : Not Specified	4.487	0.000		0.000		0.000		-		0.000	0.000	4.487	Continuing
		Subtotal	24.636	0.000		0.000		0.000		-		0.000	0.000	24.636	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development	WR	SPAWAR : Charleston, SC	10.838	0.000		0.000		0.000		-		0.000	0.000	10.838	Continuing
		Subtotal	10.838	0.000		0.000		0.000		-		0.000	0.000	10.838	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWCCD, Bethesda, MD : Bethesda, MD	220.916	6.770	Nov 2018	6.950	Nov 2019	8.089	Nov 2020	-		8.089	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NRL,Wash,DC : Wash,DC	33.524	0.500	Nov 2018	0.050	Nov 2019	0.050	Nov 2020	-		0.050	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	NSWCPD, Philadelphia, PA : Philadelphia, PA	0.913	0.301	Nov 2018	0.279	Nov 2019	0.479	Nov 2020	-		0.479	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	SPAWARSYSCEN : SD,CA	12.308	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	Misc. Govt Labs : TBD	23.475	0.175	Nov 2018	0.050	Nov 2019	0.080	May 2021	-		0.080	0.000	23.780	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	C/CPFF	Misc. Contracts : TBD	13.103	0.000		0.650	Jul 2020	0.700	May 2021	-		0.700	0.000	14.453	-
		Subtotal	304.239	7.746		7.979		9.398		-		9.398	Continuing	Continuing	N/A

Remarks

Increased funding to NSWCCD for Ballast Water Management (BWM) tasking related to testing of both commercial and modified commercial BWTSs; for identification and testing of Capture and Clean Hull Cleaning Technology; and to investigate and spearhead design, integration and testing of innovative solid waste equipment. FY20 and 21 Miscellaneous Contract funding for BWM and Hull Cleaning Technology to be identified in FY20.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	NAVSEA HQ : Washington, DC	0.375	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SBIR Assessment	TBD	Not Specified : Not Specified	0.227	0.000		0.000		0.000		-		0.000	0.000	0.227	Continuing
		Subtotal	0.602	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	340.315	7.746		7.979		9.398		-		9.398	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
SHIPBOARD WASTE MANAGEMENT																												
Technical Authority																												
Liquid Wastes																												
Hazardous Material Control and Management																												
Ballast Water Management																												
Solid Waste Management																												
Non-Copper Antifouling																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
SHIPBOARD WASTE MANAGEMENT				
Technical Authority	1	2019	4	2025
Liquid Wastes	1	2019	4	2025
Hazardous Material Control and Management	1	2019	4	2025
Ballast Water Management	1	2019	4	2025
Solid Waste Management	1	2019	4	2025
Non-Copper Antifouling	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
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COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0817: *Environmental Sustainability Development (NESDI)*	54.699	4.227	4.440	5.939	-	5.939	6.195	6.314	6.442	6.571	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The vision outlined in "A Design for Maintaining Maritime Superiority, Version 2.0" (December 2017) and "2018 National Defense Strategy of the United States of America" is for our Navy to become more lethal, resilient and a rapidly innovating joint force. We must maintain a fleet that is trained ready to operate and fight decisively. Today's reality requires training and operating within environmental constraints (national and international laws and agreements) and searching for alternatives to comply with and alleviate those constraints. Moreover, as we develop new systems and technologies in support of the National Defense Strategy, the Navy must anticipate and address potential environmental constraints which could in the future adversely impact our ability to protect and sustain our forces at home and abroad.

This program identifies pervasive Navy shore side environmental requirements and develops and validates information, new processes, and technologies that address requirements that pose significant impact on Naval shore activities in complying with environmental laws, regulations, orders, and policies. The goal of the program is to maximize opportunities for significant cost savings while minimizing personnel liabilities, operational costs, and regulatory oversight and preserving or enhancing the ability of Naval shore activities to accomplish their required missions and functions in support of the Navy's transformational strategy.

Environmental Enabling Capabilities -2 (EEC-2) MAXIMIZE TRAINING AND TESTING RANGE REQUIREMENTS WITHIN ENVIRONMENTAL CONSTRAINTS: This capability addresses environmental impacts and restrictions at Navy land and sea ranges, including munitions testing and manufacturing, to ensure Navy ranges are available to conduct required training and testing operations for the Fleet. Investments in EEC-2 provide validated knowledge, models, and processes to mitigate environmental impacts, restrictions, and costs at Navy training and test ranges to maximize the availability and utilization of the ranges. The results support operational readiness by providing the tools and technologies necessary for sustaining and managing Navy land and sea ranges related to unexploded ordnance (UXO) and munitions, encroachment, air quality, airborne noise, water quality, and wetlands. Capabilities gained include the ability to assess and determine the risks from underwater UXO, the evaluation and prioritization of ordnance contaminated sites for evaluation in environmental programs and the implementation of range specific best management practices by evaluating and modeling available process, procedures, and technologies.

Environmental Enabling Capabilities-3 (EEC-3)PLATFORM MAINTENANCE AND REPAIR WITH MINIMAL ENVIRONMENTAL FOOTPRINT: This capability focuses on minimizing or eliminating environmental impact related to Navy and Marine Corps weapon system repair and maintenance operations. Investments in EEC-3 provide valid knowledge, models, processes, and technologies to minimize regulated emissions, discharges and hazardous material usage during the repair and maintenance of ships, submarines, and surface/sub-surface vehicles and aircraft and air vehicles. The program supports Fleet operational readiness and Navy acquisition communities by investing in information to understand emerging environmental requirements and to develop innovative processes and technologies that result in savings while reducing the fleet environmental constraints related to platform maintenance. Capabilities and benefits gained include, but are not limited to, the reduction in the usage of heavy metals used in metal finishing (chromium and cadmium), reduced hazardous air pollutant (HAP) emissions, the development of best management practices

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and tools to minimize the use of hazardous materials, and the generation of hazardous wastes associated with maintaining and repairing ships, submarines, aircraft, and unmanned vehicles. Results of program investments will be leveraged across weapon system and platform acquisition to ensure continued reduction in lifecycle costs and long-term environmental compliance burdens to the Fleet.

Environmental Enabling Capabilities-4 (EEC-4). SUPPORT SHORE READINESS WITHIN ENVIRONMENTAL CONSTRAINTS: Naval shore establishment requires the capability to operate and maintain facilities and provide waterfront and airfield services to the fleet while complying with applicable environmental regulations and minimizing environmental impacts and costs. The program invests in knowledge and innovative processes and technologies that minimize infrastructure and operational costs, regulated emissions, while minimizing discharges and hazardous material usage from ship (waterfront) and aviation operations. Capabilities and benefits gained under EEC-4 include, reduced costs associated with wastewater treatment, elimination/reduction in the use of HAPs, ozone depleting substances (ODSs), volatile organic compounds (VOCs) and the associated reporting requirements, reduced hazardous waste and disposal costs, and improved storm water management.

Environmental Enabling Capabilities-5 (EEC-5). COST-EFFECTIVE MANAGEMENT OF ENVIRONMENTAL REGULATORY REQUIREMENTS: The environmental compliance regulations require base managers to permit, monitor and report on many processes associated with weapon system and platform operations. Naval shore environmental managers require the capability to efficiently and cost effectively manage these compliance requirements. Under EEC-5, the program invests in improved data collection, methods, and models to assess environmental impacts and ecological risk assessments of Naval Operations on harbors, U.S. waterways, and surrounding communities. Benefits include gaining standardized technical environmental management improvements/techniques related to source control, assessment, and monitoring. EEC-5 also provides validated knowledge, models, processes and technologies to improve environmental monitoring and reporting, and to reduce the cost of compliance with regulations applicable to coastal contamination and contaminated sediments.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Maximize Training & Testing Requirements Within Environmental Constraints	0.696	0.705	0.587	0.000	0.587
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Base Plans: -Continue providing validated knowledge, models, and processes to mitigate environmental impacts, restrictions, and costs of Navy training and test ranges to maximize the availability and utilization of the ranges. - Continue to evaluate the feasibility of Cost Effective Main Charge Remediation of Insensitive Munitions for Range Clearance. - Complete the initiatives: Analysis of the Long-Term Fate of Munitions Constituents on Terrestrial Sites.					
FY 2021 Base Plans: FY 2021 Base Plans: -Continue providing validated knowledge, models, and processes to mitigate environmental impacts, restrictions, and costs of Navy training and test ranges to maximize the availability and utilization of the ranges.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Continue to evaluate the feasibility of Cost Effective Main Charge Remediation of Insensitive Munitions for Range Clearance. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease by 0.118 due to completion of analysis of the long-Term Fate of Munitions constituent of terrestrial sites					
Title: Platform Maintenance and Repair With Minimal Environmental Footprint	1.007	0.953	1.401	0.000	1.401
Articles:	-	-	-	-	-
FY 2020 Plans: FY2020 Base Plans: - Continue evaluations and demonstrations of innovative solutions for difficult and persistent aviation and shipyard platform sustainment issues related to hexavalent chrome, cadmium, volatile organic compounds (VOC) hazardous air pollutants (HAP) and other hazardous compounds at Naval Aviation Systems Command Fleet Readiness Centers and the Navy's shipyards. - Continue providing innovative solutions for difficult and persistent shipyard environmental compliance issues. - Continue evaluating the feasibility of Electromagnetic Interference Shielding Tape, Replacement of Cadmium in GSE Avionics Applications. - Continue the initiatives: Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers, Low VOC Primers for Ground Support Equipment Application. - Complete the initiatives: Demonstration of Non-Chromated Adhesive Bond Primer For Metal Repair Bonding, Non-Isocyanate Polyurethane-Free Formulation Coatings for Aircraft and Support Equipment, Multi-Functional Surface Preparation Technology for Maintenance Painting, Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting, Initiation Decision Report of Laser Coating Removal on Naval Aircraft Components. ***FY 2021 Base Plans:*** -Continue evaluations and demonstrations of innovative solutions for difficult and persistent aviation and shipyard platform sustainment issues related to hexavalent chrome, cadmium, volatile organic compounds (VOC) hazardous air pollutants (HAP) and other hazardous compounds at Naval Aviation Systems Command Fleet Readiness Centers and the Navy's shipyards.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Continue the initiatives: Replacement of Cadmium in Ground Support Equipment Avionics Applications, Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers, Low VOC Primers for Ground Support Equipment Application. -Continue to evaluate the feasibility of Assessment of Cadmium Alternatives for Connector Applications, Development and Implementation of Methods to Reduce Sealant Waste in Fleet/Depot Level Operations. -Complete the initiatives: Electromagnetic Interference Shielding Tape. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase by 0.448 due to increased project management costs and increase in field work for continuing projects such as Replacement of Cadmium in Ground Support Equipment Avionics Applications, Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers, Development, Implementation of Methods to Reduce Sealant Waste in Fleet/Depot Level Operations and Low VOC Primers for Ground Support Equipment Application.					
Title: Support Shore Readiness within Environmental Constraints	1.039	1.068	1.510	0.000	1.510
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Base Plans: -Continue evaluations and demonstrations of innovative solutions to minimize regulated emissions, discharges and hazardous material usage resulting specifically from waterfront support, aviation support, and other base operations. -Continue funding demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites, NPDES Copper Effluent Control System with increase field work. ***FY 2021 Base Plans:*** FY 2021 Base Plans: -Continue evaluations and demonstrations of innovative solutions to minimize regulated emissions, discharges and hazardous material usage resulting specifically from waterfront support, aviation support, and other base operations. -Continue demonstration of New Strategies for Enhanced Monitored Natural Recovery at Navy Sediment Sites. -Continue to evaluate the feasibility of Developing Lines of Evidence to Support Nutrient Compliance at Navy shipyards, Flexible Under Pier Sediment Assessment					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0817 / *Environmental Sustainability Development (NESDI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Complete the initiative NPDES Copper Effluent Control System. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of 0.442 due to increased project management costs and increase in field work for continuing projects addressing contaminated sediment management and treatment, evaluate the feasibility of Developing Lines of Evidence to Support Nutrient Compliance at Navy shipyards and Flexible Under Pier Sediment Assessment.					
Title: Cost-Effective Management of Environmental Regulatory Requirements	1.485	1.714	2.441	0.000	2.441
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Base Plans: - Continue providing validated knowledge, models, processes and systems to improve environmental monitoring and reporting, and reduce the cost of compliance with regulations and management of coastal contamination and contaminated sediments. - Continue to evaluate the feasibility of Air Filtration for Indoor Air Quality, Stormwater Piping-Based Pollutant Best Management Practice, Improving Site Closure Decision-Making with Time-Integrated Groundwater Samples. - Continue the initiatives: Addressing Temporal Variability in Industrial Buildings during Vapor Intrusion Assessments, Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater, In-situ Automatic Stormwater Sampling Device for Use at Tidally Impacted Sampling Locations, Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal. - Complete the initiatives: Utility Vault Water Treatment, Preventative Management of Contaminated Silt, Using Stable-Isotope Labeled Tracers to Validate Natural Attenuation of RDX in Groundwater, In Situ Treatment of 1,4-Dioxane using Enhanced Biodegradation, Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts, Sewer Gas Elimination Technology, Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options. ***FY 2021 Base Plans:*** FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0817 / *Environmental Sustainability Development (NESDI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Continue providing validated knowledge, models, processes and systems to improve environmental monitoring and reporting, and reduce the cost of compliance with regulations and management of coastal contamination and contaminated sediments. -Continue the initiatives: Air Filtration for Indoor Air Quality, Improving Site Closure Decision-Making with Time-Integrated Groundwater Samples, Addressing Temporal Variability in Industrial Buildings during Vapor Intrusion Assessments, Development and Demonstration of a Portable, Temporary Barrier to Aid in Cargo and Equipment Inspections to Prevent Brown Treesnake Dispersal. -Continue to evaluate the feasibility of In-situ Biodegradation of 1,4-Dioxane and Chlorinated Solvent Mixtures in Dilute Plumes, Mesocosm Field Testing of In situ PFAs Treatment Trains, Demonstrating the Use of a Novel, Hybrid Polyelectrolyte/Hydrophilic Polymer for In situ PFAS Treatment Applications, Sensor interface and infrastructure for monitoring (SIIM), Contaminant Monitoring and Mapping for Informing Stormwater Best Management Practices, In-well headspace samplers for long-term groundwater chlorinated hydrocarbon monitoring, Innovative Activated Carbon Filters to Address Vapor Intrusion within Commercial/Industrial Buildings, Field Demonstration of Colloidal Activated Carbon for In Situ Sequestration of Per- and Polyfluoroalkyl Substances. Complete the initiatives: Stormwater Piping-Based Pollutant Best Management Practice, In-situ Automatic Stormwater Sampling Device for Use at Tidally Impacted Sampling Locations, Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of 0.727 due to increased project management costs and increase in field work for continuing projects such as Demonstrating the Use of a Novel, Hybrid Polyelectrolyte/Hydrophilic Polymer for In situ PFAS Treatment Applications, Field Demonstration of Colloidal Activated Carbon for In Situ Sequestration of Per- and Polyfluoroalkyl Substances, Sensor interface and infrastructure for monitoring (SIIM), Mesocosm Field Testing of In situ PFAs Treatment Trains, Contaminant Monitoring and Mapping for Informing Stormwater Best Management Practices and increased costs for program web site management.					
Accomplishments/Planned Programs Subtotals	4.227	4.440	5.939	0.000	5.939

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

This project is categorized as Non-ACAT (Non Acquisition). The project delivers a broad spectrum of products that require a variety of acquisition processes to implement. Equipment products for naval stations and other mission funded activities are often procured directly through the base operating budget. Equipment products for Shipyards and other Navy Working Capital Fund (NWCF) activities costing over $250K are procured through their Capital Investment Program (CIP). For both types of activities, equipment products costing less than $250K, and process changes not requiring the purchase of new equipment such as consumable material or product substitutions, are funded through the activity's operating budgets. Occasionally there is a technology that must be implemented as a specialized facility. These are acquired through the Military Construction (MILCON) Program. All these acquisition processes are pursued using a common strategy that satisfies the needs of all the critical stakeholders: 1) fleet end user; 2) funding sponsor for the Navy end user; 3) other stakeholders with cognizance over the Navy process or operation being changed, 4) cognizant environmental federal, state, and local regulators; and 5) the private or government organization that will produce the product.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0817 / *Environmental Sustainability Development (NESDI)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EEC 2	Various	EXWC : PT HUENEME, CA	6.825	0.410	Oct 2018	0.400	Oct 2019	0.283	Oct 2020	-		0.283	Continuing	Continuing	Continuing
EEC 2	Various	SSC : SAN DIEGO, CA	6.254	0.325	Dec 2018	0.305	Dec 2019	0.300	Dec 2020	-		0.300	Continuing	Continuing	Continuing
EEC 3	WR	NAWC : PATUXENT RIVER, MD	2.293	0.135	Mar 2019	0.120	Mar 2020	0.150	Mar 2021	-		0.150	Continuing	Continuing	Continuing
EEC 3	Various	NSWC : BETHESDA, MD	4.042	0.175	Feb 2019	0.197	Feb 2020	0.200	Feb 2021	-		0.200	Continuing	Continuing	Continuing
EEC 3b	Various	EXWC : PT HUENEME, CA	1.462	0.077	Mar 2019	0.069	Mar 2020	0.160	Mar 2021	-		0.160	Continuing	Continuing	Continuing
EEC 4	Various	EXWC : PT HUENEME, CA	8.920	0.404	Mar 2019	0.390	Mar 2020	0.630	Mar 2021	-		0.630	Continuing	Continuing	Continuing
EEC 4	Various	NSWC : BETHESDA, MD	4.695	0.260	Nov 2018	0.255	Nov 2019	0.300	Nov 2020	-		0.300	Continuing	Continuing	Continuing
EEC 4a	Various	SSC : SAN DIEGO, CA	3.905	0.375	Apr 2019	0.423	Apr 2020	0.580	Apr 2021	-		0.580	Continuing	Continuing	Continuing
EEC 5	Various	EXWC : PT HUENEME, CA	4.076	0.394	Nov 2018	0.489	Nov 2019	0.870	Nov 2020	-		0.870	Continuing	Continuing	Continuing
EEC 5	Various	SSC : SAN DIEGO, CA	2.205	0.350	Feb 2019	0.494	Feb 2020	0.791	Feb 2021	-		0.791	Continuing	Continuing	Continuing
EEC 5	Various	NAWC : PATUXENT RIVER, MD	1.377	0.100	Jun 2019	0.095	Jun 2020	0.130	Jun 2021	-		0.130	Continuing	Continuing	Continuing
EEC 5	Various	NSWC : BETHESDA, MD	2.794	0.387	Jan 2019	0.385	Jan 2020	0.300	Jan 2021	-		0.300	Continuing	Continuing	Continuing
EEC 5	WR	NAWCWD : CHINA LAKE, CA	1.482	0.140	Dec 2018	0.150	Dec 2019	0.210	Dec 2020	-		0.210	Continuing	Continuing	Continuing
EEC 5	WR	NAWC : LAKE HURST, NJ	0.906	0.075	Nov 2018	0.100	Nov 2019	0.140	Nov 2020	-		0.140	Continuing	Continuing	Continuing
EEC 3	WR	FRC - SE : JACKSONVILLE, FL	2.065	0.380	May 2019	0.305	May 2020	0.600	May 2021	-		0.600	Continuing	Continuing	Continuing
EEC 3	Various	NSWC : San Diego, CA	0.060	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
EEC 3	WR	FRC - CE : Cherry Point, NC	0.455	0.075	Jun 2019	0.085	Jan 2020	0.100	Jan 2021	-		0.100	Continuing	Continuing	Continuing
EEC 3	Various	FRC-SW : San Diego, CA	0.883	0.165	Mar 2019	0.178	Mar 2020	0.195	Mar 2021	-		0.195	Continuing	Continuing	Continuing
		Subtotal	54.699	4.227		4.440		5.939		-		5.939	Continuing	Continuing	N/A

Remarks

Performing Activities: Naval Surface Warfare Center, Carderock Division (NSWC/CD); Engineering and Expeditionary Warfare Center (EXWC), Port Hueneme, CA; Naval Surface Warfare Center, Indian Head Division (NSWC/IH); Space and Warfare Systems Center, San Diego (SSC/SD); Naval Air Warfare Center Aircraft Division Patuxent River (NAWCAD/PAX); Naval Air Warfare Center (NAWCWD/China Lake); Naval Air Warfare Center Aircraft Division Lakehurst (NAWCAD/Lakehurst); Fleet Readiness Center Southeast, Jacksonville FL (FRC-SE); Fleet Readiness Center Southwest, San Diego (FRC-SW), Fleet Readiness Center East, Cherry Point (FRC-CE). Total Prior Years Cost: Subtotal does not include performing activities from prior years that are no longer performing activities. Award Dates: About 55% of the project is executed via contracts awarded by the performing activities. More rigorous contracting, funding and performer work induction processes are slightly increasing project management costs. Contracting and financial management offices across the performing organizations may be understaffed. Projects are derived from field level needs and awarded competitively to performing organizations, the portfolio mix of cost category/performing organization naturally changes from fiscal year to fiscal year. Due to this, some individual line items in the R-3 will increase at greater than a 2% escalation factor.

Explanation of increases greater than 2% between FY2020 and FY2021:
-EEC2 EXWC PT Hueneme CA decrease from 0.400 to 0.283 due to completion of Analysis of the Long-Term Fate of Munitions Constituents on Terrestrial Sites.
-EEC3 NAWC Patuxent River MD increased from 0.120 to 0.150 due to increase in field work for continuing projects such as Replacement of Cadmium in Ground Support Equipment Avionics Applications.
-EEC3b EXWC PT Hueneme CA increased from 0.069 to 0.160 due to increased field work for support to continuing projects.
-EEC4 EXWC PT Hueneme CA increased from 0.390 to 0.630 due to increase in field work for continuing projects addressing contaminated sediment management and treatment.
-EEC4 NSWC Bethesda MD increased from 0.255 to 0.300 due to increased project management costs and increase in field work for continuing projects.
-EEC4a SSC San Diego CA increased from 0.423 to 0.580 due to increase in field work for continuing projects such as evaluate the feasibility of Developing Lines of Evidence to Support Nutrient Compliance at Navy shipyards and Flexible Under Pier Sediment Assessment.
-EEC5 EXWC PT Hueneme CA increased from 0.489 to 0.870 due to increase in field work for continuing projects such as Demonstrating the Use of a Novel, Hybrid Polyelectrolyte/Hydrophilic Polymer for In situ PFAS Treatment Applications and Field Demonstration of Colloidal Activated Carbon for In Situ Sequestration of Per- and Polyfluoroalkyl Substances.
-EEC5 SSC San Diego CA increased from 0.494 to 0.940 due to increase in field work for continuing projects such as Sensor interface and infrastructure for monitoring (SIIM), Mesocosm Field Testing of In situ PFAs Treatment Trains, and Contaminant Monitoring and Mapping for Informing Stormwater Best Management Practices.
-EEC5 NAWC Patuxent River MD increased from 0.095 to 0.130 due to increased project management costs and increase in field work for continuing projects.
-EEC5 NSWC Bethesda MD decreased from 0.385 to 0.300 due to completion of field work.
-EEC5 NAWCWD China Lake CA increased from 0.150 to 0.210 due to increased costs to support overall program management.
-EEC5 NAWC Lakehurst NJ increased from 0.100 to 0.140 due to increased costs for program web site management.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
-EEC3 FRC SE Jacksonville FL increased from 0.305 to 0.600 due to increase in field work for continuing projects such as Replacement of Cadmium in Ground Support Equipment Avionics Applications, Elimination of Hexavalent Chromium from Magnesium Conversion Coating Processes at Fleet Readiness Centers, and Development and Implementation of Methods to Reduce Sealant Waste in Fleet/Depot Level Operations. -EEC3 FRC CE Cherry Point NC increased from 0.085 to 0.100 due to increased project management costs and increase in field work for continuing projects. -EEC3 FRC SW San Diego CA increased from 0.178 to 0.195 due to increased field work for support to continuing projects such as Low VOC Primers for Ground Support Equipment Application.															

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	54.699	4.227		4.440		5.939		-		5.939	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0817 / *Environmental Sustainability Development (NESDI)*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 0817																												
EEC 2																												
EEC 3																												
EEC 4																												
EEC 5																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 0817 / *Environmental Sustainability Development (NESDI)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0817				
EEC 2	1	2019	4	2024
EEC 3	1	2019	4	2024
EEC 4	1	2019	4	2024
EEC 5	1	2019	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9204: *Marine Mammal Research*	55.096	4.656	5.145	5.264	-	5.264	5.379	5.467	5.573	5.683	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Navy has been and will continue to be subject to litigation with regard to the potential injuring, killing or biologically significant disturbance of marine animals by the use of intense underwater sound. Since Fleet operation and training areas coincide with known or probable habitats, migration routes, or breeding areas of marine mammals and other protected marine species, the possibility exists that such incidents are likely to continue in the future. The increasing public interest and pressure has resulted in escalating Fleet costs. For example, Fleet and SYSCOM development activities have been interrupted; modified, or altogether cancelled and environmental regulations have, among other things, required new ship construction shock trials to obtain Federal permits and conduct extensive environmental planning that can take several years to complete. The incorporation of mitigation measures in Fleet training operations to minimize the potential adverse effects on protected marine animals can significantly reduce the realism of these operations. In addition, the testing, evaluation, and deployment of new sonar detection and monitoring systems that use active acoustics are under intense public scrutiny for their potential adverse effects on whales and other marine mammals. Navy needs scientific evidence to substantiate its claims of limited or inconsequential adverse effects to marine life from operations.

This project primarily focuses on the development of planning, monitoring, and mitigating tools to aid the Fleet in minimizing contact with and the potential harassment of protected marine animals during operations, exercises, training, and undersea surveillance and weapons testing. These new capabilities will encompass historical and newly acquired data and analytical models that together can predict marine animal habitats (where they are likely to be), and their natural and expected behavior (diving patterns, prey localization, calling activity, etc.). This project consists of three major areas that will help ensure Navy compliance with the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA).
These areas are (1) Marine Ecology and Population Dynamics - determine the likelihood of the presence of marine mammals or other protected species by developing habitat and ecological models. Refine marine animal survey techniques to optimize the accuracy of abundance estimates in small ocean regions of Navy interest.
(2) Criteria, Thresholds, and Mitigation - Establish criteria and thresholds from which to measure potential impact on marine mammals and other marine species from Navy training operations. Determine the effectiveness and usefulness of various mitigation measures in relation to the potential impact of Navy operations on marine mammals; and (3) Mitigation Methodologies - Determine the observation, detection and classification measures required to develop effective monitoring and mitigation procedures for Fleet and SYSCOM use. Focus on improving marine animal monitoring capabilities over current methods by developing new technologies or improving existing technologies that improve monitoring and mitigation effectiveness, reduce cost and minimize impacts on readiness activities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Marine Ecology and Population Dynamics	0.900	0.900	1.019	0.000	1.019
Articles:	-	-	-	-	-
FY 2020 Plans: FY2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Within the area of 'Marine Ecology and Population Dynamics', ongoing work covers topics such as density estimation from passive acoustic data, standards/metrics development and development of an automated sonar detector to standardize analysis of acoustic data. Ongoing studies that will continue into FY2021: -Acoustic Metadata Management for Navy Fleet Operations -Standardizing Methods and Nomenclature for Automated Detection of Navy Sonar -Analytical methods to support the development of noise exposure criteria for behavioral response Ongoing studies that are expected to be completed by the end of FY2020: -Blue and fin whale density estimation in the US Pacific Fleet Southern California Offshore Range using PAM data -DECAF-TEA: Density Estimation for Cetaceans from Acoustic Fixed sensors in Testing and Evaluation Areas Studies that will begin in FY20 (initiated in late FY2019): -ACCURATE: ACoustic CUe RATEs for passive acoustic density estimation -MSM4PCoD: Marine Species Monitoring for the Population Consequences of Disturbance -Demonstration and validation of passive acoustic density estimation for right whales Funding within the area of 'Marine Ecology and Population Dynamics' is expected to remain stable from FY19 to FY20.					
FY 2021 Base Plans: Within the area of 'Marine Ecology and Population Dynamics', ongoing work covers topics such as density estimation from passive acoustic data, standards/metrics development and development of an automated sonar detector to standardize analysis of acoustic data. Ongoing studies that will continue into FY2022: -Standardizing Methods and Nomenclature for Automated Detection of Navy Sonar -Analytical methods to support the development of noise exposure criteria for behavioral response -ACCURATE: ACoustic CUe RATEs for passive acoustic density estimation -MSM4PCoD: Marine Species Monitoring for the Population Consequences of Disturbance -Demonstration and validation of passive acoustic density estimation for right whales Ongoing studies that are expected to be completed by the end of FY2021:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Acoustic Metadata Management for Navy Fleet Operations In addition, studies are expected to be initiated in FY2021 in response to needs collected from Navy personnel in FY20. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding required in FY21 is expected to increase by 0.119 compared to FY20, with a number of ongoing projects hitting the height of their effort (data collection and data analysis) along with some new projects that are expected to begin.					
Title: Criteria and Thresholds, Physiology and Behavior, and Effects of Sound	2.541	3.030	3.030	0.000	3.030
Articles:	-	-	-	-	-
FY 2020 Plans: FY2020 Plans: Within the area of 'Criteria and Thresholds, Physiology and Behavior, and Effects of Sound', ongoing work covers topics such as hearing, temporary threshold shift, behavioral response studies, and effects from underwater explosions. Ongoing studies that will continue into FY2021: -Multi-spaced measurement of underwater sound fields from explosive sources -Hearing and estimated noise impacts in three species of Auk: Implications for the marbled murrelet -Cuvier's beaked whale and fin whale behavior during military sonar operations -Measuring the effect of range on the behavioral response of marine mammals through the use of Navy sonar and small source playbacks -The effects of underwater explosions on fish Ongoing studies that are expected to be completed by the end of FY2020: -Hawaiian Monk seal auditory sensitivity study -Frequency-dependent growth and recovery of temporary threshold shift in bottlenose dolphins -Temporary threshold shift in harbor seals due to fatiguing noise of several frequencies -Temporary threshold shift in harbor porpoises due to naval sonar sounds and recovering of hearing -3S3-Behavioral responses of sperm whales to naval sonar					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Studies that will begin in FY20 (initiated in late FY19): -Collection of auditory evoked potential hearing thresholds in minke whales (Balaenoptera acutorostrata) -Towards a mysticete audiogram using humpback whales' behavioral response thresholds -Use of "Chirp" Stimuli for non-invasive, low-frequency measurement of marine mammal auditory evoked potentials -Temporary threshold shifts in underwater hearing sensitivity in aquatic turtles Funding within the area of 'Criteria and Thresholds, Physiology and Behavior, and Effects of Sound' is expected to increase for FY20. Funding in this topic area is particularly important in FY20 because the results are needed by the end of 2022 to update the criteria and thresholds for the Phase IV acoustic effects modeling. Therefore most of the projects will be in the final stages of trying to push to get final results in time to support this deadline.					
FY 2021 Base Plans: Within the area of 'Criteria and Thresholds, Physiology and Behavior, and Effects of Sound', ongoing work covers topics such as hearing, temporary threshold shift, behavioral response studies, and effects from underwater explosions. Ongoing studies that will continue into FY2022: -Collection of auditory evoked potential hearing thresholds in minke whales (Balaenoptera acutorostrata)data on sea turtle hearing/TTS -Towards a mysticete audiogram using humpback whales' behavioral response thresholdsdata on mysticete hearing -Use of "Chirp" Stimuli for non-invasive, low-frequency measurement of marine mammal auditory evoked potentials -Temporary threshold shifts in underwater hearing sensitivity in aquatic turtles Ongoing studies that are expected to be completed by the end of FY2021: -Multi-spaced measurement of underwater sound fields from explosive sources -Hearing and estimated noise impacts in three species of Auk: Implications for the marbled murrelet -Cuvier's beaked whale and fin whale behavior during military sonar operations -Measuring the effect of range on the behavioral response of marine mammals through the use of Navy sonar and small source playbacks -The effects of underwater explosions on fish					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
In addition, studies are expected to be initiated in FY2021 in response to needs collected from Navy personnel in FY20. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding in FY21 is expected to remain similar to FY20, due to some projects coming to an end and some projects beginning.					
Title: Mitigation Methodologies: Monitoring, New Technology, and Risk Assess	1.215	1.215	1.215	0.000	1.215
Articles:	-	-	-	-	-
FY 2020 Plans: FY2020 Plans: Within the area of 'Mitigation Methodologies', ongoing work covers demonstration and validation of new technologies for monitoring and mitigation. Ongoing studies that will continue into FY2021: -M3R (Marine Mammal Monitoring on Navy Ranges) Ongoing studies that are scheduled to be completed in FY20: -Extended duration acoustic tagging of right whales -High fidelity acoustic and fine-scale movement tags to enable behavioral response research on deep diving whales Studies that will begin in FY20 (initiated in late FY19): -Improved Tag Attachment System for Remotely-Deployed Medium-Term Cetacean Tags Funding within this area is expected to remain stable from FY19 to FY20. ***FY 2021 Base Plans:*** Within the area of 'Mitigation Methodologies', ongoing work covers demonstration and validation of new technologies for monitoring and mitigation. Ongoing studies that will continue into FY22:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-M3R (Marine Mammal Monitoring on Navy Ranges) -Improved Tag Attachment System for Remotely-Deployed Medium-Term Cetacean Tags No studies are scheduled to be completed by the end of FY21. However, studies are expected to be initiated in FY21 in response to needs collected from Navy personnel in FY20. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding required in FY21 is expected to remain similar to FY20. Although no projects will be completed in FY21, some of the ongoing projects will have less effort in FY21, which balances out required funding.					
Accomplishments/Planned Programs Subtotals	4.656	5.145	5.264	0.000	5.264

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

RDTEN Contracts are Competitive Procurements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mar Ecol & Pop Dynamics	Various	EXWC : Port Hueneme, CA	2.977	0.745	Oct 2018	0.745	Oct 2019	0.871	Oct 2020	-		0.871	Continuing	Continuing	Continuing
Criteria & Thresholds	SS/CPFF	NMMF : San Diego, CA	0.184	0.000		0.000		0.000		-		0.000	0.000	0.184	-
Mitigation Methods	SS/CPFF	SDSU : San Diego, CA	0.574	0.000		0.000		0.000		-		0.000	0.000	0.574	-
Criteria & Thresholds	SS/CPFF	SEAMARCO : Netherlands	0.316	0.000		0.000		0.000		-		0.000	0.000	0.316	-
Criteria & Thresholds	SS/CPFF	U Saint Andrews : United Kingdom	0.506	0.400	Oct 2018	0.000		0.000		-		0.000	0.000	0.906	-
Mitigation Methods	SS/CPFF	Syracuse U : Syracuse, NY	0.030	0.000		0.000		0.000		-		0.000	0.000	0.030	-
Criteria & Thresholds	SS/CPFF	WHOI : Falmouth, MA	0.138	0.200	Oct 2018	0.000		0.000		-		0.000	0.000	0.338	-
Mitigation Methods	WR	SPAWAR : San Diego, CA	1.073	0.100	Oct 2018	0.200	Oct 2019	0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
Criteria & Thresholds	SS/CPFF	MARECOTEL : Seabeck, WA	0.560	0.600	Oct 2018	0.600	Oct 2019	0.600	Oct 2020	-		0.600	0.000	2.360	-
Mitigation Methods	SS/CPFF	Scripps Institute : San Diego, CA	1.048	0.200	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Criteria & Thresholds	SS/CPFF	U Washington : Seattle, WA	0.403	0.300	Oct 2018	0.000		0.000		-		0.000	0.000	0.703	-
Mitigation Methods	SS/CPFF	Oregon State Univ : OR & HI	0.809	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Criteria & Thresholds	Various	EXWC : Port Hueneme, CA	0.613	0.538	Jan 2019	1.830	Jan 2020	1.823	Jan 2021	-		1.823	0.000	4.804	-
Mar Ecol & Pop Dynamics	WR	NAVAIR : Lakehurst, NJ	0.507	0.075	Oct 2018	0.075	Oct 2019	0.075	Oct 2020	-		0.075	Continuing	Continuing	Continuing
Mitigan Methods	Various	EXWC : Port Hueneme, CA	0.183	0.515	Jan 2019	0.715	Jan 2020	0.715	Oct 2020	-		0.715	Continuing	Continuing	Continuing
Mar Ecol & Pop Dynamics	SS/CPFF	BMC Inc. : Chicago, IL	0.541	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Mitigation Methods	WR	NUWC : Newport, RI	10.851	0.400	Oct 2018	0.300	Oct 2019	0.300	Oct 2020	-		0.300	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mar Ecol & Pop Dynamics	WR	NPGS : Monterey, CA	3.609	0.030	Oct 2018	0.030	Oct 2019	0.030	Oct 2020	-		0.030	Continuing	Continuing	Continuing
Mar Ecol & Pop Dynamics	MIPR	NOAA: Various : La Jolla, CA	3.511	0.050	Oct 2018	0.050	Oct 2019	0.050	Oct 2020	-		0.050	Continuing	Continuing	Continuing
Mitigation Methods	SS/CPFF	Scripps Institute : La Jolla, CA	9.715	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Mitigation Methods	SS/CPFF	Oregon State Univ. : Corvallis, OR	2.066	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Criteria & Thresholds	WR	NUWC : Newport, RI	0.000	0.100	Oct 2018	0.300	Oct 2019	0.300	Oct 2020	-		0.300	0.000	0.700	-
Criteria & Thresholds	SS/CPFF	SPAWAR : San Diego, CA	4.090	0.403	Oct 2018	0.300	Oct 2019	0.300	Oct 2020	-		0.300	Continuing	Continuing	Continuing
Criteria & Thresholds	SS/CPFF	Cascadia Research Collective : Olympia, WA	8.249	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Criteria & Thresholds	SS/CPFF	San Diego State Univ : San Diego, CA	2.543	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	55.096	4.656		5.145		5.264		-		5.264	Continuing	Continuing	N/A

Remarks

Individual projects are derived from field level needs and awarded competitively to performing organizations, the portfolio mix of cost category/performing organization naturally changes from fiscal year to fiscal year.

The following increases are above 2% from FY19 to FY20:
- Mitigation Methods: SPAWAR: San Diego, CA; Increase from $0.100 to $0.200. Increase due to added projects from FY18 that has increase efforts in FY20.
- Mitigation Methods: EXWC: Port Hueneme, CA; Increase from $0.515 to $0.715. Increase due to planned FY19/20 projects that will be awarded competitively by EXWC to performing organizations based on subject matter expertise required by Navy need.
- Criteria & Thresholds: NUWC: Newport, RI; Increase from $0.100 to $0.300. Increase due to increase on existing projects due to field year.(Clarity: Field Year means that the project will have a field effort (in this situation: Data Collection at Sea) in FY2020. This will increase cost.)
- Criteria & Thresholds: EXWC: Port Hueneme, CA; Increase from $0.651 to $1.590. Increase due to planned FY19/20 projects that will be awarded competitively by EXWC to performing organizations based on subject matter expertise required by Navy need.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	55.096	4.656		5.145		5.264		-		5.264	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603721N / *Environmental Protection*	Project (Number/Name) 9204 / *Marine Mammal Research*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MARINE MAMMAL RESEARCH																												
Marine Mammal Ecology and Population Dynamics																												
Criteria and Thresholds, Physiology and Behavior, and Effects of Sound																												
Mitigation Methodologies: Monitoring, New Technology, and Risk Assessment																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9204 / *Marine Mammal Research*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MARINE MAMMAL RESEARCH				
Marine Mammal Ecology and Population Dynamics	1	2019	4	2024
Criteria and Thresholds, Physiology and Behavior, and Effects of Sound	1	2019	4	2024
Mitigation Methodologies: Monitoring, New Technology, and Risk Assessment	1	2019	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*				**Project (Number/Name)** 9205 / *Marine Mammal Settlement*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
9205: *Marine Mammal Settlement*	3.000	3.000	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Navy developed the Surveillance Towed Array Sensory System (SURTASS) Low Frequency Active (LFA) sonar system to meet the requirement for improved capability to detect quieter and harder to find foreign submarines at greater distances. The Navy employs SURTASS LFA systems onboard up to four U.S. Navy surveillance ships for routine training, testing, and military operations in the Atlantic, Pacific, and Indian Oceans and the Mediterranean Sea. Employment of these systems has been the subject of litigation over the last two decades. The U.S. Navy, the National Oceanic and Atmospheric Administration (NOAA), and the Natural Resources Defense Council et al. entered into a settlement agreement, which has been filed with the U.S. District Court for the Northern District of California, to resolve claims alleged by the plaintiffs that the Navy and NOAA violated the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the National Environmental Policy Act (NEPA). The purpose of this funding is to comply with the terms of the settlement agreement filed with the court. Under the terms of the settlement, the Navy agrees to spend $9M over the course of three years from fiscal year 2018 through 2020 to fund research projects within the following research topic areas: 1) Developing capacity to protect acoustic habitats, including in national marine sanctuaries managed under the National Marine Sanctuaries Act 16 U.S.C. 1431 et seq., and high-risk areas for protected species; 2) improve marine mammal density and distribution modeling in data poor areas to assist with the identification of areas of biological importance; and 3) density data collection. Funding of this research will ensure compliance with the settlement agreement and will ensure that SURTASS training, testing and operational activities are able to proceed without interruption.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: MARINE MAMMAL SETTLEMENT	3.000	3.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: FY2020 Base Plans: Work under topic area 1 will be focused on continuing soundscape monitoring and fieldwork within National Marine Sanctuaries on the East Coast, West Coast, and Hawaii. This includes deployment and maintenance of passive acoustic monitoring equipment, gliders, and telemetry stations. In addition, analysis of data collected and final products will be completed. Work under topic area 2 will be focused on continued development of new modeling techniques to address key issues identified by the working group. A workshop will be held in FY2020 to bring the workgroup together to go over progress made and provide recommendations to support final products.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9205 / *Marine Mammal Settlement*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Work under topic area 3 will focus on analysis of density data collected during FY2019. Per settlement requirements, funding under Project 9205 will remain stable at $3M per year (over FY18-20). FY2020 will be the last year of funding. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease by 3.0 due to settlement requirements, funding under Project 9205 will remain stable at $3M per year (over FY18-20). FY2020 will be the last year of funding.					
Accomplishments/Planned Programs Subtotals	3.000	3.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

RDTEN Contracts are Competitive Procurements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9205 / *Marine Mammal Settlement*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SURTASS	MIPR	NOAA, HQ : Silver Spring, MD	2.500	2.500	Oct 2018	1.800	Oct 2019	0.000		-		0.000	0.000	6.800	-
SURTASS	WR	EXWC : Port Hueneme, CA	0.500	0.500	Oct 2018	1.200	Oct 2019	0.000		-		0.000	0.000	2.200	-
		Subtotal	3.000	3.000		3.000		0.000		-		0.000	0.000	9.000	N/A

Remarks

Annual funding in the amount of $3M are required to comply with the settlement. Funding will likely be disbursed as indicated below and all monies are required in the 1st Quarter of the Fiscal Year (Oct 1 2019).

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	3.000	3.000		3.000		0.000		-		0.000	0.000	9.000	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9205 / *Marine Mammal Settlement*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9205																												
SURTASS Marine Mammal Settlement: SURTASS Marine Mammal Settlement																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603721N / *Environmental Protection*	**Project (Number/Name)** 9205 / *Marine Mammal Settlement*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9205				
SURTASS Marine Mammal Settlement: SURTASS Marine Mammal Settlement	1	2019	4	2020

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	437.721	31.726	58.014	23.422	-	23.422	29.646	29.462	28.590	29.163	Continuing	Continuing
0829: *ENERGY CONSERVATION (ADV)*	85.049	6.532	5.607	5.811	-	5.811	5.874	5.983	6.102	6.223	Continuing	Continuing
0838: *Mobility Fuels (ADV)*	99.609	7.774	8.281	7.463	-	7.463	9.078	9.058	8.874	9.051	Continuing	Continuing
0928: *Shore Energy Technology*	53.982	1.682	1.869	1.879	-	1.879	1.920	1.960	1.998	2.039	Continuing	Continuing
0996: *Aircraft Energy Conservation*	150.182	8.981	10.757	8.269	-	8.269	12.774	12.461	11.616	11.850	Continuing	Continuing
9999: *Congressional Adds*	48.899	6.757	31.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	87.156

A. Mission Description and Budget Item Justification

This program supports projects to evaluate, adapt, and demonstrate energy related technologies for Navy aircraft and ship operations to: (a) increase fuel-related weapons systems capabilities such as range and time on station; (b) reduce energy costs; (c) apply energy technologies that improve environmental compliance; (d) examine restrictive fuel specification requirements to reduce cost and increase availability worldwide; (e) provide guidance to fleet operators for the safe use of commercial grade or off-specification fuels; and (f) make needed periodic changes to fuel specifications to ensure fuel quality and avoid fleet operating problems. This program supports the achievement of legislated, White House, Department of Defense, and Navy energy management goals.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	32.656	26.514	26.915	-	26.915
Current President's Budget	31.726	58.014	23.422	-	23.422
Total Adjustments	-0.930	31.500	-3.493	-	-3.493
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	31.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.930	0.000			
• Program Adjustments	0.000	0.000	-3.518	-	-3.518
• Rate/Misc Adjustments	0.000	0.000	0.025	-	0.025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*

Congressional Add Details ($ in Millions, and Includes General Reductions)

	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Program Increase*	0.000	15.000
Congressional Add: *Program Increase: Renewable Energy Development*	6.757	0.000
Congressional Add: *Marine energy systems for sensors and microgrids*	0.000	11.500
Congressional Add: *Navy energy program/shore energy*	0.000	5.000
Congressional Add Subtotals for Project: 9999	6.757	31.500
Congressional Add Totals for all Projects	6.757	31.500

Change Summary Explanation

Schedule:

Technical:

0838 - The FY 2021 funding request was reduced by $0.902 million to account for the availability of prior year execution balances.

0996 - Program pivoting to ASN energy guidance focusing on capability enhancing efficiency, power and energy technologies vice conservation. The FY 2021 funding request was reduced by $2.682 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603724N / *Navy Energy Program*				Project (Number/Name) 0829 / *ENERGY CONSERVATION (ADV)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
0829: *ENERGY CONSERVATION (ADV)*	85.049	6.532	5.607	5.811	-	5.811	5.874	5.983	6.102	6.223	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:
The Energy Conservation Advanced Project is designed to develop, test, and evaluate energy and maintenance saving improvements for existing and future Fleet assets with the aim of extending the operational reach of current and future platforms systems through more effective use of energy. This energy conservation project, managed through NAVSEA 05T, will identify mature potential energy saving areas by involvement with Fleet representatives, Life-Cycle Managers (LCMs), NAVSEA Technical Warrant Holders, In-Service Engineering Agents (ISEAs), PEOs, Top Management Attention/Top Management Interest (TMA/TMI), Industry, and Academia. The project directly supports Department of Navy goals for agility, resilient force posture, and innovation by maximizing energy to increase operational capability (e.g., extend range, increase time on station, employ high power and energy systems). Potential technology areas include Power Generation and Storage, Hull Hydrodynamics, Underwater Hull Husbandry, Heating, Ventilation & Air Conditioning (HVAC) Systems, Thermal Management, Main Propulsion Systems, Electrical Systems, Auxiliary Systems, and Energy Monitoring, Planning, and Assessment. Promising energy management proposals that improve the effective use, conversion, storage, distribution, and control of energy to enable the integration with future weapons and sensors onto platforms are developed each FY for evaluation. Projects are selected based on technical review and business case analysis. Not all proposals are pursued, and funding changes between functional categories or fiscal years may occur based on fleet needs, technology maturity level, ship schedule changes, or other factors.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Power Generation and Storage Sub Project	0.000	0.000	0.300	0.000	0.300
Articles:	-	-	-	-	-

Description: Power Generation & Storage System Sub Project - This project area will accomplish prototype development, laboratory and Fleet testing to determine overall effectiveness of technologies focused on improving efficiency of current power generation & storage methodologies.

FY 2020 Plans:
N/A

FY 2021 Base Plans:
Perform research and development activities on promising power generation and energy storage technologies to support future sensors and weapons. Future systems like SEWIP Block III, Navy Laser programs, and other directed energy applications have unique and challenging power and energy requirements. This sub-project

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
invests in novel approaches to generate, store, and manage energy to support future systems on current and future ship classes. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of 0.300M reflects a decrease in Global Energy Information System (GENISYS) development efforts and development of technologies that improve energy conservation and increase operational capabilities in the Power Generation and Storage functional area.					
Title: Hull Hydrodynamic Sub Project	0.000	0.000	0.735	0.000	0.735
Articles:	-	-	-	-	-
Description: Hull Hydrodynamic Sub Project - This project area will accomplish prototype development, modeling, laboratory and Fleet testing of ship modifications to propellers and/or hull appendages to determine overall mission, energy, and cost effectiveness of these improvements. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Conduct assessments and mature hardware designs for hull hydrodynamic projects including "stern flaps." Perform stern flap integration studies on Fleet assets, which may including retrofit hardware for LCS-3 (and subsequent) or new construction designs for FFG(X). Efforts include conducting finite element analysis; structural design; design development and selection of ship; development of Ship Change Document; ship construction drawings; insertion of stern flap installation into Availability Plan. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of 0.735M reflects a decrease in GENISYS development efforts and development of technologies that improve energy conservation and increase operational capabilities in the hull hydrodynamic functional area.					
Title: Thermal Management Sub Project	0.256	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: (U) Thermal Management Sub Project - Project funds will be utilized to identify and evaluate potential uses for Thermal Management techniques designed to reduce overall shipboard heat generation as well as incorporating waste heat recovery techniques to reduce the shipboard electrical demand on HVAC and other systems. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: Energy Monitoring & Assessment	6.276	5.607	4.776	0.000	4.776
Articles:	-	-	-	-	-
Description: This project area will focus on methods of capturing and displaying energy related data to shipboard personnel as actionable information for ships force to employ energy conservation measures underway and in port as mission requirements permit. ***FY 2020 Plans:*** Provide engineering, technical and programmatic support of energy initiatives that put in place shore and shipboard monitoring and assessment tools aimed at optimizing ships' energy profiles and increasing operational capabilities. Continue GENISYS development efforts and shipboard evaluation including integration of GENISYS with enterprise Remote Monitoring (eRM) capabilities to support future fleet-wide implementation. Support expanding the use of the data collected by GENISYS to support Maritime Energy Operational Command and Control requirements currently being developed by DASN RD&A and US Fleet Forces Command. Continue to identify additional energy saving/capability improvement technologies and monitoring methodologies and prepare proposals and business case analyses for promising technologies with potential to reduce fossil fuel. ***FY 2021 Base Plans:*** Provide engineering, technical and programmatic support of energy initiatives that put in place shore and shipboard monitoring and assessment tools aimed at optimizing ships' energy profiles and increasing operational capabilities.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue GENISYS development and implementation efforts for operational energy evaluation includes integration of Condition Based Maintenance Plus applications. Support limited deployment testing and implement the initial operating capability release to Fleet Surface ship assets. Conduct analysis on collected GENISYS data to support Operational Energy requirements, such as Maritime Tactical Command and Control program. Continue to identify additional energy capability improvement technologies and monitoring methodologies while also preparing proposals and business case analyses for promising technologies within scope of NAVSEA technology objectives. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of 0.906M is result of GENISYS development efforts winding down in FY21 and putting additional focus on pursuit of promising technologies in other functional areas such as Hull Hydrodynamics and Power Generation & Storage.					
Accomplishments/Planned Programs Subtotals	6.532	5.607	5.811	0.000	5.811

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

RDT&E Contracts are Competitive Procurements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	C/CPFF	NAVSEA HQ : Washington, DC	1.110	0.000		0.200	Jan 2020	0.000		-		0.000	0.000	1.310	-
Systems Engineering	WR	NSWC DD : Dahlgren, MD	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	-
Systems Engineering	WR	NSWC PHila : Philadelphia, PA	2.734	0.328	Nov 2018	0.100	Nov 2019	0.375	Nov 2020	-		0.375	0.000	3.537	-
Primary Hardware Development	WR	NSWC Carderock : Bethesda, MD	8.983	0.000		0.000		0.000		-		0.000	0.000	8.983	-
Systems Engineering	WR	NSWC PHD : Port Hueneme, CA	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	-
Systems Engineering	C/CPAF	NSWC Carderock : Bethesda, MD	6.948	0.000		0.000		0.000		-		0.000	0.000	6.948	-
Engineering Development	WR	NSWC Carderock : Bethesda, MD	8.369	0.000		0.000		0.633	Nov 2020	-		0.633	0.000	9.002	-
Demonstration & Evaluation	WR	NSWC Carderock : Bethesda, MD	8.149	0.000		0.000		0.000		-		0.000	0.000	8.149	-
System Development	C/BOA	NAWC-AD : Lakehurst, NJ	2.586	2.769	Jan 2019	0.883	Jan 2020	0.800	Jan 2021	-		0.800	0.000	7.038	-
Primary Hardware Development	C/CPAF	NSWC PHila : Philadelphia, PA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
System Engineering	WR	NSWC CR : Crane, Indiana	0.300	0.000		0.000		0.000		-		0.000	0.000	0.300	-
System Engineering	WR	NUWC NPT : Newport, Rhode Is	0.193	0.000		0.000		0.000		-		0.000	0.000	0.193	-
		Subtotal	39.572	3.097		1.183		1.808		-		1.808	0.000	45.660	N/A

Remarks

Decrease of 0.200M for Systems Engineering / NAVSEA HQ reflects reduced contract support in product development at HQ; Increase of 0.200M for Systems Engineering / NSWC Phila and 0.633M increase for Engineering Development / NSWC CD reflects gradual shift from GENISYS development to Warfare Center support of shipboard new technology product development. Decrease of 0.083M for System Development NAWC-AD reflects decrease of GENISYS product development as it's focus shifts toward test & evaluation.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	NSWC Carderock : Bethesda, MD	2.843	0.344	Nov 2018	0.217	Nov 2019	0.280	Nov 2020	-		0.280	Continuing	Continuing	Continuing
Software Support	WR	NSWC Carderock : Bethesda, MD	0.522	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Integrated Logistics Support	WR	NSWC Carderock : Bethesda, MD	1.200	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Study Anaylsis	WR	NSWC Carderock : Bethesda, MD	1.174	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Development Support	C/CPAF	NSWC SSES : Philadelphia, PA	0.878	0.100	Jan 2019	0.050	Jan 2020	0.000		-		0.000	0.000	1.028	-
Development Support	C/CPAF	NAVSEA HQ : Washington, DC	1.565	0.479	Jan 2019	0.421	Jan 2020	0.430	Jan 2021	-		0.430	0.000	2.895	-
Software Support	C/CPAF	NSWC SSES : Philadelphia, PA	0.281	0.000		0.000		0.000		-		0.000	0.000	0.281	-
Software Support	C/CPAF	NAVSEA HQ : Washington, DC	1.200	0.000		0.000		0.000		-		0.000	0.000	1.200	-
Development Support	WR	NSWC PHila : Philadelphia, PA	2.296	0.337	Nov 2018	0.397	Nov 2019	0.208	Nov 2020	-		0.208	0.000	3.238	-
Development Support	C/CPAF	SUPSHIP : Bath, MA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Development Support	WR	NSWC DD : Dahlgren, Va	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Development Support	WR	SPAWAR : Charleston, SC	0.000	0.000		0.000		0.190	Nov 2020	-		0.190	0.000	0.190	-
		Subtotal	12.009	1.260		1.085		1.108		-		1.108	Continuing	Continuing	N/A

Remarks

Increase of 0.063M for Development Support / NSWC CD reflects increased support related to stern flap design; decrease of 0.50M and 0.189M for Development Support / NSWC Phila reflects shift from Support to Product Development and increase of 0.190M for Development Support / SPAWAR reflects support of GENISYS Software Cloud Hosting services.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC Carderock : Bethesda, MD	9.961	0.085	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	NSWC Carderock : Bethesda, MD	10.645	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
LIve Fire Test & Evaluation	WR	NSWC Carderock : Bethesda, MD	0.382	0.000		0.000		0.000		-		0.000	0.000	0.382	-
Developmental Test & Evaluation	C/CPAF	NSWC Philadelphia : Philadelphia, PA	0.383	0.000		0.000		0.000		-		0.000	0.000	0.383	-
Developmental Test & Evaluation	WR	NSWC SSES : Philadelphia, PA	0.918	0.000		0.000		0.000		-		0.000	0.000	0.918	-
Developmental Test & Evaluation	WR	APL : Washington, DC	0.000	0.085	Jan 2019	0.000		0.000		-		0.000	0.000	0.085	-
System Development	C/BOA	NAWC-AD : Lakehurst, NJ	0.000	0.000		1.924	Jan 2020	1.715	Dec 2020	-		1.715	0.000	3.639	-
		Subtotal	22.289	0.170		1.924		1.715		-		1.715	Continuing	Continuing	N/A

Remarks

Decrease of 0.209M for System Development / NAWC-AD reflects reduced GENISYS Software development effort as it approaches Initial Operating Capability (IOC).

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NSWC Philadelphia : Philadelphia, PA	7.100	0.000		0.000		0.328	Dec 2020	-		0.328	0.000	7.428	-
Travel	Allot	NAVSEA HQ : Washington, DC	0.202	0.007	Dec 2018	0.007	Dec 2019	0.021	Dec 2020	-		0.021	0.000	0.237	-
Total Assets	WR	NSWC Carderock : Bethesda, MD	0.352	0.000		0.000		0.000		-		0.000	0.000	0.352	-
Program Management Support	C/CPAF	NAVSEA HQ : Washington, DC	2.493	1.978	Jan 2019	1.388	Jan 2020	0.729	Jan 2021	-		0.729	0.000	6.588	-
Program Management Support	WR	NSWC Carderock : Bethesda, MD	1.032	0.020	Mar 2019	0.020	Mar 2020	0.102	Oct 2020	-		0.102	0.000	1.174	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	11.179	2.005		1.415		1.180		-		1.180	0.000	15.779	N/A

Remarks

Increase of 0.328 for Program Management Support / NSWC Phila reflects need to manage efforts associated with Engineering Product Development; increase of 0.014M for travel reflects need to visit fleet activities; Decrease of 0.659M for Program Management Support reflects decrease in contractor support efforts; increase of 0.082M in Program Management support / NSWC CD reflects need to oversee engineering product development efforts.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	85.049	6.532		5.607		5.811		-		5.811	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0829 / *ENERGY CONSERVATION (ADV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
ENERGY CONSERVATION (ADV)				
Proposal Development - FY19	1	2019	3	2019
Proposal Acceptance - FY19	4	2019	4	2019
Proposal Development - FY20	1	2020	3	2020
Proposal Acceptance - FY20	4	2020	4	2020
Proposal Development - FY21	1	2021	3	2021
Proposal Acceptance - FY21	4	2021	4	2021
Proposal Development - FY22	1	2022	3	2022
Proposal Acceptance - FY22	4	2022	4	2022
Proposal Development - FY23	1	2023	3	2023
Proposal Acceptance - FY23	4	2023	4	2023
Proposal Development - FY24	1	2024	1	2024
Proposal Acceptance - FY24	4	2024	4	2024
Model & Simulation (if required)	1	2019	4	2023
Proposal Development	1	2023	3	2023
Prototype Development	1	2019	4	2023
Proposal Acceptance	1	2023	4	2023
Prototype Demo	1	2019	4	2023
Land Based Testing	1	2019	4	2023
Determine Fuel and Maintenance Savings	1	2019	4	2023
Shipboard Evaluation	1	2019	4	2023
Component Implementation Energy Savings	1	2019	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0838: *Mobility Fuels (ADV)*	99.609	7.774	8.281	7.463	-	7.463	9.078	9.058	8.874	9.051	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The FY2021 funding request was reduced by $0.902 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

This project represents the Navy's only RDTE investment designed to maintain its capability to operate as a "smart" customer for aviation and ship tactical fuels that are an operationally critical, single point of failure, $4.0 billion per year consumable requiring worldwide availability and interoperability.

Recent field problems have demonstrated the adverse effects that fuel-related problems can have on ship and aircraft performance, durability, and readiness. The potential risk and adverse operational impacts of fuel-related problems over the next decade, given the evolving production technologies, changing feedstocks, more stringent environmental regulations and the introduction of new operational requirements and platforms will continue to increase.

This project provides data through laboratory, component, engine, fuel system, and platform tests, which relate the effects of changes in the Navy fuel properties and chemistry to the performance and durability of Naval ship, aircraft, ground and fuel distribution systems. The information is required to: (a) assure interoperability with fuel procured from commercial/ international specifications, (b) determine the extent to which unnecessarily restrictive military specification requirements can be relaxed to reduce cost and increase availability
worldwide, (c) provide guidance to fleet operators for the safe use of off-specification fuels or emerging CONOPS requiring the use of non-traditional fuels,(d) assure operational interoperability with evolving changes in fuel production technology, feedstocks, environmental regulations and tactical system demands, (e) improve the capability and reduce the cost of field fuel quality surveillance and (f) facilitate rapid identification and resolution of field identified fuel deficiencies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Naval Tactical Fuels	7.774	8.281	7.463	0.000	7.463
Articles:	-	-	-	-	-
Description: Perform development, test and evaluation work on Naval tactical fuels to: a) assure interoperability with commercial/international fuel specifications, b) determine the extent to which unnecessarily restrictive military specification features can be relaxed to reduce cost and increase availability worldwide; c) provide guidance to fleet operators for the safe use of off-specification or non-primary fuels , d) validate periodic changes to the Navy tactical fuel specifications to ensure fuel quality and avoid fleet operating problems while accommodating					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
evolutionary changes in the fuel supply industry and e) improve fleet methods to ensure fuel quality and performance. ***FY 2020 Plans:*** Develop and evaluate forward-positioned fuel chemistry and property Quality Surveillance sensor systems. Continue development of interactive data visualization and data science tools to rapidly analyze fuel property, composition, performance, and logistics data. Field trial advance fuel contamination quality surveillance technology. Conduct lab, rig and component tests to assure interoperability with evolving commercial specification and platform requirements. ***FY 2021 Base Plans:*** Continue development of forward-positioned fuel chemistry and property Quality Surveillance sensors. Augment rapid data analysis tool to include hardware fuel performance test data. Conduct lab, rig and component tests to assure interoperability with evolving commercial specification and platform requirements. Develop advanced fuel compositional measurement capability. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The FY 2021 funding request was reduced to account for the availability of prior year execution balances. Decrease of FY21 funding will delay the development of advance composition measurement capability needed to expedite field problem root cause investigations by 18 months.					
Accomplishments/Planned Programs Subtotals	7.774	8.281	7.463	0.000	7.463

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Testing efforts will be competitively contracted, and performed under Cost Plus Fixed Fee and Firm Fixed Price contracts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NRL : Washington, D.C.	6.152	0.800	Dec 2018	1.000	Dec 2019	1.000	Dec 2020	-		1.000	Continuing	Continuing	Continuing
Systems Engineering	WR	NAWCAD : Patuxent River, MD	19.115	2.046	Dec 2018	2.187	Dec 2019	2.200	Dec 2020	-		2.200	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC : Philadelphia, PA	3.928	0.453	Jan 2019	0.500	Jan 2020	0.500	Jan 2021	-		0.500	Continuing	Continuing	Continuing
Systems Engineering	WR	NSWC : Bethesda, MD	0.362	0.100	Mar 2019	0.000		0.000		-		0.000	0.000	0.462	-
Systems Engineering	C/FFP	Various : Various	2.083	0.652	Apr 2019	1.021	Apr 2020	1.000	Apr 2021	-		1.000	0.000	4.756	4.756
Prior year Prod Dev no longer funded in the FYDP	Various	Various : Various	0.161	0.000		0.000		0.000		-		0.000	0.000	0.161	-
		Subtotal	31.801	4.051		4.708		4.700		-		4.700	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hardware Testing	WR	NAWCAD : Patuxent River, MD	4.649	0.200	Dec 2018	1.000	Dec 2019	0.500	Dec 2020	-		0.500	Continuing	Continuing	Continuing
Hardware Testing	C/CPFF	Life Cycle Engineering : Charleston, SC	14.980	1.943	Apr 2019	2.000	Mar 2020	2.000	Mar 2021	-		2.000	0.000	20.923	20.923
Hardware Testing	C/CPFF	Univ of Dayton Research Inst : Dayton, OH	0.889	0.400	Feb 2019	0.000		0.000		-		0.000	0.000	1.289	1.289
Hardware Testing	WR	US Naval Academy : Annapolis, MD	0.148	0.000	Apr 2019	0.040	Apr 2020	0.000		-		0.000	0.000	0.188	-
Hardware Testing	C/FFP	Various : Various	6.683	0.920	Feb 2019	0.223	Mar 2020	0.000		-		0.000	0.000	7.826	7.826
Fuel Delivery	MIPR	DLA-Energy : Ft. Belvoir, VA	0.647	0.000		0.050	Jan 2020	0.025	Jan 2021	-		0.025	0.000	0.722	-
Prior year T & E no longer funded in the FYDP	Various	Various : Various	31.545	0.000		0.000		0.000		-		0.000	0.000	31.545	-
		Subtotal	59.541	3.463		3.313		2.525		-		2.525	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract

Remarks

All prior year lines have been consolidated.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NAWCAD : Patuxent River, MD	1.591	0.250	Dec 2018	0.250	Dec 2019	0.228	Dec 2020	-		0.228	Continuing	Continuing	Continuing
Program Management Support	C/FFP	Coord Research Council : Alpharetta, GA	0.060	0.010	Nov 2018	0.010	Nov 2019	0.010	Nov 2020	-		0.010	0.000	0.090	0.080
Prior year Mgmt Supp no longer funded in the FYDP	Various	Various : Various	6.616	0.000		0.000		0.000		-		0.000	0.000	6.616	-
		Subtotal	8.267	0.260		0.260		0.238		-		0.238	Continuing	Continuing	N/A

Remarks

1.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	99.609	7.774		8.281		7.463		-		7.463	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*

Mobility Fuels– Project 0838 Schedule

1

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0838 / *Mobility Fuels (ADV)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Mobility Fuels (ADV)				
Fuel Quality Surveillance/Analysis: Advance Chemical Composition Detection	1	2019	2	2023
Fuel Quality Surveillance/Analysis: Deployable Fuel Property/Chemical Sensors	3	2019	4	2025
Mitigation of Field Identified Deficiencies: Develop and Implement advance fuel chemistry and properties analysis test methods and technologies	1	2019	4	2025
Mitigation of Field Identified Deficiencies: Enterprise Rapid Assessment Data Analytics	1	2019	4	2023
Emerging platform/CONOPS fuel interoperability: Conduct rig, component and hardware testing	1	2019	4	2025
Maintain operational compatibility with Commercial and International Fuel Specifications: Conduct laboratory, rig and hardware testing.	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603724N / *Navy Energy Program*				Project (Number/Name) 0928 / *Shore Energy Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
0928: *Shore Energy Technology*	53.982	1.682	1.869	1.879	-	1.879	1.920	1.960	1.998	2.039	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Legislation, Executive Orders (EO), and SECNAV Guidance direct DoN to increase energy security through resiliency, efficiency, reliability, cybersecurity and alternative energy sources. This guidance includes the National Defense Strategy (NDS) of 2018, A Design for Maintaining Maritime Superiority 2.0, and the NAVFAC Strategic Design 2.0. Guidance directs DOD to posture logistics capability (projected from Navy Installations) ashore and at sea in ways that allow the fleet to operate globally, at a pace that can be sustained over time. Improved resilience of our installations (employing key technology focus areas defined in the NDS) will enable platform refueling, re-arming, resupply and repair. Installations shall enable Dynamic Force Employment and Distributed Lethality.

This Energy RDT&E Project will test, evaluate, and validate components as well as demonstrate cost-effective and technical viability of energy security , efficiency, resilience, reliability, and technologies. All efforts will be coordinated across DOD and with other agencies as appropriate. Specifically, this project aims to pursue three areas of development, testing and evaluation: (A) Modeling and possible prototype testing of new energy sources for use at Naval installations with potential for widespread applicability to energy security; (B) It will support demonstration and validation of advanced electric grid management systems, known as "Smart Grid" and "Micro Grid" technology, for use at Naval installations to enable improved energy security; (C) Demonstration and Validation of Alternative Energy, Energy Efficiency, and Resiliency and Smart Energy Management Technology: This project will support the testing, demonstration, validation, and application of innovative facility energy efficiency and alternative energy technology.Cyber Security resilience technology shall align to NIST 800-82 and be interoperable within the NAVFAC cybersecurity enclave.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Shore Energy Technology	1.682	1.869	1.879	0.000	1.879
Articles:	-	-	-	-	-
FY 2020 Plans: -Continue development and demonstration of large-scale energy storage sites to include cyber security measures for execution. -Continue development and demostration of adaptable microgrids that utilize artificial intelligence and high voltage solid-state power electronics using renewable energy test bed. -Continue development and demonstration of predictive modeling, neural network, and predictive energy tools.					
FY 2021 Base Plans: -Development and demonstrate of large-scale energy storage sites to include cyber security measures. -Development and demostrate adaptable microgrids that utilize artificial intelligence and high voltage solid-state power electronics using renewable energy test bed.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0928 / *Shore Energy Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Development and demonstrate predictive modeling, neural network, and predictive energy tools. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** - FY 2020 to FY 2021 Increase/Decrease Statement: Increase of $0.01 in FY2021 budget due to additional investment in the demonstration of large-scale energy storage in operational locations.					
Accomplishments/Planned Programs Subtotals	1.682	1.869	1.879	0.000	1.879

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Demonstration and validation are conducted for maximum transfer and interaction with industry such as to influence the industry COTS with the results of this demonstration and prototype validation. Acquisition is based on performance specifications enabled by this project.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0928 / *Shore Energy Technology*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Renewable Energy	WR	EXWC : Port Hueneme, CA	42.260	0.000		0.040	Mar 2020	0.027	Oct 2020	-		0.027	Continuing	Continuing	Continuing
Energy Resiliency and Reliability, Security and Systems (Includes cybersecurity)	Various	EXWC : Port Hueneme, CA	6.400	1.682	Oct 2018	1.374	Oct 2019	0.800	Oct 2020	-		0.800	Continuing	Continuing	Continuing
Energy Storage	WR	EXWC : Port Hueneme, CA	5.322	0.000		0.455	Mar 2020	0.842	Oct 2020	-		0.842	Continuing	Continuing	Continuing
Renewable Energy (Direct Cite)	Various	EXWC : Port Hueneme, CA	0.000	0.000		0.000		0.210	Dec 2020	-		0.210	0.000	0.210	-
		Subtotal	53.982	1.682		1.869		1.879		-		1.879	Continuing	Continuing	N/A

Remarks

-Renewable Energy: ($0.040 FY20 - $0.27 in FY21): Increase in FY21 budget due to additional investment in demonstration of advanced large-scale energy collection technologies

- Energy Resiliency: ($1.374 FY20 - $0.800 in FY21): Decreased in FY21 due to shifting funding to renewable energy and to energy storage.

- Energy Storage: ($0.455 FY20 - $0.842 in FY21): Increase in FY21 budget due to additional investment in the demonstration of large-scale energy storage in operational locations

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	53.982	1.682		1.869		1.879		-		1.879	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0928 / *Shore Energy Technology*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Renewable Energy																												
Renewable Energy																												
Energy Resiliency and Reliability, Security and Systems (Includes Cybersecurity)																												
Energy Resiliency and Reliability, Security and Systems (Includes Cybersecurity)																												
Energy Storage																												
Energy Storage																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0928 / *Shore Energy Technology*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Renewable Energy				
Renewable Energy	1	2019	4	2025
Energy Resiliency and Reliability, Security and Systems (Includes Cybersecurity)				
Energy Resiliency and Reliability, Security and Systems (Includes Cybersecurity)	1	2019	4	2025
Energy Storage				
Energy Storage	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0996: *Aircraft Energy Conservation*	150.182	8.981	10.757	8.269	-	8.269	12.774	12.461	11.616	11.850	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The FY2021 funding request was reduced by $2.682 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

Naval aviation must operate independently worldwide often with limited logistics support. Additionally, legacy and emerging aircraft continually add capability to enhance their lethality and survivability. Improving an aircraft's energy efficiency has a direct relationship to enhanced combat capability in austere operating environments and meet the challenges of emerging threats. This program engages technical experts from across Naval aviation, industry, and academia to identify potential energy efficiency, best practices and technologies for development, testing and assessment to determine technical viability and potential benefit to mission capability.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Aircraft Operational Energy	8.981	10.757	8.269	0.000	8.269
Articles:	-	-	-	-	-

FY 2020 Plans:
Continue identification, testing and assessment of energy efficiency best practices, technologies and metrics. Conduct MQ-8C engine efficiency technology air vehicle integration testing. Continue fielding and assessing algorithm to optimize trim/reduce drag of F-18 during flight. Assess potential to expand Naval Aviation Energy Dashboard with maintenance/reliability metrics. Develop multiple classes of lithium ion battery designs for aviation applications.

FY 2021 Base Plans:
Continue identification, testing and assessment of energy efficiency best practices, technologies and metrics. Validate models and technologies to mitigate emerging thermal management challenges. Validate aircraft lithium ion battery designs.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The FY 2021 funding request was reduced to account for the availability of prior year execution balances. Decrease identified engine related efficiency testing by 18 months delaying potential validation of efficiencies and implementation.					
Accomplishments/Planned Programs Subtotals	8.981	10.757	8.269	0.000	8.269

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This is a non-acquisition program that develops, evaluates, and validates mature technologies in support of energy efficiency and increased mission capability.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	WR	NAWCAD : Patuxent River, MD	7.369	1.100	Dec 2018	2.257	Dec 2019	2.500	Dec 2020	-		2.500	Continuing	Continuing	Continuing
Systems Engineering	C/CPFF	The Boeing Company : Seattle, WA	1.150	0.850	Jan 2019	0.000		0.000		-		0.000	0.000	2.000	1.750
Systems Engineering	C/CPFF	Various : Various	8.009	4.394	Mar 2019	3.100	Mar 2020	2.439	Apr 2021	-		2.439	0.000	17.942	18.611
Systems Engineering	C/BA	Deloitte Consulting : Alexandria, VA	1.600	0.971	Apr 2019	1.000	Apr 2020	1.000	Apr 2021	-		1.000	0.000	4.571	4.800
Prior year Sys Eng no longer funded in the FYDP	Various	Various : Various	3.612	0.000		0.000		0.000		-		0.000	0.000	3.612	-
		Subtotal	21.740	7.315		6.357		5.939		-		5.939	Continuing	Continuing	N/A

Remarks

3. Decrease of $0.661 in FY21 will delay the development and validation of aircraft thermal management models.
5. All Prior Year lines have been consolidated.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hardware Testing	WR	NAWCAD : Patuxent River, MD	4.885	0.651	Dec 2018	1.000	Jan 2020	1.000	Jan 2021	-		1.000	Continuing	Continuing	Continuing
Hardware Testing	C/CPFF	Various : Various	0.000	0.740	Mar 2019	3.000	Mar 2020	1.000	Mar 2021	-		1.000	0.000	4.740	5.000
Prior year T&E no longer funded in the FYDP	Various	Various : Various	117.125	0.000		0.000		0.000		-		0.000	0.000	117.125	-
		Subtotal	122.010	1.391		4.000		2.000		-		2.000	Continuing	Continuing	N/A

Remarks

2. Decrease of 2.000 in FY21 will delay the testing of identified component engine efficiency technologies.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NAWCAD : Patuxent River, MD	1.920	0.275	Dec 2018	0.400	Nov 2019	0.330	Dec 2020	-		0.330	Continuing	Continuing	Continuing
Prog Mgnt no longer funded in the FYDP	Various	Various : Various	4.512	0.000		0.000		0.000		-		0.000	0.000	4.512	-
		Subtotal	6.432	0.275		0.400		0.330		-		0.330	Continuing	Continuing	N/A

Remarks

1. Decrease of 0.070 in FY21 to NAWCAD for program management support.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	150.182	8.981		10.757		8.269		-		8.269	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*

Aviation Energy - 0996

Notes:
* Roadmap leverages technology opportunities as they become available for maturation and transition to programs

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 0996 / *Aircraft Energy Conservation*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Aircraft Energy Conservation				
Air ENCOM Program: Aircraft Dashboard	1	2019	1	2022
Air ENCOM Program: Operational Energy Modeling	1	2019	3	2025
Air Vehicle Energy Efficiency RDT&E: Common Affordable Safe Energy Storage Batteries	1	2019	4	2024
Air Vehicle Energy Efficiency RDT&E: Advanced Thermal Management	3	2019	4	2025
Air Vehicle Energy Efficiency RDT&E: Advanced Fuel Cells for UAS Applications	1	2020	2	2023
Air Vehicle Energy Efficiency RDT&E: Technology Assessments	1	2019	4	2025
Engine Efficiency RDT&E: Turbine Engine Recuperator for UAS Applications	3	2019	4	2025
Engine Efficiency RDT&E: Advanced Component Technology	1	2019	4	2025
Engine Efficiency RDT&E: Technology Assessments	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603724N / *Navy Energy Program*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	48.899	6.757	31.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	87.156
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add for Hydrokinetic Energy Research
Congressional Add for Natural Gas Technologies.
Congressional Add for C545-Marine energy systems for sensors and microgrids
Congressional Add for C546-Navy energy program/shore energy

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Program Increase ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Commence and complete Battery Development and Safety Enterprise efforts.	0.000	15.000
Congressional Add: Program Increase: Renewable Energy Development ***FY 2019 Accomplishments:*** NAVFAC will continue to research and develop land- and ocean-based energy generation and energy efficiency technologies, and renewable energy systems, that have the potential to reduce the cost of energy and increase energy security, reliability and resiliency at Department of Defense facilities. NAVFAC will also continue its program of marine and hydrokinetic energy development and demonstration activities in coordination with other Federal agencies and entities. ***FY 2020 Plans:*** N/A	6.757	0.000
Congressional Add: Marine energy systems for sensors and microgrids ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** N/A	0.000	11.500
Congressional Add: Navy energy program/shore energy ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** N/A	0.000	5.000
Congressional Adds Subtotals	6.757	31.500

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

RDTEN Contracts are Competitive Procurements

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hydrokinetic Energy Research & Development	Various	EXWC : Port Hueneme, CA	15.915	0.000		0.000		0.000		-		0.000	0.000	15.915	-
Renewable Energy Development	Various	EXWC : Port Hueneme, CA	24.148	6.757	Jan 2020	0.000		0.000		-		0.000	0.000	30.905	-
Installation Energy Efficiency Enhancements	Various	EXWC : Port Hueneme, CA	4.836	0.000		0.000		0.000		-		0.000	0.000	4.836	-
Natural Gas Technology	Various	EXWC : Port Hueneme, CA	4.000	0.000		0.000		0.000		-		0.000	0.000	4.000	-
Marine energy systems for sensors and microgrids	Various	EXWC : Port Hueneme, CA	0.000	0.000		1.000	Sep 2020	0.000		-		0.000	0.000	1.000	-
C545-Marine energy systems for sensors and microgrids	TBD	University Affialisted Research Center : Port Hueneme, CA	0.000	0.000		8.000	Sep 2020	0.000		-		0.000	0.000	8.000	-
C545-Marine energy systems for sensors and microgrids	TBD	Wage energy Support Contractor : Port Hueneme, CA	0.000	0.000		2.500	Sep 2020	0.000		-		0.000	0.000	2.500	-
C546-Navy energy program/shore energy	TBD	EXWC : Port Hueneme, CA	0.000	0.000		5.000	Sep 2020	0.000		-		0.000	0.000	5.000	-
Battery Development and Safety Enterprise	TBD	TBD : TBD	0.000	0.000		15.000	Sep 2020	0.000		-		0.000	0.000	15.000	-
		Subtotal	48.899	6.757		31.500		0.000		-		0.000	0.000	87.156	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	48.899	6.757		31.500		0.000		-		0.000	0.000	87.156	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603724N / *Navy Energy Program*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Hydrokinetic Energy Research & Development: Hydrokinetic Energy Research & Development	1	2019	4	2020
Hydrokinetic Energy Research & Development: Renewable Energy Development: Renewable Energy Development	1	2019	4	2019
Hydrokinetic Energy Research & Development: Installation Energy Efficiency Enhancements: Installation Energy Efficiency Enhancements	2	2019	4	2020
Hydrokinetic Energy Research & Development: Installation Energy Efficiency Enhancements: Project C545-Marine energy systems for sensors and microgrids	4	2020	1	2025
Hydrokinetic Energy Research & Development: Installation Energy Efficiency Enhancements: Project C546-Navy energy program/shore energy	4	2020	1	2025
Battery Development and Safety Enterprise: Battery Development and Safety Enterprise	2	2020	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	16.803	5.177	3.440	4.664	-	4.664	6.607	6.651	6.714	6.819	Continuing	Continuing
0995: *Naval Facilities System*	11.598	4.001	2.240	2.215	-	2.215	2.146	2.176	2.215	2.256	Continuing	Continuing
3155: *Force Protection Ashore*	5.205	1.176	1.200	2.449	-	2.449	4.461	4.475	4.499	4.563	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mission Description and Budget Item Justification:

This program provides for capabilities to: a) overcome performance limitations and reduce the life cycle cost of shore facilities and, b) provide protection against terrorist attacks for shore installations and their operations. The program focuses on technical and operational issues of specific Navy interest, where there are no unbiased test validated Commercial Off the Shelf (COTS) solutions available, and where timely capabilities may not materialize without specific demonstration or validation by the Navy. Additionally, the program completes the development of technologies originating from Navy, DOD and other sources of Science and Technology programs, including the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST) and Department of Energy (DOE). Validated technologies are implemented in the Navy's Military Construction (MILCON) and Facilities, Sustainment Restoration and Modernization (FSRM) program, and Antiterrorism and Force Protection (ATFP) Other Procurement, Navy (OP,N) program.

Project 0995 addresses the following Navy facilities requirements during FY 2014 through FY 2020: Advance Technology for Waterfront Facilities Repair and Enhancements, Facilities Technologies to Reduce the Cost of Facilities Sustainment, Restoration and Modernization for reducing the total ownership cost (TOC) of future and existing Facilities and addressing natural and catastrophic risk of critical Naval Waterfront Facilities.

Force Protection Ashore Project 3155 addresses selective topics in modeling, and material technologies to reduce the vulnerability of installations; and reduce the acquisition and operating costs of protective technologies. The demonstrations and validations provide the independent, technical and operational test data for the development of competitive performance specifications to acquire the required capabilities. The ATFP project is coordinated with other DOD programs.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy					Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*		**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*			
B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	5.301	3.440	3.284	-	3.284
Current President's Budget	5.177	3.440	4.664	-	4.664
Total Adjustments	-0.124	0.000	1.380	-	1.380
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.124	0.000			
• Program Adjustments	0.000	0.000	1.301	-	1.301
• Rate/Misc Adjustments	0.000	0.000	0.079	-	0.079

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*				**Project (Number/Name)** 0995 / *Naval Facilities System*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
0995: *Naval Facilities System*	11.598	4.001	2.240	2.215	-	2.215	2.146	2.176	2.215	2.256	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In accordance with the National Defense Strategy (NDS) of 2018, A Design for Maintaining Maritime Superiority 2.0 and the NAVFAC Strategic Design 2.0 Guidance, this program provides the Navy with new engineering capabilities that are required to overcome specific performance limitations of Naval shore facilities while reducing the cost of sustaining the Naval shore infrastructure and increasing resiliency. The program focuses available RDT&E resources on satisfying facility requirements where the Navy is a major stakeholder or where there are no tested validated Commercial Off the Shelf (COTS) solutions available, and a timely solution will not emerge without a Navy sponsored demonstration and validation. The program completes the development and validation of facility technologies originating in Navy science and technology programs, plus a variety of other sources that includes the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). This program introduces the idea of resilient facilities and infrastructure thru hardening, rapid assessment, and recovery. The validated technologies will be implemented in the Navy's Military Construction (MILCON) and Facilities Sustainment Restoration and Modernization Programs (FSRM). The Duncan Hunter National Defense Authorization Act of 2009 laid down very specific guidelines for the correction of corrosion deficiencies in DoD shore facilities which is estimated to be $1.9B (DOD Annual Cost of Corrosion for the Department of Defense Facilities and Infrastructure July 2010).

Project 0995 addresses two Navy facilities requirements: 1) waterfront facilities repair, upgrade and service life extension; and, 2) validation testing/performance monitoring of critical facilities (such as dry docks, piers, runways, magazines, etc.), testing and evaluation of the performance of alternative materials, and surfacing concepts, and, methods and corrosion technologies to reduce the cost of Sustainment, Restoration and Modernization (SRM).

Waterfront facilities, repair, upgrade and service life extension:
Improved resilience of our installations (employing key technology focus areas defined in the NDS) will enable readiness and fleet lethality. An urgent requirement exists for early identification of strategies and solution recommendations for sea level rise at Naval Facilities, and especially nuclear capable waterfront facilities. Recent weather patterns have heightened anxiety levels on perceived huge risks to Navy waterfront facilities. The sub-project will provide analysis and solution recommendations for facilities affected by sea level rise. Approximately 75% of the Navy's waterfront facilities are over 45 years old, but they were designed for a service life of 25 years. The over aged reinforced concrete requires costly and repetitive repairs. Besides providing more pier side ship maintenance and thus reduce dry dock costs, these piers must be strengthened to support concentrated crane loads up to 140 tons when piers were originally not designed for concentrated loads. Piers were previously designed to service one, or possibly two, specific ship classes. Berthing flexibility is now limited by mooring and utility arrangements. This sub-project addresses new material design and retrofit methods, which extends the service life of existing waterfront facilities by an additional 15 years, or longer. The project also addresses updating the mission-based service, environmental, and protection loading requirements imposed by changes in platforms, operations and threats. Other initiatives include leveraging Building Information Modeling (BIM) technology to provide for enhanced facilities management processes and waterfront utilities service enhancements using models to achieve flexible berthing arrangements consistent with current and future platform mooring configurations and hotel service requirements including Facilities and Infrastructure Integrated Product Support for Acquisition Category (ACAT) Programs.

Technologies to reduce the cost of Sustainment, Restoration and Modernization (SRM):

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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Technologies to reduce the cost of SRM issues of high operational significance are addressed on a priority basis. The Navy's portion of corrosion deficiencies at DoD shore facilities is estimated to be $433M (DOD Annual Cost of Corrosion for the Department of Defense Facilities and Infrastructure July 2010). This effort will demonstrate and validate the cost and reliability of advanced corrosion technologies in order to ensure their acceptance and implementation.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Waterfront facilities, repair, upgrade and service life extension:	2.831	0.769	0.944	0.000	0.944
Articles:	-	-	-	-	-
FY 2020 Plans: FY20 Plans to include: -Funding the development of methodologies for Field Carrier Landing Practice (FCLP) pavement repairs and material selection capable of withstanding repeated exposure to Joint Strike Fighter (JSF) F-35 Short Take-Off and Vertical Landing (STOVL) conditions. -Funding technologies that facilitate the assessment, repair and continued operation of Strategic Airlift (STRATLIFT) sorties. -Funding technologies to physically harden critical facility elements that enable fleet operations. ***FY 2021 Base Plans:*** -Continue the development of methodologies for Field Carrier Landing Practice (FCLP) pavement repairs and material selection capable of withstanding repeated exposure to Joint Strike Fighter (JSF) F-35 Short Take-Off and Vertical Landing (STOVL) conditions. -Continue funding technologies that facilitate the assessment, repair and continued operation of Strategic Airlift (STRATLIFT) sorties. -Continue funding technologies to physically harden critical facility elements that enable fleet operations and mitigate the effects of sea level rise. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** -Increase of 0.175 in FY21 budget due to expanding investments in Implementation of "Internet of things," SCADA, and cybersecurity initiatives that require 5G wireless broadband access at Naval facilities.					
Title: Sustainment, Restoration & Modernization:	1.170	1.471	1.271	0.000	1.271
Articles:	-	-	-	-	-
FY 2020 Plans: -Funding strategies and technologies to better maintain and modernize Navy undersea facility infrastructure, focusing on harvesting, distribution and supply of subsea power and communications.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Funding technologies that will significantly reduce the sustainment cost of installations. This includes technologies that mitigate corrosion, facilitate inspection and assessment, increase longevity and reduce the cost of construction and reduce the cost of maintenance by developing systems that are more reliable and maintainable by the user. ***FY 2021 Base Plans:*** -Continue funding strategies and technologies to better maintain and modernize Navy undersea facility infrastructure, focusing on harvesting, distribution and supply of subsea power and communications. -Continue funding technologies that will significantly reduce the sustainment cost of installations. This includes technologies that mitigate corrosion, facilitate inspection and assessment, increase longevity while reducing the cost of construction, and reducing the cost of maintenance by developing systems that are more reliable and maintainable by the user. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** -Decrease of 0.2 in FY21 budget due to decreasing efforts for corrosion prevention					
Accomplishments/Planned Programs Subtotals	4.001	2.240	2.215	0.000	2.215

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Projects identified in this budget have been carefully selected to respond to: Facilities support for the National Defense Strategy of 2018, Acquisition Category Programs, to address TOC and resiliency considerations of an evolving and aging infrastructure, and to facilitate rational risk based decisions and solutions to protect and decrease risk levels for Department of the Navy-critical infrastructure and facilities. Each project has been assessed to ensure that it is addressing legitimate risks and requirements of the shore establishment. The results of these projects will be the development of design and construction criteria and or components that directly influence shore facilities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Waterfront Facilities, Repair, Upgrade and Services Life Extension	Various	NAVFAC EXWC : Pt Hueneme, CA	4.296	2.831	Oct 2018	0.769	Jan 2020	0.944	Oct 2020	-		0.944	Continuing	Continuing	Continuing
Sustainment, Restoration and Modernization	Various	NAVFAC EXWC : Pt Hueneme, CA	7.302	1.170	Oct 2018	1.471	Jan 2020	1.271	Oct 2020	-		1.271	Continuing	Continuing	Continuing
		Subtotal	11.598	4.001		2.240		2.215		-		2.215	Continuing	Continuing	N/A

Remarks

-Sustainment, Restoration and Modernization: ($1.247 FY19-$1.471 in FY20): Increase of 224K in FY20 budget due to expanding investment in Implementation of "Internet of things," SCADA, and cybersecurity initiatives that require 5G wireless broadband access.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	11.598	4.001		2.240		2.215		-		2.215	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 0995 / *Naval Facilities System*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Waterfront Facilities, Repair, Upgrade and Service Life Extension																												
Continue Waterfront Facilities, Repair, Upgrade and Service Life Extension																												
Engineering Coatings for Fasteners																												
Carbon Fiber Reinforced Polymer Rebar for Concrete Waterfront Facilities																												
Autonomous Inspection Techonology and Systems for Waterfront Facilities																												
Sea Level Rise Effects																												
Fluid Induced Vibrational (FIV) Degradation and Augmented Reality (AR)																												
Sustainment, Restoration & Moderization																												
Continue Sustainment, Restoration & Moderization																												
Corrosion Prevention and Control																												
High Temperature Pavement Design Mix Optimization																												
Evaluate Solutions to Develope Design and Contruction Criteria																												
Retrofitting Existing Facilities to Conform to High Performance Building Standards																												
Develope Design Criteria for Closed Piers and Wharves																												
Effectiveness of Vapor Phase Corrosion Inhibitors in Protection of Aboveground Storage Tanks																												

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 0995 / *Naval Facilities System*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Unmanned Systems for Facilities Inspection and Design Reconstruction																												
Additive Manucturing (AM)																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 0995 / *Naval Facilities System*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Waterfront Facilities, Repair, Upgrade and Service Life Extension				
Continue Waterfront Facilities, Repair, Upgrade and Service Life Extension	1	2019	4	2025
Engineering Coatings for Fasteners	1	2019	4	2025
Carbon Fiber Reinforced Polymer Rebar for Concrete Waterfront Facilities	1	2019	4	2025
Autonomous Inspection Techonology and Systems for Waterfront Facilities	1	2019	4	2025
Sea Level Rise Effects	1	2019	4	2025
Fluid Induced Vibrational (FIV) Degradation and Augmented Reality (AR)	1	2019	1	2025
Sustainment, Restoration & Moderization				
Continue Sustainment, Restoration & Moderization	1	2019	4	2025
Corrosion Prevention and Control	1	2019	4	2025
High Temperature Pavement Design Mix Optimization	1	2019	4	2025
Evaluate Solutions to Develope Design and Contruction Criteria	1	2019	1	2025
Retrofitting Existing Facilities to Conform to High Performance Building Standards	1	2019	1	2025
Develope Design Criteria for Closed Piers and Wharves	1	2019	1	2025
Effectiveness of Vapor Phase Corrosion Inhibitors in Protection of Aboveground Storage Tanks	1	2019	1	2025
Unmanned Systems for Facilities Inspection and Design Reconstruction	1	2019	1	2025
Additive Manucturing (AM)	1	2019	1	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 3155 / *Force Protection Ashore*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3155: *Force Protection Ashore*	5.205	1.176	1.200	2.449	-	2.449	4.461	4.475	4.499	4.563	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Protection of Navy installations against terrorist activities requires deployment of advanced technology for force protection capabilities. This antiterrorism and force protection (AT/FP) ashore project will develop, demonstrate and validate technologies for the following: access control and integrated perimeter security surveillance sensors and intelligent electronic security systems for automated intruder detection (Installation Protection); perimeter security; waterside protection against craft and swimmer intrusion; secure and efficient operations centers and emergency management centers including human and information support systems (Command and Control). Programs currently being evaluated are, standard-based enterprise physical security system integration and automation; Command, Control, and Communications (C3) capabilities for emergency operations; integrated and networked mass notification systems (MNS); Waterside intelligent video security systems; integrated over-the-water sensors and analytics for automated course of action planning; identifying and interdicting malevolent threats - watercraft, swimmers, divers, and unmanned underwater vessels (UUVs) to reduce injury and death to the warfighter and damage to high value units (HVUs)(Waterside Protection). Through demonstration and validation of risk modeling and simulation models, the potential of emerging technologies will be evaluated and installation security strategies that reduce manpower and other costs will be formulated. Multiple systems with sensors and cameras are being deployed on Navy installations to be used for threat assessment. These systems are not integrated and there is not a centralized location or system that all the data can be analyzed. The Sensor Assessment Cell (SAC) brings all these sensor feeds into one location and the Physical Security Information Management (PSIM) software provides an integrated picture so that an intelligent assessment can be made. Current AT/FP systems to be integrated include Automated Vehicle Gates (AVG), Regional Alarms/Local Alarms (AMAS), Navy Munition Command enclave (NMC), and Electronic Harbor Security System. These demonstrations and validations derive advanced technology from science and technology programs of government academia and industry. The technology evaluation and validation produces data for performance specifications used for competitive procurement. All work will be coordinated with other programs and through industry forums as appropriate.

Project 4038:Cyber Vulnerability Assessments of Critical Infrastructure
The Cyber Vulnerability Assessments and Evaluations program funds cyber vulnerability assessments of critical shore infrastructure as directed by Section 1650 of the FY17 National Defense Authorization Act (NDAA). Funding will be used for assessments of prioritized critical shore infrastructure. Sec. 1650 of the FY17 NDAA directs the Secretary of Defense to submit a plan for assessing the cyber vulnerability of critical defense infrastructure and begin assessment of this infrastructure during a preliminary pilot program that will assess no fewer than two installations by December, 31 2019. Funded vulnerability assessments will end by calendar year 2020 and will build upon existing mission assurance, blue team, and red team capabilities. As instructed by the Congressional language, the assessments will utilize DoE and DoD national laboratory partnerships. Assessments will end with the submission of a final report to Congress. Strategies and procedures for mitigating the risk of cyber vulnerabilities should be identified during the course of evaluation vulnerability

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Force Protection Ashore	1.176	1.200	2.449	0.000	2.449
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 3155 / *Force Protection Ashore*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: FY 2020 Base Plans: - Continue Counter Unmanned Aerial Systems (CsUAS) - Used to detect, assess and classify airborne threat for the defense against full scale and man deployable UAV, Drones, R/C platforms. Emphasis on spoof and kill-on-kill technologies. [450K] - Initiate Access Control Point (ACP) Video Analytics - Using Video Analytics to Detect, Assess and Classify Vehicles or Personnel attempting to enter or leave an ACP. Emphasis on foot traffic, small footprint vehicles (Scooter, Bicycle), wrong-way detection. [250K] - Initiate Waterside Intelligent Video Security System (WSIVDS) - Integrated over-the-water sensors and analytics for automated course of action planning. Identifying and interdicting malevolent threats (watercraft, swimmers, divers, and unmanned underwater vessels (UUVs)) for the protection of personnel and High Value Units (HVU). [$500K]					
FY 2021 Base Plans: FY 2021 Base Plans (Project 3155 ATFP): -Continue Waterside Intelligent Video Security System (WSIVDS) - Integrated over-the-water sensors and analytics for automated course of action planning. Identifying and interdicting malevolent threats (watercraft, swimmers, divers, and unmanned underwater vessels (UUVs)) for the protection of personnel and High Value Units (HVU). [$300K] -Initiate the Integrated Multi-sensor Perimeter Awareness with Intelligent LiDAR (IMPAIL) System of Systems (SoS) will leverage advancements and ubiquity in autonomous vehicle obstacle detection / avoidance sensors (LiDAR), fusing with Installations' existing electronic security systems to enhance unauthorized access situational awareness, detection, threat classification, and tracking in 3-Dimensions.[$250K] -Initiate Multimodal Automated Vehicle Barrier (MAVB)- Integrate Active Vehicle Barriers (AVB's) using a PLC and Sensor alarms into an enterprise Physical Security Information Manager (PSIM) architecture able to be monitored at the Sensor Assessment Cells (SAC) and develop multimode active vehicle interface to further reduce unauthorized access by reducing likely avenues of approach.[450K] -Initiate Modeling and Simulation of Requirements (M/S - REQ) Modeling and Simulation of system requirements using SysML modeling software. Changes in requirements will be tracked via the model to ascertain how a system requirements change affects the enterprise systems architecture[$155K] FY21 BASE PLAN PROJECT 4038: -Participate in Joint Testing and Training exercises for ICS/SCADA Assessments -Conduct Red Team review of deployed FRCS Architecture and (CSPE) Control Systems Platform Enclave					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 3155 / *Force Protection Ashore*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Continue a common environment to TRL-6 to monitor and configure SDN flow controllers -Develop implementation guides for future FRCS SDN deployments -Continue Fleet Level Experimentation Exercise (FLEX) participation and integration in to Control systems Test Bed -Continue Modeling and Simulation (SCEPTRE) deployment into CSTB -Cyber Protection and Response Capability (CPRC) [.500] -Continue More Situational Awareness (MOSAICS) Industrial Control systems [.800] ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of 1.249 is to continue Cyber Protection Response Capabilities(Project 4038) and to continue providing Situational awareness of Control Systems					
Accomplishments/Planned Programs Subtotals	1.176	1.200	2.449	0.000	2.449

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Demonstration and validation is conducted for maximum transfer and interaction with industry such as to influence the industry COTS with the results of this demonstration and prototype validation. Acquisition is based on performance specifications enabled by this project.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Command and Control Capability Development: Government Engineering Support	Various	SPAWAR : San Diego, CA	0.499	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Installation Protection: Airborne Threat	WR	NAWCAD/ONR : Pax River, MD	0.907	0.330	Nov 2018	0.450	Feb 2020	0.000		-		0.000	0.000	1.687	-
Access Control Point (ACP)	Various	SPAWAR : San Diego, CA	0.000	0.000		0.250	Feb 2020	0.000		-		0.000	0.000	0.250	-
Waterside Intelligent Video Security System (WSIVDS)	Various	SPAWAR : San Diego, CA	0.000	0.000		0.500	Feb 2020	0.300	Dec 2020	-		0.300	0.000	0.800	-
Command and Control Capability Development: Virtual Field Support	WR	SPAWAR : San Diego, CA	0.677	0.220	Nov 2018	0.000		0.000		-		0.000	0.000	0.897	-
Integrated Multi-sensor Perimeter Awareness with Intelligent LiDAR (IMPAIL) System	Various	NIWC-PAC : San Diego, CA	0.000	0.000		0.000		0.244	Dec 2020	-		0.244	0.000	0.244	-
Waterside Protection: Boat Barriers	C/CPFF	CTTSO : CTTSO	0.677	0.322	Nov 2018	0.000		0.000		-		0.000	0.000	0.999	-
Multimodal Automated Vehicle Barrier (MAVB	Various	NIWC-PAC : San Diego, CA	0.000	0.000		0.000		0.450	Dec 2020	-		0.450	0.000	0.450	-
Sensor Assessment Cell (SAC) Capability Development	Various	SPAWAR : San Diego, CA	0.000	0.304	Nov 2018	0.000		0.000		-		0.000	0.000	0.304	-
Modeling and Simulation of Requirements (M/S ? REQ)	Various	NIWC-LANT : Charleston,SC	0.000	0.000		0.000		0.155	Dec 2020	-		0.155	0.000	0.155	-
Cyber Protection and Response Capability	WR	EXWC : Pt. Hueneme, CA	0.000	0.000		0.000		0.500	Aug 2021	-		0.500	0.000	0.500	-
More Situational Awareness (MOSAICS)	C/CPFF	SANDIA National Labs : SANDIA National Labs	0.000	0.000		0.000		0.800	Aug 2021	-		0.800	0.000	0.800	-
Installation Protection Capability Development	Various	NSWC : Dahlgren, VA	0.597	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
- Integrated Physical Security and Access Control Automation: Spiral Development															
Installation Protection Capability Development -Integrated Physical Security and Access Control Automation:Test & Evaluation (DT)	Various	NSWC : Dahlgren, VA	0.449	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Installation Protection Capability Development - Integrated Physical Security and Access Control Automation:Test & Evaluation (OT)	Various	SPAWAR : San Diego, CA	0.332	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Water Protection - Common Information Exchange Spiral Development	WR	SSC-PAC : SSC-PAC	0.244	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Installation Protection - Versatile Access Control Spiral Development	WR	NSWC : Dahlgren, VA	0.339	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Waterside Protection - Boat Barrier Electronic Infrastructure - Spiral Development	WR	SSC-PAC : SSC-PAC	0.484	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	5.205	1.176		1.200		2.449		-		2.449	Continuing	Continuing	N/A

Remarks

-Installation Protection: Airborne Threat: ($0.330 FY19-$0.450 in FY20): Increase due to increase in scope of testing to include kinetic solutions for airborne threats. Testing kinetic solutions is at a higher cost.

- Access Control Point (ACP): ($0.00 FY19-$0.250 in FY20): Increase due to new start in pilot program to design/test smart active barriers at an ACP.

- Waterside Intelligent Video Security System (WSIVDS): ($0.00 FY19-$0.500 in FY20): Increase due to new Start in pilot program to design/test new technologies for the detection of swimmers and UUAV's.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project 4038: -Cyber Protection and Response Capability $.500 FY21 -More Situational Awareness $.800 FY21															

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.205	1.176		1.200		2.449		-		2.449	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Installation Protection Capability Development																												
Installation Protection Capability Development																												
Subproj: Integrated Physical Security and Access Control Automation: Spiral Development																												
Subproj: Installation Protection - Airborne Threat: Test & Evaluation (DT)																												
Installation Protection - Access Control: Test & Evaluation (DT)																												
Subproj: (Access Control Point) ACP Video Analytics																												
Command and Control Capability Development																												
Command and Control Capability Development																												
Subproj: Command and Control Capability Development - Virtual Field Support: Test & Evaluation (DT)																												
Waterside Protection Capability Development																												
Waterside Protection Capability Development																												
Subproj: Automated Sensor Assessment and Course of Action Planning: Spiral Development																												
Subproj: Waterside Protection: Common Information Exchange - Sprial Development																												

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 3155 / *Force Protection Ashore*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Waterside Protection Boat Barriers - Test and Evaluation (OT)																												
Subproj: Waterside Intelligent Video Security System																												
Sensor Assessment Cell (SAC) Capability Development: Subproj: Physical Security Information Manager (PSIM)																												
Sensor Assessment Cell (SAC) Capability Development: Subproj: PSIM Sensor Integration																												
Sensor Assessment Cell (SAC) Capability Development: Subproj: Regional Dispatch/ SAC systems Integration																												

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603725N / *Facilities Improvement*	**Project (Number/Name)** 3155 / *Force Protection Ashore*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Installation Protection Capability Development				
Installation Protection Capability Development	1	2019	4	2022
Subproj: Integrated Physical Security and Access Control Automation: Spiral Development	2	2019	4	2022
Subproj: Installation Protection - Airborne Threat: Test & Evaluation (DT)	2	2019	4	2020
Installation Protection - Access Control: Test & Evaluation (DT)	2	2019	4	2020
Subproj: (Access Control Point) ACP Video Analytics	1	2019	1	2021
Command and Control Capability Development				
Command and Control Capability Development	1	2019	4	2022
Subproj: Command and Control Capability Development - Virtual Field Support: Test & Evaluation (DT)	2	2019	4	2020
Waterside Protection Capability Development				
Waterside Protection Capability Development	1	2019	4	2022
Subproj: Automated Sensor Assessment and Course of Action Planning: Spiral Development	1	2019	4	2022
Subproj: Waterside Protection: Common Information Exchange - Sprial Development	1	2019	2	2022
Waterside Protection Boat Barriers - Test and Evaluation (OT)	2	2019	4	2021
Subproj: Waterside Intelligent Video Security System	1	2019	4	2021
Sensor Assessment Cell (SAC) Capability Development: Subproj: Physical Security Information Manager (PSIM)	1	2019	4	2022
Sensor Assessment Cell (SAC) Capability Development: Subproj: PSIM Sensor Integration	1	2019	4	2022
Sensor Assessment Cell (SAC) Capability Development: Subproj: Regional Dispatch/ SAC systems Integration	1	2019	4	2022

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603734N / *CHALK CORAL*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	254.023	307.392	545.763	3.000	548.763	516.887	582.078	614.073	543.361	Continuing	Continuing
1804: *Chalk Coral*	0.000	254.023	307.392	545.763	3.000	548.763	516.887	582.078	614.073	543.361	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	267.477	346.800	492.010	-	492.010
Current President's Budget	254.023	307.392	545.763	3.000	548.763
Total Adjustments	-13.454	-39.408	53.753	3.000	56.753
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-39.408			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-5.000	0.000			
• SBIR/STTR Transfer	-8.454	0.000			
• Program Adjustments	0.000	0.000	53.436	-	53.436
• Rate/Misc Adjustments	0.000	0.000	0.317	3.000	3.317

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	51.489	2.803	3.857	3.884	-	3.884	4.024	4.242	4.206	4.291	Continuing	Continuing
2955: *JEDMICS*	47.864	2.803	2.880	2.837	-	2.837	2.981	3.224	3.168	3.232	Continuing	Continuing
3223: *Logistics R&D*	3.625	0.000	0.977	1.047	-	1.047	1.043	1.018	1.038	1.059	Continuing	Continuing

A. Mission Description and Budget Item Justification

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

Includes development and evaluation of incentive systems for improving the productivity of civilian and military personnel. Identifies barriers to increased productivity and evaluates the effect of removing them. Develops techniques for easing the introduction of new technology to the work place. Identifies and evaluates methods for improving the quality of work-life.

Excludes civilian and military manpower and their related costs and military construction costs which are included in appropriate Management and Support elements in this program.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	2.913	3.857	3.943	-	3.943
Current President's Budget	2.803	3.857	3.884	-	3.884
Total Adjustments	-0.110	0.000	-0.059	-	-0.059
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.110	0.000			
• Program Adjustments	0.000	0.000	-0.057	-	-0.057
• Rate/Misc Adjustments	0.000	0.000	-0.002	-	-0.002

Change Summary Explanation

The increase to project 3223 from FY 2020 to FY 2021 is to accommodate additional material studies and analysis of Clothing Protection for the Warfighter.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*				**Project (Number/Name)** 2955 / *JEDMICS*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2955: *JEDMICS*	47.864	2.803	2.880	2.837	-	2.837	2.981	3.224	3.168	3.232	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In FY85 Congress directed the Services and Defense Logistics Agency to permanently capture, manage and control engineering data in digital format so it would be available to support competitive spares re-procurement. The Joint Engineering Data Management Information & Control System (JEDMICS) program manages and controls 100,000,000 engineering images and has 13,000 authorized users responsible for over 77,000 user sessions per month. Over 1.2 million digital images are retrieved each month. New data and new users are added each month as DoD re-engineers its business processes to take advantage of digital data that is managed and controlled for corporate reuse. The JEDMICS system is deployed at 5 interoperable sites that service user locations worldwide. Data stored in JEDMICS is used for Logistics Support, Spares re-procurement, Weapons Systems procurement, Engineering, Maintenance, Distribution, Manufacturing, Air National Guard and Deployed Engineering Technical Services organizations. JEDMICS facilitates work process re-design since it brings the electronic drawings to the desktop, shop floor or flight line in real time eliminating walk, wait and slack time to retrieve drawings. Additionally, Administrative Lead Time, Repair Turn Around Time, Engineering Change Proposal processing time, demilitarization time, and all cycle times dependent on engineering data have decreased with the real time availability of digital engineering data. JEDMICS also facilitates Electronic Commerce since it produces digital technical data packages that can be forwarded along with an electronic order. Funds are for Commercial Off The Shelf (COTS) test, evaluation and integration. JEDMICS development efforts are required to integrate and test COTS upgrades.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: JEDMICS Development	2.751	2.828	2.785	0.000	2.785
Articles:	-	-	-	-	-
Description: Conduct development efforts associated with JEDMICS software releases. Conduct COTS requirements definition, evaluation, integration and testing of annual baseline releases. Conduct technology insertion of the JEDMICS system that is required to protect the $21B digital data asset managed in JEDMICS. These annual releases are necessary to incorporate changes that are essential to keeping the system running within the Navy's Enterprise. They include Service mandated Information Technology changes, storage capability increases for emerging engineering data formats, changes to accommodate commercial hardware and software end-of-life product obsolescence, and defenses for newly recognized Information Assurance vulnerabilities affecting the systems various software applications.					
FY 2020 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Develop and integrate JEDMICS Software Release 3.0.21. ***FY 2021 Base Plans:*** Develop and integrate JEDMICS Software Release 3.0.22 ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20-21 decrease due to requirement integration cost.					
Title: JEDMICS Test	0.026	0.026	0.026	0.000	0.026
Articles:	-	-	-	-	-
Description: Conduct test and readiness reviews and functional performance tests on JEDMICS system. ***FY 2020 Plans:*** Complete DT of JEDMICS Software Release 3.0.20. Initiate DT of JEDMICS Software Release 3.0.21. ***FY 2021 Base Plans:*** Complete DT of JEDMICS Software Release 3.0.21. Initiate DT of JEDMICS Software Release 3.0.22. ***FY 2021 OCO Plans:*** N/A					
Title: JEDMICS Evaluation & Review	0.026	0.026	0.026	0.000	0.026
Articles:	-	-	-	-	-
Description: Conduct technical evaluations and configuration control reviews of JEDMICS system. ***FY 2020 Plans:*** Conduct technical evaluations and review for JEDMICS Software Release 3.0.22. ***FY 2021 Base Plans:*** Conduct technical evaluations and review for JEDMICS Software Release 3.0.23. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	2.803	2.880	2.837	0.000	2.837

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Competitively awarded requirements type contract for engineering, design, development and test efforts. Performance-based reviews conducted quarterly by the Project Management Office.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	TBD	TBD : TBD	0.000	0.000		0.160	Oct 2019	0.160	Oct 2020	-		0.160	0.000	0.320	-
Software Development	Various	Northrop Grumman Information : McLean, VA	41.702	2.751	Nov 2018	2.668	Nov 2019	2.625	Nov 2020	-		2.625	Continuing	Continuing	Continuing
Prior Year Support no Longer Funded in Budget Year or Out years	Various	Various : Various	1.862	0.000		0.000		0.000		-		0.000	0.000	1.862	-
		Subtotal	43.564	2.751		2.828		2.785		-		2.785	Continuing	Continuing	N/A

Remarks

Remarks: Funds are for development efforts associated with Commercial Off The Shelf (COTS) obsolescence on the fully deployed COTS Intensive Joint Engineering Data Management Infomation & Control System. Funds are for COTS evaulation, integration, and test and evaluation. The common baseline will be maintained and obsolete COTS software and hardware will be replaced. Baseline releases will protect joint interoperability, upgrade operating systems for security patches and supportable versions, support integration to replace obsolete COTS, and upgrade the Oracle database to supportable versions.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	MIPR	WR-ALC/TILAB : Robins AFB, GA	2.598	0.026	Oct 2018	0.026	Oct 2019	0.026	Oct 2020	-		0.026	Continuing	Continuing	Continuing
		Subtotal	2.598	0.026		0.026		0.026		-		0.026	Continuing	Continuing	N/A

Remarks

Supports testing and evaluation of baseline releases in a user environment.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	Naval Air Warfare Center : NAS Patuxent River, MD	0.320	0.015	Oct 2018	0.015	Oct 2019	0.015	Oct 2020	-		0.015	Continuing	Continuing	Continuing
Travel	Various	Various : Various	0.299	0.011	Jul 2019	0.011	Jul 2020	0.011	Jul 2021	-		0.011	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Year Mgmt no Longer Funded in Budget Year or Out years	Various	Various : Various	1.083	0.000		0.000		0.000		-		0.000	0.000	1.083	-
		Subtotal	1.702	0.026		0.026		0.026		-		0.026	Continuing	Continuing	N/A

Remarks

Supports program compliance reviews and program related travel by government employees.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	47.864	2.803		2.880		2.837		-		2.837	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
JEDMICS				
Aquisition Milestones: IOC: IOC Release 3.0.19	2	2019	2	2019
Aquisition Milestones: IOC: IOC Release 3.0.20	2	2020	2	2020
Aquisition Milestones: IOC: IOC Release 3.0.21	2	2021	2	2021
Aquisition Milestones: IOC: IOC Release 3.0.22	2	2022	2	2022
Aquisition Milestones: IOC: IOC Release 3.0.23	2	2023	2	2023
Aquisition Milestones: IOC: IOC Release 3.0.24	2	2024	2	2024
Aquisition Milestones: IOC: IOC Release 3.0.25	2	2025	2	2025
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.21	4	2019	4	2019
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.22	4	2020	4	2020
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.23	4	2021	4	2021
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.24	4	2022	4	2022
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.25	4	2023	4	2023
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.26	4	2024	4	2024
Aquisition Milestones: Requirements: Service IPT/ECPs: Service IPT/ECPs Release 3.0.27	4	2025	4	2025
Aquisition Milestones: Contract Award: 2019 Contract Award	1	2019	1	2019
Aquisition Milestones: Contract Award: 2020 Contract Award	1	2020	1	2020
Aquisition Milestones: Contract Award: 2021 Contract Award	1	2021	1	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Aquisition Milestones: Contract Award: 2022 Contract Award	1	2022	1	2022
Aquisition Milestones: Contract Award: 2023 Contract Award	1	2023	1	2023
Aquisition Milestones: Contract Award: 2024 Contract Award	1	2024	1	2024
Aquisition Milestones: Contract Award: 2025 Contract Award	1	2025	1	2025
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.20	1	2019	3	2019
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.21	1	2020	3	2020
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.22	1	2021	3	2021
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.23	1	2022	3	2022
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.24	1	2023	3	2023
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.25	1	2024	3	2024
Aquisition Milestones: Software & Hardware Evaluation/Integration: Software Hardware Evaluation/Integration Release 3.0.26	1	2025	3	2025
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.20	3	2019	3	2019
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.21	3	2020	3	2020
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.22	3	2021	3	2021
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.23	3	2022	3	2022
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.24	3	2023	3	2023
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.25	3	2024	3	2024
Test & Evaluation Milestones: Risk Assesment: Risk Assessment Release 3.0.26	3	2025	3	2025
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.20	4	2019	4	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.21	4	2020	4	2020
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.22	4	2021	4	2021
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.23	4	2022	4	2022
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.24	4	2023	4	2023
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.25	4	2024	4	2024
Test & Evaluation Milestones: Developmental/Functional Testing: Developmental/ Functional Testing Release 3.0.26	4	2025	4	2025
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.20	4	2019	1	2020
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.21	4	2020	1	2021
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.22	4	2021	1	2022
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.23	4	2022	1	2023
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.24	4	2023	1	2024
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.25	4	2024	1	2025
Test & Evaluation Milestones: Alpha/Beta Testing: Alpha/Beta Testing Release 3.0.26	4	2025	4	2025
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.19	2	2019	2	2019
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.20	2	2020	2	2020
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.21	2	2021	2	2021
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.22	2	2022	2	2022
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.23	2	2023	2	2023

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 2955 / *JEDMICS*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.24	2	2024	2	2024
Deliveries: Engineering Change Package: Engineering Change Package Release 3.0.25	2	2025	2	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603739N / *Navy Logistic Productivity*				Project (Number/Name) 3223 / *Logistics R&D*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3223: *Logistics R&D*	3.625	0.000	0.977	1.047	-	1.047	1.043	1.018	1.038	1.059	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Stable annual funding is required to facilitate implementation and execution of a robust, flexible Logistics R&D program that will provide the means for Naval Supply Systems Command (NAVSUP) to effectively pursue solutions to mission-related capability and technology gaps. The NAVSUP Logistics R&D program has an established infrastructure and business process for ensuring that R&D funds are applied to projects that address high priority enterprise needs established in accordance with OPNAV goals and the NAVSUP Commander's Guidance.

From a process perspective, Logistics R&D investments are governed by a NAVSUP enterprise-wide Executive Steering Group (ESG) chaired by the NAVSUP Vice Commander, and comprised of SES and Command leadership representatives. The ESG ratifies capability and technology gaps identified by all activities within the enterprise, and then assesses and prioritizes all proposed Logistics R&D initiatives in accordance with their potential for filling the established gap and generating return on investment.

The established Logistics R&D business management process has currently identified capability/technology gaps in the following general areas: 1) the need to develop formalized food service management techniques that focus on increased efficiency of new and existing systems and facilities. 2) the need to modernize quality of life (QOL) services to improve overall services, offer additional desired features and reduce total ownership costs, 3) the need to assess clothing protection for the warfighter in areas of thermal/flame threats, protective footwear, and physical (hearing, vibration, etc.) clothing/accessories, 4) the need to develop logistics data access and information sharing through enhanced Graphical User Interfaces (GUI) and web-based data services, 5) the need to develop a capability that allows Integrated Logistics Support (ILS) repair and modernization tools, 6) the need to leverage breakthrough technologies to improve supply chain processing. This modest R&D investment will establish a NAVSUP Logistics R&D Program to explore additional technologies and significantly increase potential cost savings.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Supply Chain Optimization	0.000	0.355	0.125	0.000	0.125
Articles:	-	-	-	-	-
Description: Enable innovation in our supply chain processes in the areas of data sciences, logistics IT application development, and quality engineering through incorporation of Science, Technology, Engineering, and Math (STEM) projects performed by interns and academia. Peform market research on emerging supply chain technologies and methods that could be adopted to support the DoN/DoD material supply chain.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Developed a new functionality (software supporting data structure and migration of current data) within Ordinance Information System (OIS) that provides visibility of serialized assets use and requirements.					
FY 2020 Plans: Additive Manufacturing/3D Printing: Continue to drive towards SECNAV Additive Manufacturing (AM) goals and enable NAVSUP logistics innovation projects. Integrate AM as an order fulfillment strategy to increase readiness and improve maintenance and sustainment operations through reducing long-lead times and eliminating obsolescence-related issues. Furthermore, the technology enables improvements to current systems (e.g., weight reduction, part count reduction, increased system performance) through designs that are not possible by conventional manufacturing techniques. ($112K)					
Data Sciences and Logistics Engineering STEM Projects: Continued innovation in our supply chain processes in the areas of Data Sciences, Data Analytics, Logistics IT application development, and Quality Engineering through incorporation of Science, Technology, Engineering, and Math (STEM) projects performed by computer science interns and academia, which allows us to bridge the gaps in new methods of data utilization and industry trends. ($43K)					
Artificial Intelligence (AI) for custom code: Develop an AI solution to allow for business constraints to be dynamically adapted to current solutions, whether a Commercial Off the Shelf (COTS), Government Off the Shelf (GOTS) or a custom solution. DoD unique business rules exist while multiple systems implement business rules with differing logic. Given the DoD unique business rules that exist and multiple systems that implement business rules in many different ways, the AI can learn from all of those existing applications. The objective is for AI development that can automate learning to ensure the gaps that exist in out-of-the box solutions are identified and implemented before a product is released. ($100K)					
Artificial Intelligence for (AI) for Information Assurance (IA) vulnerabilities: Current IA processes require many highly qualified resources. IA and security processes require extensive hours to accomplish vital tasks that keep our Sailors' data safe and this dependency on humans introduces risk. Develop an AI automated learning solution to ensure future vulnerabilities that could be exploited to gain unauthorized system access to enterprise logistics systems are identified and corrected before the vulnerability is exploited. Specific areas to be addressed will include non-stop and true continuous monitoring of enterprise logistics IT systems. The AI					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
solution developed will provide consistent, secure, and scalable security measures to be implemented during all phases of the development cycle in a flexible, scalable and agile means. ($100K) ***FY 2021 Base Plans:*** Supply Capabilities Repository to Lower Costs of Contracts, Reduce Lead-Time of Spare Parts Procurements, and Lower Risk of Supply Chain Availability: The current method for finding sources for Critical Application Items (CAI) and Non-Critical Items (NC) are based on employee corporate knowledge of different vendor capabilities and calling a company to see if they have capacity and interest. Newer employees generally know few sources and may not know all the capabilities associated with each vendor. NAVSUP needs to create a Sourcing Portal with a repository listing of companies and capabilities. As requirements are submitted by NAVSUP without any or enough sources, an employee should review the drawing to find requirements, enter the requirements into the repository, and receive a list of compatible companies' contact information. This repository and workflow will increase the pool of known companies and their capabilities for any part thereby increasing competition and lowering lead-time and the costs to the Navy. Development of this Sourcing Portal will mitigate risk to the supply chain by providing a broad and complete visibility of vendor's capacity and capability. ($125K) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease reflects resources moving to "Clothing Protection for the Warfighter".					
Title: Readiness through Logistics Solutions	0.000	0.361	0.150	0.000	0.150
Articles:	-	-	-	-	-
Description: Supply chain improvements are required to support logistics efficiency and Fleet readiness through logistics solutions technological improvements. Develop technological capabilities that improve Naval Logistics in part or in its record (from manufacture, storage, delivery, use, maintenance, and disposal). ***FY 2020 Plans:*** RFID Interface: Perform case study assessment of Next Generation RFID technology and Real Time Location System (RTLS) graphical user interface scalability. FY 2019 prototype must be proofed via tangible real-world industrial environments. Case studies will demonstrate technology by monitoring logistics information such as forklift flow optimization and aviation aircraft engine monitoring at long term storage facilities. ($361K) ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
NAVSUP Augmented Reality (AR) Initiative: NAVSUP Business Systems Center (BSC) is an epicenter for technology Insertion for Navy. In addition, BSC provides end-to-end program management and lifecycle management for Business Systems and a variety of DoD Information Systems. An emerging technology at the forefront of the commercial sector is Virtual/Mixed Reality (VR). VR has vast proven industrial applications for supporting training, warfighting simulations, system maintenance, collaboration and logistics. Augmented Reality harnesses the power of virtual reality while creating an enhanced version of reality created by the use of technology to add digital information to any space. NAVSUP has a requirement to assess emerging VR/MR technologies to fully understand and evaluate the following: a) The technological maturity of the hardware and software, b) The full costs of VR/MR systems and implementation parameters, c) The capabilities and "ready now" use cases involving supply and maintenance applications, and d) the system architectures required to support VR/MR systems, to include security postures. NAVSUP will perform a series of technical demonstrations and hands on workshops for the technical teams. The purpose of the engagements will be to use several VR/MR systems and study the applications including the Microsoft HoloLense 2 Platform, Blippar, Meta 2, MagicLeap One, Smart Reality, AccuVein, Bosh augmented understanding of the technology, the supporting architecture and the strengths/limitations of the VR capability. Specific use cases will involve maintainers and warehouse operations. ($150K) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease reflects resources moving to "Clothing Protection for the Warfighter".					
Title: Clothing Protection for the Warfighter	0.000	0.261	0.772	0.000	0.772
Articles:	-	-	-	-	-
Description: Identify challenges to effectively manage durability and safety aspects of common work/combat uniforms for the warfighter. Eliminate risk of hazardous factors such as fire, weather, and general wear/tear to maximize readiness and strength in Fleet uniforms. Assist with specifications associated with permanent press finish related to the rollout of the Navy's Type III uniform. ***FY 2020 Plans:*** "Green" Laundering Services: Validate new "green" shipboard laundering formulas for Navy uniforms subject to shipboard laundering. The new "green" formulation is a replacement of harsh chemicals with high acidity, with an enzymatic detergent that requires lower water temperatures and lower water consumption wash cycles, and a					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
potential reduction of the wear and fading effects on uniforms, as well as a reduction of these chemical products stowed on-board in large quantities. Validation will allow NAVSUP to understand the effects of the chemicals on appearance, color change, and special finishes on Navy uniforms. An updated shipboard formulation will further support OPNAV's Environmental Readiness Program. ($75K) Product Lifecycle Management (PLM) digital platform: Enhance efficiency in the management and standardization of materials documentations in support of uniform development of USN Uniforms and Materials. Over the years, the Navy Clothing and Textile Research Facility (NCTRF) has amassed extensive data on USN uniforms, fabrics and trims. With each garment and material update, multiple files must be created or amended manually and then stored in various server locations. As time goes on, employees transition and files multiply; the man hours to locate, research and review information on current uniforms and materials has increased. Incorporation of a PLM digital platform will streamline the garment creation process and reduce costs by effectively managing USN uniforms and materials with a product lifecycle management tool. Effort includes development, trial and inclusion of this tool into navy clothing and textile research efforts. ($61K) Navy Boot Enhancement: Develop, select and integrate Foreign Object Damage (FOD) and slip resistant outsole. An evaluation conducted in FY18 revealed that the outsole of the current boot was not FOD-resistant and has poor split resistance in flight deck environments. Determine the characteristics of an outsole (tread design and rubber compound) that meet the FOD-resistance and slip requirements of multiple Navy environments. The objective is to develop a common outsole that meets or exceeds safety boot requirements for all Navy communities and work environments. ($75K) E-yarn Development for embedded garment performance monitoring: Initiate a study related to the incorporation of e-yarns to support monitoring of personnel data to support safety goals. Technology changes driving new ship design will require a real-time connection between the ship and the sailor for delivery and receipt of information and data to and from the sailor. The challenge is connecting all the systems together with the sailor into intelligible human-system interfaces, so that, the ship of the future will be securely controlled by fewer sailors located anywhere on board. Study will research innovative multi-functional garment systems with embedded technologies to become the structure for robust human-systems interface. ($50K) ***FY 2021 Base Plans:*** 3D Virtual Design Software for Improving Uniform Fit and Providing Virtual Prototypes: This new capability will address a need for quick, affordable, and accurate prototyping. The system will provide a capability to bypass					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
the time consuming process of multiple physical prototypes for any type of item whether it be dress, utility, or chemical-biological, resulting in a better fitting garment in a shorter amount of time. ($100K) Sensor Data Validation and System Verification of Articulating Thermal Sensing Manikin for use in a Flame Filled Environment: Develop a methodology of characterizing each sensor response in place and evaluate the capabilities and performance of the Articulating Thermal Sensing Manikin (ARTHESMA) system and integration with the systems at the Ouelette Thermal Test Facility in Natick, MA. ($75K) Analysis of Impact on Navy Uniforms by Proposed Change of Navy Shipboard Wash Chemicals: Investigate the acceptability of the product system change from Ecolab Solid Surge Navigator Systems to Ecolab Aquanomic Biocare System for shipboard laundry and is there is any effect/change on uniform care labels. This new greener approach in shipboard laundry systems has the potential to reduce energy costs, lower water consumption and through this evaluation determine if there are reduced negative effects that current washing has on material. ($90K) Improved Flame Resistance Variant Coverall (I2FRV): Management of organizational clothing will be streamlined by eliminating three (3) coveralls/70 NSNs from the system. Sailors will benefit by receiving a more functional coverall which can work in multiple shipboard environments, eliminating the need for storage and management of multiple coverall types. ($75K) Improved Shipboard Flame Resistance (FR) Jacket: The goal of this effort is to develop an improved cold weather shipboard FR jacket with a modernized design which meets or exceeds current requirements, while being cheaper, lighter weight, and space-saving. Current jacket design and materials in the system have not been evaluated in over 20 years. ($100K) Standardization of Identification Markings and Technology for Organizational Clothing Worn by Navy Sailors in Surface Warfare Operations: This will establish a standard identification requirement for U.S. Navy organizational clothing and provide a recommendation for integrating the most effective technology solutions into both Sailor's work environment and uniform/personal equipment without adverse impact to the mission. ($90K) Identification of Sustainability Implementation Opportunities to Navy Clothing and Equipment throughout the Acquisition Life Cycle: Innovate the uniform supply chain by exploring sustainability in areas such as manufacturing process, use of recycled materials, repurposing surplus material, and recycling and reclaiming end items while implementing more closed loop systems and creation of circular product lifecycles.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
($75K) Standard Sizing to Incorporate into Body Scanners: The objective is to establish standardized sizes for uniforms and input the data into current developmental Body Scanner Technology. This project will validate the necessity of standardized sizes in order for the Body Scanner technology to accurately predict a Sailor's uniform size. ($77K) Validation of Wissler Apparel Requirement Model (WARM) and expansion of protective clothing database for the model to predict thermal status in Extreme Environments: The project objective is to select a stable FORTRAN code for Wissler's model to run WARM (graphical user interface based). Using the Navy Clothing and Textile Research Facility's (NCTRF) submersible thermal manikin (NEMO) expand the database of localized thermal properties of current and new anti-exposure suits as well as protective garments used to support extreme climate operations. Predict safe exposure limits, and provide garment design guidelines to achieve required mission requirements. ($90K) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase reflects an emphasis for innovative projects within "Clothing Protection for the Warfighter".					
Accomplishments/Planned Programs Subtotals	0.000	0.977	1.047	0.000	1.047

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

NAVSUP R&D executed through firm fixed price negotiated contracts and NAVSUP support. Performance-based reviews conducted quarterly by the Project Management Office.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Effective Food Service Management	C/FFP	Various : Various	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Quality of Life Services Modernization & Cost Reduction (Initiative 1)	C/FFP	BSC : Mechanicsburg, PA	0.259	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Quality of Life Services Modernization & Cost Reduction (Initiative 2)	C/FFP	Various : Various	1.037	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Readiness through Logistics Solutions	C/FFP	Various : Various	1.203	0.000		0.355	Dec 2019	0.150	Dec 2020	-		0.150	Continuing	Continuing	Continuing
Clothing Protection for the Warfighter	C/FFP	NCTRF : Natick,MA	1.126	0.000		0.361	Oct 2019	0.772	Oct 2020	-		0.772	Continuing	Continuing	Continuing
Supply Chain Optimization	C/FFP	Various : Various	0.000	0.000		0.261	Dec 2019	0.125	Dec 2020	-		0.125	Continuing	Continuing	Continuing
		Subtotal	3.625	0.000		0.977		1.047		-		1.047	Continuing	Continuing	N/A

Remarks

There were no FY19 projects.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	3.625	0.000		0.977		1.047		-		1.047	Continuing	Continuing	N/A

Remarks

In previous plans, NAVSUP forecast budget requirements based on projections rooted in the current year's capability gaps. As our priorities and Strategic Guidance evolves so does our budget requirements. Through leveraging new technologies, NAVSUP will enhance efforts for supply ashore and distant support. We will strengthen our supply chain information technology and management solutions for supply and financial requirements. We will collaborate with partners to improve the quality-of-life experiences and expand services to deployed forces. NAVSUP will continue to build an ethical and effective workforce dedicated to the mission by developing new technological programs that are advantageous to the warfighter. We will reduce risk and minimize vulnerabilities to protect against disruptions to supply chain and business systems. All of our actions will follow a culture of moral excellence to successfully execute the current and future missions of NAVSUP.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Logistics R&D				
Supply Chain Optimization: Contract Award: FY 2020 Contract Award	2	2020	2	2020
Supply Chain Optimization: Contract Award: FY 2021 Contract Award	2	2021	2	2021
Supply Chain Optimization: Developmental/Functional Testing: FY 2020 Developmental/Functional Testing	3	2020	3	2021
Supply Chain Optimization: Developmental/Functional Testing: FY 2021 Developmental/Functional Testing	3	2021	3	2022
Supply Chain Optimization: Implementation: FY 2020 Implementation	4	2021	4	2021
Supply Chain Optimization: Implementation: FY 2021 Implementation	4	2022	4	2022
Readiness through Logistics Solutions: Contract Award: FY 2020 Contract Award	2	2020	2	2020
Readiness through Logistics Solutions: Contract Award: FY 2021 Contract Award	2	2021	2	2021
Readiness through Logistics Solutions: Developmental/Functional Testing: FY 2020 Developmental/Functional Testing	3	2020	3	2021
Readiness through Logistics Solutions: Developmental/Functional Testing: FY 2021 Developmental/Functional Testing	3	2021	3	2022
Readiness through Logistics Solutions: Implementation: FY 2020 Implementation	4	2021	4	2021
Readiness through Logistics Solutions: Implementation: FY 2021 Implementation	4	2022	4	2022
Clothing Protection for the Warfighter: Contract Award: FY 2020 Contract Award	1	2020	1	2020
Clothing Protection for the Warfighter: Contract Award: FY 2021 Contract Award	1	2021	1	2021
Clothing Protection for the Warfighter: Developmental/Functional Testing: FY 2020 Developmental/Functional Testing	2	2020	2	2021
Clothing Protection for the Warfighter: Developmental/Functional Testing: FY 2021 Developmental/Functional Testing	2	2021	2	2022
Clothing Protection for the Warfighter: Implementation: FY 2020 Implementation	3	2021	3	2021

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603739N / *Navy Logistic Productivity*	**Project (Number/Name)** 3223 / *Logistics R&D*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Clothing Protection for the Warfighter: Implementation: FY 2021 Implementation	3	2022	3	2022

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603746N / *RETRACT MAPLE*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	307.563	242.144	353.226	-	353.226	242.206	275.820	269.750	242.888	Continuing	Continuing
1906: *Retract Maple*	0.000	307.563	242.144	353.226	-	353.226	242.206	275.820	269.750	242.888	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	318.878	258.519	288.850	-	288.850
Current President's Budget	307.563	242.144	353.226	-	353.226
Total Adjustments	-11.315	-16.375	64.376	-	64.376
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-16.375			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.900	0.000			
• SBIR/STTR Transfer	-10.415	0.000			
• Program Adjustments	0.000	0.000	57.154	-	57.154
• Rate/Misc Adjustments	0.000	0.000	7.222	-	7.222

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603748N / *LINK PLUMERIA*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	347.395	396.509	544.388	-	544.388	638.784	680.697	1,262.909	2,324.891	Continuing	Continuing
1978: *Link Plumeria*	0.000	347.395	396.509	544.388	-	544.388	638.784	680.697	1,262.909	2,324.891	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	381.268	403.909	403.872	-	403.872
Current President's Budget	347.395	396.509	544.388	-	544.388
Total Adjustments	-33.873	-7.400	140.516	-	140.516
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-7.400			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-20.000	0.000			
• SBIR/STTR Transfer	-13.873	0.000			
• Program Adjustments	0.000	0.000	-10.406	-	-10.406
• Rate/Misc Adjustments	0.000	0.000	150.922	-	150.922

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603751N / *RETRACT ELM*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	49.869	63.434	86.730	-	86.730	58.485	65.135	67.623	66.953	Continuing	Continuing
2003: *Retract Elm*	0.000	49.869	63.434	86.730	-	86.730	58.485	65.135	67.623	66.953	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	58.192	63.434	53.973	-	53.973
Current President's Budget	49.869	63.434	86.730	-	86.730
Total Adjustments	-8.323	0.000	32.757	-	32.757
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-6.700	0.000			
• SBIR/STTR Transfer	-1.623	0.000			
• Program Adjustments	0.000	0.000	2.364	-	2.364
• Rate/Misc Adjustments	0.000	0.000	30.393	-	30.393

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603764M / *LINK EVERGREEN*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	30.000	236.234	-	236.234	202.572	250.532	275.134	257.491	Continuing	Continuing
1972: *Link Evergreen*	0.000	0.000	30.000	236.234	-	236.234	202.572	250.532	275.134	257.491	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	30.000	236.234	-	236.234
Total Adjustments	0.000	30.000	236.234	-	236.234
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	30.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	236.234	-	236.234

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603764N / *LINK EVERGREEN*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	167.735	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	167.735
1972: *Link Evergreen*	0.000	0.000	167.735	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	167.735

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	184.110	246.700	-	246.700
Current President's Budget	0.000	167.735	0.000	-	0.000
Total Adjustments	0.000	-16.375	-246.700	-	-246.700
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-16.375			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	-246.700	-	-246.700

Change Summary Explanation

Technical: Not applicable.
Schedule: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	89.906	9.280	7.697	6.880	-	6.880	10.154	9.997	9.465	9.655	Continuing	Continuing
2293: *NATO Cooperative R & D*	89.906	9.280	7.697	6.880	-	6.880	10.154	9.997	9.465	9.655	Continuing	Continuing

A. Mission Description and Budget Item Justification

In accordance with Title 10 United States Code, Section 2350a, this Program Element (PE) provides funding for research and development (R&D) programs with approved allies under international agreements. These funds can only be applied to work efforts in the U.S.. The Under Secretary of Defense, Acquisition and Technology and Logistics (USD, AT&L) must approve each international agreement. The program provides funds for multiple projects under separately approved international agreements as well as funds that support the establishment of such agreements. Each international agreement is summarized in a separate Summary Statement of Intent (SSOI) that also states why the project serves to increase the defense capabilities of the U.S. The SSOI is used to obtain project approval by the Department of the Navy and the Office of the Secretary of Defense.

The North Atlantic Treaty Organization (NATO) R&D cooperative programs differ from other Research, Development, Test and Evaluation (RDT&E) programs because issuance of funding from this PE coincides with the signature of international agreements. These signatures occur throughout the fiscal year and often encounter unexpected delays during the staffing and negotiation phases of agreement processing prior to signature.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	9.652	7.697	8.793	-	8.793
Current President's Budget	9.280	7.697	6.880	-	6.880
Total Adjustments	-0.372	0.000	-1.913	-	-1.913
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.372	0.000			
• Program Adjustments	0.000	0.000	-1.908	-	-1.908
• Rate/Misc Adjustments	0.000	0.000	-0.005	-	-0.005

Change Summary Explanation

The FY 2021 funding request was reduced by $1.908 million to account for the availability of prior year execution balances.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*

The FY 2020 to FY 2021 decrease of $0.817 million is due to decreased developmental test and evaluation costs associated with FY 2021 international agreements.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*				**Project (Number/Name)** 2293 / *NATO Cooperative R & D*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2293: *NATO Cooperative R & D*	89.906	9.280	7.697	6.880	-	6.880	10.154	9.997	9.465	9.655	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

In accordance with Title 10 United States Code, Section 2350a, this Program Element (PE) provides funding for research and development (R&D) programs with approved allies under international agreements. These funds can only be applied to work efforts in the U.S. The Under Secretary of Defense, Acquisition and Technology and Logistics (USD, AT&L) must approve each international agreement. The program provides funds for multiple projects under separately approved international agreements as well as funds that support the establishment of such agreements. Each international agreement is summarized in a separate Summary Statement of Intent (SSOI) that also states why the project serves to increase the defense capabilities of the U.S. The SSOI is used to obtain project approval by the Department of the Navy and the Office of the Secretary of Defense.

The North Atlantic Treaty Organization (NATO) R&D cooperative programs differ from other Research, Development, Test and Evaluation (RDT&E) programs because issuance of funding from this PE coincides with the signature of international agreements. These signatures occur throughout the fiscal year and often encounter unexpected delays during the staffing and negotiation phases of agreement processing prior to signature.
This NATO Research and Development funding provides funding for U.S. efforts under established International agreements (IAs) intended to address CNO priorities and identified interoperability gaps, as well as activities to support the identification and implementation of those agreements.

- Projects depend on commitment of U.S. and Ally, and are subject to imprecise staffing timelines (funding typically provided when international agreement is signed, often later in the FY)
- Funds must be identified/committed early (1-2 years prior) to indicate support during processing (in Summary Statement of Intent)
- These funds only constitute a portion of U.S. project funding

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: NATO Cooperative R & D	9.280	7.697	6.880	0.000	6.880
Articles:	-	-	-	-	-
FY 2020 Plans: FY 2020 Base Plans: -Continue to support approved Cooperative projects FY19. -Plan and support approved FY20 Cooperative projects. Projects include, but are not limited to: -Advanced Surveillance Technology [U.S. and Australia]					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Advanced Structural Monitoring Techniques (ASMT) [U.S. and Australia] -Air Vehicle Technologies Amendment One [U.S. and Israel] -Anti-Ship Threat Countermeasures (ASTC) [FVEY] -Biomimetic Threat Detection System (BTDS) [U.S. and United Kingdom] -Collaborative Situational Awareness Development (CSA DEV) Amendment One [U.S. and Italy] -Electromagnetic Silencing [U.S. and United Kingdom] -Helo Seat Damper [U.S. and Canada] -International Programs Opportunities Engagement Tool (iPoet) [U.S.] -Maritime C2/Operations PA [U.S. and Australia] -Next Generation Amphibious Technologies (NGAT) [U.S. and Japan] -Project Hammerhead [U.S. and Israel] -Submarine Superiority [U.S. and Australia] -Superconducting Quantum Small Electromagnetic Sensor System Research and Development (Super QSES) [U.S. and Australia] -VLF Radar PA [U.S. and United Kingdom]					
FY 2021 Base Plans: -Continue to support approved Cooperative projects from prior Fiscal Years. -Plan and support approved FY21 Cooperative projects. Projects may include, but are not limited to: -Advanced Surveillance Technology(AST) Amendment 1 [U.S. and Australia] -Advanced Structural Monitoring Techniques (ASMT) Amendment 1 [U.S. and Australia] -Anti-Ship Threat Countermeasures (ASTC) [FVEY] -DYSMAS Mines [U.S. and Germany] -Electromagnetic Propagation (EM Prop) [U.S. and United Kingdom] -International Programs Opportunities Engagement Tool (iPoet) [U.S.] -Lightweight Transparent Armor (LWTA) [U.S. and United Kingdom] -Next Generation Amphibious Technologies (NGAT) [U.S. and Japan] -Open Cognitive Computing Framework [U.S. and Finland] -Submarine Superiority [U.S. and Australia] -Tactical Air Responsive Microsat Delivery [U.S. and Multiple] -VLF Radar PA [U.S. and United Kingdom]					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The FY 2021 funding request was reduced by $1.908 million to account for the availability of prior year execution balances. The FY 2020 to FY2021 decrease of $0.817 million is due to decreased developmental test and evaluation costs associated with FY 2021 international agreements.					
Accomplishments/Planned Programs Subtotals	9.280	7.697	6.880	0.000	6.880

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test and Evaluation	C/FP	NAVSEA : Washington Navy Yard, DC	26.876	0.669	Dec 2018	0.750	Dec 2019	0.514	Nov 2020	-		0.514	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NSWC : West Bethesda, MD	13.621	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NUWC : Newport, RI	2.761	0.300	Dec 2018	0.250	Dec 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NIWC : San Diego, CA	6.171	1.000	Jan 2019	0.701	Jan 2020	1.000	Feb 2021	-		1.000	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NAVAIR : Patuxent River, MD	4.029	0.353	Dec 2018	0.349	Dec 2019	0.350	Dec 2020	-		0.350	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NRL : Washington, DC	3.876	1.644	Nov 2018	1.723	Nov 2019	0.800	Jan 2021	-		0.800	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	NAWC : Point Mugu, CA	7.100	0.000		0.459	Dec 2019	0.400	Dec 2020	-		0.400	Continuing	Continuing	Continuing
Developmental Test and Evaluation	C/FP	Miscellaneous : Washington Navy Yard	16.893	1.500	Apr 2019	1.300	May 2020	1.000	Apr 2021	-		1.000	Continuing	Continuing	Continuing
Deveiopmental Test and Evaulation	C/FP	MARCOR : Washington.DC	1.200	0.000		0.000		0.000		-		0.000	0.000	1.200	-
Developmental Test and Evaulation	C/FP	NSWCCD : Carderock, MD	2.935	0.594	Apr 2019	0.275	Apr 2020	0.500	Feb 2021	-		0.500	0.000	4.304	-
Developmental Test and Evaulation	C/FP	ONR : Arlington, VA	2.475	0.710	Mar 2019	0.725	Mar 2020	0.500	Mar 2021	-		0.500	0.000	4.410	-
Developmental Test and Evaluation	C/FP	USMC : Quantico, VA	0.000	0.500	May 2019	0.350	May 2020	0.300	Dec 2020	-		0.300	0.000	1.150	-
Developmental Test and Evaulation	C/FP	NSWC : Indian Head, MD	0.250	0.000		0.000		0.000		-		0.000	0.000	0.250	-
Developmental Test and Evaulation	C/FP	NSWC : Panama City , FL	0.250	0.200	Oct 2018	0.200	Oct 2019	0.200	Nov 2020	-		0.200	0.000	0.850	-
Developmental Test and Evaulation	C/FP	GSA : Washington, DC	0.400	0.400	Mar 2019	0.200	Mar 2020	0.466	Nov 2020	-		0.466	0.000	1.466	-
Developmental Test and Evaulation	C/FP	DISA : Ft Meade MD	0.000	1.410	Dec 2018	0.415	Dec 2019	0.200	Oct 2020	-		0.200	0.000	2.025	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test and Evaulation	C/FP	CDSA : Dam Neck, VA	1.020	0.000		0.000		0.400	Nov 2020	-		0.400	0.000	1.420	-
		Subtotal	89.857	9.280		7.697		6.880		-		6.880	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ACQ Workforce Fund	Various	Various : Various	0.049	0.000		0.000		0.000		-		0.000	0.000	0.049	-
		Subtotal	0.049	0.000		0.000		0.000		-		0.000	0.000	0.049	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	89.906	9.280		7.697		6.880		-		6.880	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 2293																												
International Agreements																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603790N / *NATO Research and Deve*	**Project (Number/Name)** 2293 / *NATO Cooperative R & D*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2293				
International Agreements	1	2019	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	29.979	6.924	7.328	10.578	1.457	12.035	10.098	5.831	5.543	5.652	Continuing	Continuing
2038: *ADVANCED MINOR CALIBER GUN*	18.197	1.400	5.928	4.422	1.457	5.879	4.181	1.806	1.536	1.566	Continuing	Continuing
3401: *Guided Projectile*	11.782	0.700	1.400	6.156	-	6.156	5.917	4.025	4.007	4.086	Continuing	Continuing
9999: *Congressional Adds*	0.000	4.824	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.824

A. Mission Description and Budget Item Justification

Project 2038 Base & OCO: The MK 38 MOD 3 Machine Gun System (MGS) provides Anti-Surface Warfare (ASUW) and Anti-terrorism and Force Protection (AT/FP) capability as a simple, stabilized, low cost solution to outfit near-term deployers to counter small boat threats. Over 300 systems are installed on U.S. Navy AS, CG, CVN, DDG, LCC, LHA, LHD, LSD, OSV, PC class ships and MK VI Patrol Boats. In order to respond to the Joint Urgent Operational Need (JUONS CC-0558) Counter Unmanned Aerial Systems (C-UAS), the MK 38 MOD 3 MGS' electro-optical/infra-red sensor, hardware, and software is being upgraded to counter emerging unmanned aerial threats. Fielding of initial capability will start in fourth quarter of FY19. Incremental improvements will be made in the out years to further improve on accuracy, effective range, and lethality. Starting in FY20, further development will improve the MK 38 MGS' accuracy, lethality, and effective range to counter unmanned air (C-UAS) and unmanned surface (C-USV) threats with integration to highly accurate fire control system, 30mm gun, and targeting sensor.

Projects 3401 & C452: The Gun Launched Guided Projectile program leverages Hypervelocity Projectile (HVP) technology developed under each of the respective Strategic Capabilities Office (SCO) and Office of Naval Research (ONR) Future Naval Capabilities (FNC) programs to provide gun-based Anti-Ship Cruise Missile (ASCM) defense. Gun-based ASCM defense capability increases both ship's weapon capacity against ASCM raids and battle persistence in successive ASCM raids. The performance improvement is achieved without relying on Vertical Launch System (VLS) cells for weapon deployment. This effectively deepens the ship's magazine for raid defense and supports larger allocation of VLS cells to offensive capability. In addition to improved capacity and battle persistence, gun-based ASCM defense solutions provide a cost effective response to an ASCM attack due to the unit cost of the projectile relative to missiles.

The introduction of gun-based ASCM defense for large caliber guns is made possible by recent advancements in microelectronics, sensors, and energetic systems that enable precision guidance and tailored lethality. GLGP incorporates these HVP technologies into an aerodynamically streamlined sub-caliber airframe to achieve a highly maneuverable projectile. When launched from the MK 45 Gun Weapon System (GWS) at high velocities, GLGP's high maneuverability combined with high kinetic energy at the intercept yields effectiveness against ASCMs.

Initial HVP technology demonstration focused on land-based system integration and implementation. Shipboard integration requires some modifications to the initial concept of operations to implement the technology effectively and affordably. This project matures critical enabling technologies needed to integrate HVP technology on Navy ships and executes the requisite acquisition, systems engineering, and test planning activities to initiate a development effort.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.100	9.086	11.095	-	11.095
Current President's Budget	6.924	7.328	10.578	1.457	12.035
Total Adjustments	-0.176	-1.758	-0.517	1.457	0.940
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-3.186			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.176	0.000			
• Program Adjustments	0.000	1.428	-0.546	1.457	0.911
• Rate/Misc Adjustments	0.000	0.000	0.029	-	0.029

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Guided Projectile*	4.824	0.000
Congressional Add Subtotals for Project: 9999	4.824	0.000
Congressional Add Totals for all Projects	4.824	0.000

Change Summary Explanation

The FY 2021 funding request was reduced by (-$0.017) million to account for the availability of prior year execution balances.

FY19: -$0.176M SBIR
FY20: $1.428 OCO Request, -$3.186 Congressional Directed Reductions
FY21: Rate Adjustment increase $0.029, Program Adjustment -$0.529, Prior Year Execution -$0.017

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 2038 / *ADVANCED MINOR CALIBER GUN*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2038: *ADVANCED MINOR CALIBER GUN*	18.197	1.400	5.928	4.422	1.457	5.879	4.181	1.806	1.536	1.566	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The MK 38 MOD 3 Machine Gun System (MGS) provides Anti-Surface Warfare (ASUW) and Anti-terrorism and Force Protection (AT/FP) capability as a simple, stabilized, low cost solution to outfit near-term deployers to counter small boat threats. Over 350 systems are installed on U.S. Navy AS, CG, CVN, DDG, LCC, LHA, LHD, LSD, OSV, PC class ships and MK VI Patrol Boats, and U.S. Coast Guard FRC cutters. In order to respond to the Joint Urgent Operational Need (JUONS CC-0558) Counter Unmanned Aerial Systems (C-UAS), the MK 38 MOD 3 MGS' electro-optical/infra-red sensor, hardware, and software is being upgraded to counter emerging unmanned aerial threats. Fielding of initial capability will start in first quarter of FY20. Incremental improvements will be made in FY20-21 to further improve on accuracy and effective range of C-UAS capability. Starting in FY20, further development will improve the MK 38 MGS' accuracy, lethality, and effective range to counter unmanned air (C-UAS) and unmanned surface (C-USV) threats with integration to highly accurate fire control system, 30mm gun, and targeting sensor.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Systems Engineering and Testing	1.400	5.928	4.422	1.457	5.879
Articles:	-	-	-	-	-
FY 2020 Plans: - Evaluation and down-select of 30mm gun mount candidates via comparative testing - Evaluation and down-selection of electro-optical sensor via comparative testing OCO: - Train Fleet and collect feedback on operation of initial C-UAS upgrade to Mk 38 MOD 3 - Analyze Fleet feedback, identify required bug fixes and software improvements, develop follow-on software build					
FY 2021 Base Plans: - Evaluate and qualify 30mm gun weapon system prototype (including gun mounts and optical sensor) - Preliminary logistics development					
FY 2021 OCO Plans: - Install software improvements and train Fleet					
FY 2020 to FY 2021 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 2038 / *ADVANCED MINOR CALIBER GUN*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
No significant change.					
Accomplishments/Planned Programs Subtotals	1.400	5.928	4.422	1.457	5.879

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Evaluation of 30mm gun mounts and electro-optical sensors is being competitively acquired using Other Transactional Authority (OTA) through the Defense Ordnance Technology Consortium (DOTC).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 2038 / *ADVANCED MINOR CALIBER GUN*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Counter-UAS (JUONS CC-0558) Primary Product Integration	SS/BOA	BAE Systems : Minneapolis MN	14.443	0.181	Mar 2019	1.200	Jun 2020	0.000		0.800	Jun 2021	0.800	Continuing	Continuing	Continuing
MK38 Counter UAS/USV Improvement Primary Product Integration	C/CPFF	TBD : Not Specified	0.000	0.000		2.000	Apr 2020	2.000	Mar 2021	-		2.000	0.000	4.000	-
		Subtotal	14.443	0.181		3.200		2.000		0.800		2.800	Continuing	Continuing	N/A

Remarks

Counter UAS capability upgrades to MK 38 MOD 3 Machine Gun System

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Services	WR	NSWC, DD : Dahlgren, VA	2.899	1.219	Mar 2019	1.128	Jun 2020	1.772	Nov 2020	0.200	Nov 2020	1.972	0.000	7.218	-
Government Engineering Services	WR	NSWC, IHD : Picatinny, NJ	0.690	0.000		1.100	Jun 2020	0.350	Nov 2020	0.307	Nov 2020	0.657	0.000	2.447	-
Government Engineering Services	WR	NSWC, CR : Crane, IN	0.165	0.000		0.500	Jun 2020	0.300	Nov 2020	0.150	Nov 2020	0.450	0.000	1.115	-
		Subtotal	3.754	1.219		2.728		2.422		0.657		3.079	0.000	10.780	N/A

Remarks

Configuration Management (CM), qualification testing, certification

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	18.197	1.400		5.928		4.422		1.457		5.879	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 2038 / *ADVANCED MINOR CALIBER GUN*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 2038 / *ADVANCED MINOR CALIBER GUN*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2038				
Counter-UAS (JUONS CC-0558): Fleet Feedback and Analysis	1	2020	3	2020
Counter-UAS (JUONS CC-0558): Software Fixes for Capability Improvements	3	2020	3	2022
Counter-UAS (JUONS CC-0558): Certification & Fielding of Updated Software Baselines	3	2021	4	2022
MK38 Counter UAS/UAV Improvement: Evaluation of gun mount candidates	1	2020	4	2020
MK38 Counter UAS/UAV Improvement: Evaluation of EOS candidates	1	2020	4	2020
MK38 Counter UAS/UAV Improvement: Limited Qualification of Prototype Gun Weapon System	1	2020	3	2021
MK38 Counter UAS/UAV Improvement: Preliminary logistics development	4	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*				**Project (Number/Name)** 3401 / *Guided Projectile*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3401: *Guided Projectile*	11.782	0.700	1.400	6.156	-	6.156	5.917	4.025	4.007	4.086	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Gun Launched Guided Projectile program leverages Hypervelocity Projectile (HVP) technology developed under each of the respective Strategic Capabilities Office (SCO) and Office of Naval Research (ONR) Future Naval Capabilities (FNC) programs to provide gun-based Anti-Ship Cruise Missile (ASCM) defense. Gun-based ASCM defense capability increases both ship's weapon capacity against ASCM raids and battle persistence in successive ASCM raids. The performance improvement is achieved without relying on Vertical Launch System (VLS) cells for weapon deployment. This effectively deepens the ship's magazine for raid defense and supports larger allocation of VLS cells to offensive capability. In addition to improved capacity and battle persistence, gun-based ASCM defense solutions provide a cost effective response to an ASCM attack due to the unit cost of the projectile relative to missiles.

The introduction of gun-based ASCM defense for large caliber guns is made possible by recent advancements in microelectronics, sensors, and energetic systems that enable precision guidance and tailored lethality. GLGP incorporates these HVP technologies into an aerodynamically streamlined sub-caliber airframe to achieve a highly maneuverable projectile. When launched from the MK 45 Gun Weapon System (GWS) at high velocities, GLGP's high maneuverability combined with high kinetic energy at the intercept yields effectiveness against ASCMs.

Initial HVP technology demonstration focused on land-based system integration and implementation. Shipboard integration requires some modifications to the initial concept of operations to implement the technology effectively and affordably. This project matures critical enabling technologies needed to integrate HVP technology on Navy ships and executes the requisite acquisition, systems engineering, and test planning activities to initiate a development effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Systems Engineering and Testing	0.700	1.400	6.156	0.000	6.156
Articles:	-	-	-	-	-
FY 2020 Plans: - Conduct subcomponent technology performance sensitivity/ trade space analyses - Continue Milestone B documentation preparation to include Test & Evaluation Master Plan (TEMP), Systems Engineering Master Plan (SEMP), Independent Logistics Assessment (ILA), Modeling & Simulation (M&S) strategy, and draft performance specifications - Continue common interface definition documentation preparation for ammunition handling, projectile initialization - Develop combat system integration strategy based on notional EM&D entry point					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 3401 / *Guided Projectile*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Refine Milestone B documentation based on completion of sensitivity/ trade space analyses - Refine combat system integration architecture definition - Complete common interface definition documentation preparation for ammunition handling, projectile initialization - Refine the detailed Acquisition Strategy - Conduct market research to refine Request for Proposal (RFP); finalize the government furnished information library to support the RFP ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding increase due to efforts associated with Milestone B documentation development and systems definition requirements for competitive Request for Proposal (RFP).					
Accomplishments/Planned Programs Subtotals	0.700	1.400	6.156	0.000	6.156

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Leverage the Office Of Naval Research (ONR) sponsored Future Naval Capabilities project, Strategic Capabilities Office (SCO) Hypervelocity Projectile (HVP) demonstrations, and Government developed Interface Control Drawings and specification to establish a competitive solicitation for Engineering & Manufacturing Development (E&MD) Phase.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 3401 / *Guided Projectile*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
5 Inch Cartridge Case Process Modification	C/CPFF	Rock Island : Rock Island, IN	0.684	0.000		0.000		0.000		-		0.000	0.000	0.684	16.000
Interface Development	WR	NSWC Dahlgren : Dahlgren, VA	1.085	0.000		0.000		0.000		-		0.000	0.000	1.085	-
Tech Maturation	FFRDC	MIT : Boston, MA	0.350	0.000		0.000		0.000		-		0.000	0.000	0.350	-
Tech Maturation	WR	NSWC IH : Indian Head, MD	4.452	0.000		0.000		0.000		-		0.000	0.000	4.452	-
Tech Maturation	FFRDC	APL : Laurel, MD	0.312	0.000		0.000		0.000		-		0.000	0.000	0.312	-
Combat System and Terminal Guidance Analyses	C/CPFF	APL : Laurel, MD	0.500	0.000		0.000		0.311	Nov 2020	-		0.311	0.000	0.811	-
Systems Engineering, Cyber, T&E, Software Guidance, and Electronic Engineering	WR	NSWC DD : Dahlgren, VA	2.000	0.670	Nov 2018	1.300	Nov 2019	3.797	Nov 2020	-		3.797	0.000	7.767	-
Fuzing Warhead, Propellant Charge	WR	NSWC IHD : indian Head, MD	0.150	0.000		0.000		0.818	Nov 2020	-		0.818	0.000	0.968	-
CM/Data Management Acquisition Support Logistics	WR	NSWC IH : Picatinny, NJ	0.630	0.000		0.100	Feb 2020	0.848	Nov 2020	-		0.848	0.000	1.578	-
		Subtotal	10.163	0.670		1.400		5.774		-		5.774	0.000	18.007	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Office Contractor Services	C/CPFF	Various : Arlington, VA	1.415	0.030	Jul 2019	0.000		0.382	Nov 2020	-		0.382	Continuing	Continuing	Continuing
Program Support Services	FFRDC	MITRE : McLean, VA	0.089	0.000		0.000		0.000		-		0.000	0.000	0.089	-
Program Support Services	WR	NPS : Monterey, CA	0.090	0.000		0.000		0.000		-		0.000	0.000	0.090	-
		Subtotal	1.594	0.030		0.000		0.382		-		0.382	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 3401 / *Guided Projectile*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
T&E Support	WR	NSWC Dahlgren : Dahlgren, VA	0.025	0.000		0.000		0.000		-		0.000	0.000	0.025	-
		Subtotal	0.025	0.000		0.000		0.000		-		0.000	0.000	0.025	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	11.782	0.700		1.400		6.156		-		6.156	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 3401 / *Guided Projectile*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 3401																												
EMD planning																												
Technology Maturation and studies																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 3401 / *Guided Projectile*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3401				
EMD planning	1	2019	4	2025
Technology Maturation and studies	1	2020	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603795N / *Land Attack Tech*				Project (Number/Name) 9999 / *Congressional Adds*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	4.824	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.824
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Gun Launched Guided Projectile program leverages Hypervelocity Projectile (HVP) technology developed under each of the respective Strategic Capabilities Office (SCO) and Office of Naval Research (ONR) Future Naval Capabilities (FNC) programs to provide gun-based Anti-Ship Cruise Missile (ASCM) defense. Gun-based ASCM defense capability increases both ship's weapon capacity against ASCM raids and battle persistence in successive ASCM raids. The performance improvement is achieved without relying on Vertical Launch System (VLS) cells for weapon deployment. This effectively deepens the ship's magazine for raid defense and supports larger allocation of VLS cells to offensive capability. In addition to improved capacity and battle persistence, gun-based ASCM defense solutions provide a cost effective response to an ASCM attack due to the unit cost of the projectile relative to missiles.

The introduction of gun-based ASCM defense for large caliber guns is made possible by recent advancements in microelectronics, sensors, and energetic systems that enable precision guidance and tailored lethality. GLGP incorporates these HVP technologies into an aerodynamically streamlined sub-caliber airframe to achieve a highly maneuverable projectile. When launched from the MK 45 Gun Weapon System (GWS) at high velocities, GLGP's high maneuverability combined with high kinetic energy at the intercept yields effectiveness against ASCMs.

Initial HVP technology demonstration focused on land-based system integration and implementation. Shipboard integration requires some modifications to the initial concept of operations to implement the technology effectively and affordably. This project matures critical enabling technologies needed to integrate HVP technology on Navy ships and executes the requisite acquisition, systems engineering, and test planning activities to initiate a development effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Guided Projectile	4.824	0.000
FY 2019 Accomplishments: - Initiated combat system architecture and design - Progressed technology maturation for critical components such as data link and terminal guidance. - Interface design documentation is in process ***FY 2020 Plans:*** N/A		
Congressional Adds Subtotals	4.824	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

D. Acquisition Strategy

Execute efforts with government labs, FFRDCs and UARCs to preserve competitive posture for a subsequent development program.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Testing and Interface Development	WR	NSWC DD : Dahlgren, VA	0.000	1.333	Jan 2019	0.000		0.000		-		0.000	0.000	1.333	-
Tech Maturation	FFRDC	JHU APL : Laurel, MD	0.000	0.593	Feb 2019	0.000		0.000		-		0.000	0.000	0.593	-
Tech Maturation	FFRDC	MIT LL : Arlington, VA	0.000	0.350	Mar 2019	0.000		0.000		-		0.000	0.000	0.350	-
Fuzing, Warhead, propelling Charge	WR	NSWC IH : indian Head, MD	0.000	0.253	Jan 2019	0.000		0.000		-		0.000	0.000	0.253	-
Sys. Eng.,Cyber, T&E	WR	NSWC DD : Dahlgren, VA	0.000	1.471	Jan 2019	0.000		0.000		-		0.000	0.000	1.471	-
CDIM, Acq. Support, ILS	WR	NSWC IH PIC Det. : Picatinny, NJ	0.000	0.538	Jan 2019	0.000		0.000		-		0.000	0.000	0.538	-
		Subtotal	0.000	4.538		0.000		0.000		-		0.000	0.000	4.538	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Eng Support	C/CPFF	Various : Various	0.000	0.286	Dec 2018	0.000		0.000		-		0.000	0.000	0.286	-
		Subtotal	0.000	0.286		0.000		0.000		-		0.000	0.000	0.286	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	4.824		0.000		0.000		-		0.000	0.000	4.824	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 9999																												
Trade Studies																												
Common ICD Development																												
Technology Maturation																												
Combat System Architecture & Design																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603795N / *Land Attack Tech*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Trade Studies	1	2019	4	2019
Common ICD Development	2	2019	4	2020
Technology Maturation	1	2019	4	2019
Combat System Architecture & Design	2	2019	4	2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	571.790	26.695	28.466	28.435	-	28.435	29.917	30.484	31.115	31.738	Continuing	Continuing
2319: *Non-Lethal Weapons*	571.790	26.695	28.466	28.435	-	28.435	29.917	30.484	31.115	31.738	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DoD Non-Lethal Weapons Program was established by the FY96 National Defense Authorization Act. The Office of the Secretary of Defense designated the Commandant of the Marine Corps (CMC) as the DoD NLW Executive Agent (EA). The EA exercises centralized responsibility for joint research and development of non-lethal weapons and technology through the Joint Non-Lethal Weapons Program (JNLWP). The Office of the Under Secretary of Defense for Acquisition and Sustainment serves as the OSD Principal Staff Assistant and oversees, in consultation with the Under Secretary of Defense for Policy, the DoD NLW Executive Agent.

The efforts described in this Program Element (PE) reflect Joint Service research and development (R&D) investment decisions by the Joint Non-Lethal Weapons Integrated Product Team, a multi-service flag level corporate board that provides executive oversight and management of the JNLWP for the EA. Research conducted is based on the requirements and capabilities sought by the Services and the Coast Guard, as identified in JROC-approved Joint Non-Lethal Effects Initial Capabilities Documents. This coordinated joint Research and Development approach addresses mutual capability gaps and assures the most relevant non-lethal technologies, capabilities and equipment are provided to the operating forces while eliminating duplicative Service investment. Advanced Component Development and Prototypes non-lethal weapons initiatives provide non-lethal capabilities in direct support of the National Defense Strategy (NDS) objective of strategic competition by providing options to the joint force in pursuit of national objectives in legal or policy constrained scenarios, as well as complementing the use of lethal effects in complex combat scenarios, for example, in urban environments with large civilian populations. Ongoing NLW studies, analyses and exercise efforts with NATO and Allies also support NDS objectives to strengthen alliances and partnerships. Resulting capabilities facilitate a fully integrated non-lethal competency as a complement to lethal firepower, providing force application options for below lethal threshold engagements.

This PE funds Joint Service research, development, test, and evaluation of non-lethal weapons, devices, munitions and technologies which provide a non-lethal capability to minimize significant injuries as well as undesired damage to property and the environment. Counter-personnel and counter-materiel capability investment areas include directed energy (lasers, millimeter wave and high power microwave), multi-sensory suppression/incapacitation initiatives (acoustics, optical, electro-muscular incapacitation), and other emergent technologies transitioning from coordinated JNLWP Science and Technology PE initiatives. Investments also focus on Joint and allied experimentation, exercise, demonstration and assessment of advanced component and prototype initiatives in order to assist transition of suitable and effective capabilities to both joint and allied operational applications.

The Joint Non-Lethal Weapons Directorate is designated as a R&D organization and was established by the EA to manage the day to day research and development activities of the DoD's JNLWP. Each Service is responsible for their procurement and operating support costs.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	27.581	28.466	28.079	-	28.079
Current President's Budget	26.695	28.466	28.435	-	28.435
Total Adjustments	-0.886	0.000	0.356	-	0.356
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.465	0.000			
• SBIR/STTR Transfer	-0.422	0.000			
• Program Adjustments	0.000	0.000	0.096	-	0.096
• Rate/Misc Adjustments	0.001	0.000	0.260	-	0.260

Change Summary Explanation

The decrease of $0.31M between FY20 and FY21 is due to NWCF rate adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2319: *Non-Lethal Weapons*	571.790	26.695	28.466	28.435	-	28.435	29.917	30.484	31.115	31.738	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops intermediate force capabilities that minimize fatal or permanent injuries and undesired damage to property and the environment. These capabilities are designed to incapacitate or hinder movement of individuals, crowds or equipment. The availability of non-lethal weapons (NLW) allows commanders less lethal options across the range of military operations, particularly in urban warfare and military operations other than war, i.e. peacekeeping, humanitarian assistance and disaster relief, as well as special operations.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Counter-Personnel Advanced Component Development and Prototypes	10.961	11.646	11.646	0.000	11.646
Articles:	-	-	-	-	-

FY 2020 Plans:

- Continue maturation of CP directed energy technologies to increase system efficiencies and reduce system size, weight and cost in preparation for transition to joint acquisition programs of record.
- Continued the advanced development of CP emerging technologies to support Service capability gaps and priorities as they support the Combatant Commanders.
- Continued technology maturation and risk reduction of competing approaches to inform decisions for Service capability development.
- Continued prototype development and assessment of advanced payloads for technological capabilities relevant to emerging counter-personnel capability gaps.
- Continued coordination and requirements development for Service counter-personnel (CP) prototyping initiatives within the JNLWP. This includes SOCOM and USCG.
- Continued development and assessment of Service-led CP NL prototype initiatives.
- Continued prototype development and demonstration for the most promising technologies employing multisensory stimuli.
- Continued program management support for CP efforts.
- Completed munitions testing and acquisition documentation of NL capability to deny, move and suppress individuals at long ranges from currently fielded weapons systems.

FY 2021 Base Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continuing maturation of counter-personnel (CP) directed energy technologies to increase system efficiencies and reduce system size, weight and cost in preparation for transition to joint acquisition programs of record. - Continuing development of CP emerging technologies to support Service capability gaps and priorities as they support the Combatant Commanders. - Continuing technology maturation and risk reduction of competing approaches to inform decisions for Service capability development. - Continuing prototype development and assessment of advanced payloads for technological capabilities relevant to emerging counter-personnel capability gaps. - Continuing coordination and requirements development for Service counter-personnel (CP) prototyping initiatives within the Joint Non-Lethal Weapons Program. - Continuing Service-led CP intermediate force prototype initiatives. - Continuing prototype development and demonstration for the most promising technologies employing multisensory stimuli. - Continuing program management support for CP efforts. - Complete non-pyrotechnic flashbang non-developmental item (NDI) testing and high intensity light evaluation. - Initiate integration of current intermediate force capabilities into an established service platform for demonstration and prototyping purposes. ***FY 2021 OCO Plans:*** N/A					
Title: Counter-Materiel Advanced Component Development and Prototypes	10.237	10.801	10.770	0.000	10.770
Articles:	-	-	-	-	-
FY 2020 Plans: - Continued advanced component development and prototyping support to the U.S. Navy's candidate Maritime Vessel Stopping capability. - Continued development of the conceptual design of non-lethal Directed Energy (DE) vessel-stopping capability, including electro-magnetic and engagement modeling, platform feasibility and integration studies, and target characterization and validation. - Continued maturation of CM directed energy technologies to increase system efficiencies and reduce system size, weight and cost in preparation for transition to joint acquisition programs of record. - Continued coordination and requirements development for Service counter-material (CM) prototyping initiatives within the JNLWP. This includes SOCOM and USCG.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continued development and assessment of Service-led CM NL prototype initiatives. - Continued the advanced development of Counter-Materiel emerging technologies to support Service capability gaps and priorities as they support the Combatant Commanders. Specifically, complete advanced development of 40mm non-lethal counter material round for USSOCOM. - Continued technology maturation and risk reduction of competing approaches to inform decisions for Service capability development. - Continued prototype development and assessment of advanced payloads for technological capabilities relevant to emerging counter-materiel capability gaps. - Continued program management support for CM efforts. - Completed Critical Design Review for counter material: Radio Frequency vehicle stopper prototype capability. - Completed production qualification testing of a Service-endorsed pre-emplaced, counter-materiel, counter vehicle stopping capability.					
FY 2021 Base Plans: - Continuing advanced component development and prototyping support to the Department of the Navy's candidate Maritime Vessel Stopping capability. (Vessel Stopping Prototype) - Continuing development of the conceptual design of non-lethal directed energy vessel-stopping capability, including electro-magnetic and engagement modeling, platform feasibility and integration studies, target characterization and validation. - Continuing maturation of counter-materiel (CM) directed energy technologies to increase system efficiencies and reduce system size, weight and cost in preparation for transition to joint acquisition programs of record. - Continuing coordination and requirements development for Service CM prototyping initiatives within the Joint Non-Lethal Weapons Program. - Continuing development and assessment of Service-led CM intermediate force prototype initiatives. - Continuing maturation of CM directed energy technologies to increase system efficiencies such as reduce system size, weight and cost in preparation for transition to joint acquisition programs of record. - Continuing the advanced development of CM emerging technologies to support Service capability gaps and priorities as they support the Combatant Commanders. - Continuing technology maturation and risk reduction of competing approaches to inform decisions for Service capability development. - Continuing prototype development and assessment of advanced payloads for technological capabilities relevant to emerging counter-materiel capability gaps. - Continuing program management support for CM efforts.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Completing production qualification testing of a Service-endorsed pre-emplaced, counter-materiel vehicle stopping capability. - Complete advanced development of 40 mm CM round for USSOCOM. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $0.31M from FY20-21 is due to NWCF rate adjustments.					
Title: Joint and Allied Exercise, Experimentation, Demonstration and Assessment	5.497	6.019	6.019	0.000	6.019
Articles:	-	-	-	-	-
FY 2020 Plans: - Continued support of two CCMDs by demonstrating and assessing NLW capabilities for vessel interdiction and counter-migration exercises. - Continued modeling and simulation (M&S) of NLWs in warfighter training/gaming models and performance effects data collection/population to demonstrate/analyze NL effects and support optimization of training. - Continued evaluation of NLWs by Service warfighting laboratories and Joint Staff, J7, Joint and Coalition Warfighting for direct user feedback of various non-lethal (NL) technologies and munitions to include policy and strategy and strategic communication. - Continued engagement with NATO on cooperative security efforts, to include providing input for Systems Analysis and Studies (SAS) Panels and NATO assessment of NLW in appropriate allied scenarios and exercises. - Continued interaction with Combatant Commander staffs to evaluate emerging NLW capabilities and their utility in theater operations and Defense of the Homeland missions. - Continued effort to assess the utility, effect, and effectiveness of technologies for incapacitating personnel, clearing facilities, stopping vehicles and vessels, and denying enemy access to protected areas. Specifically, complete vehicle stopping pilot programs for USAF and USMC. - Continued to identify, test, and evaluate newly developed commercial products that may meet Joint service requirements for specific non-lethal capability set common items. - Continued program management support for Joint and Allied Exercise, Experimentation, Demonstration and Assessment efforts. - Continued support of Combatant Commanders (CCMD) by demonstrating and assessing NLW capabilities for multiple priority mission areas, such as port opening operations; Humanitarian Assistance and Disaster Relief					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(HA/DR) and Counter-Transnational Organized Crime (CTOC) operations; and harbor and in-transit security operations. - Complete leadership of the NATO Special Area Study 133 (SAS-133) panel addressing challenges in fielding NL capabilities.					
FY 2021 Base Plans: - Continuing support to Combatant Commands (CCMDs) by demonstrating and assessing intermediate force capabilities in vessel interdiction and counter-migration exercises. Specifically, continue support to USEUCOM/ USAFRICOM through engagement with NATO's Maritime Interdiction Operations Training Center (MIOTC). - Continuing modeling and simulation of intermediate force capabilities in warfighter training/gaming models and performance effects data collection/population to demonstrate/analyze non-lethal effects and support optimization of training. - Continuing evaluation of intermediate force capabilities by Service warfighting laboratories and Joint Staff, J7, Joint and Coalition Warfighting for direct user feedback of various non-lethal (NL) technologies and munitions to include policy and strategy and strategic communication. - Continuing engagement with NATO on cooperative security efforts, to include providing input for Systems Analysis and Studies (SAS) Panels and NATO assessment of intermediate force capabilities in appropriate allied scenarios and exercises. - Continuing interaction with Combatant Commander Staffs to evaluate emerging intermediate force capabilities and their utility in theater operations and Defense of the Homeland missions. - Continuing to assess the utility, effect, and effectiveness of technologies for incapacitating personnel, clearing facilities, stopping vehicles and vessels, and denying enemy access to protected areas. - Continuing to identify, test, and evaluate newly developed commercial products that may meet Joint service requirements for specific non-lethal capability set common items. - Continuing program management support for Joint and Allied Exercise, Experimentation, Demonstration and Assessment efforts. - Continuing support of CCMDs by demonstrating and assessing intermediate force capabilities for multiple priority mission areas, such as port opening operations; Humanitarian Assistance and Disaster Relief, Counter-Transnational Organized Crime operations; and harbor and in-transit security operations. - Complete the pre-emplaced vehicle stopping pilot program for USAF.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A					
Accomplishments/Planned Programs Subtotals	26.695	28.466	28.435	0.000	28.435

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN/0602651M/0000: *Joint Non-Lethal Weapons Applied Research*	6.137	6.346	6.343	-	6.343	6.468	6.600	6.732	6.866	Continuing	Continuing
• RDTEN/0603651M/3022: *Joint Non-Lethal Weapons Advanced Technology Development*	12.956	13.307	13.301	-	13.301	13.564	13.840	14.116	14.399	Continuing	Continuing

Remarks

D. Acquisition Strategy

The JNLW Program strategy is to pursue the fielding of NLW systems through modifying Commercial-Off-The-Shelf (COTS) products for near term capabilities and the development of new technology NLW systems in various stages of acquisition. These are balanced with efforts in state-of-the-art technology investment, experimentation, and modeling and simulation. The acquisition strategy for each weapon system is largely Lead Service dependent. The JNLWP provides RDT&E funding while the Services are responsible for procurement and operations and maintenance funding. For complex development programs, such as directed energy research, JNLWP RDT&E funds will support each Service's RDT&E joint application efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NLW Product Development	MIPR	ARDEC : Picatinny, NJ	56.871	2.749	Oct 2018	2.757	Oct 2019	0.461	Oct 2020	-		0.461	Continuing	Continuing	Continuing
NLW Product Development	MIPR	SOCOM : McDill AFB, FL	26.340	0.000		0.000		0.000		-		0.000	0.000	26.340	-
NLW Product Development	Various	NSWC : Various	50.793	6.175	Oct 2018	6.297	Oct 2019	8.812	Oct 2020	-		8.812	Continuing	Continuing	Continuing
NLW Product Development	MIPR	USAF : Ft. Sam Houston AFB, TX	59.576	0.371	Oct 2018	0.515	Oct 2019	0.365	Oct 2020	-		0.365	Continuing	Continuing	Continuing
NLW Product Development	Various	MCSC : Quantico, VA	35.194	0.475	Oct 2018	0.395	Oct 2019	4.851	Oct 2020	-		4.851	Continuing	Continuing	Continuing
NLW Product Development	Various	Uniformed Services : Various	185.190	7.718	Oct 2018	9.629	Oct 2019	5.090	Oct 2020	-		5.090	Continuing	Continuing	Continuing
Prior Year NLW Product Development	Various	Various : Various	65.401	0.000		0.000		0.000		-		0.000	0.000	65.401	-
		Subtotal	479.365	17.488		19.593		19.579		-		19.579	Continuing	Continuing	N/A

Remarks

Joint Program funds are prioritized and provided to the USA, USAF, USN, USMC, SOCOM, and USCG in support of NLW research and development efforts. Each Cost Category Item does not correlate to an individual project/effort. They fund multiple non-lethal projects/efforts that are incrementally funded throughout the fiscal year as each service identifies the project/effort requiring funding. October award dates reflect the start of incremental funding and does not indicate that the full amount will be awarded in October.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NLW Support Cost	WR	NSWC : Dahlgren, VA	17.992	0.632	Oct 2018	0.737	Oct 2019	0.268	Oct 2020	-		0.268	Continuing	Continuing	Continuing
		Subtotal	17.992	0.632		0.737		0.268		-		0.268	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
JNLW Management Support	Various	MCSC : Quantico, VA	33.712	8.575	Oct 2018	8.136	Oct 2019	8.588	Oct 2020	-		8.588	Continuing	Continuing	Continuing
Prior Year Management Services	Various	Various : Various	40.721	0.000		0.000		0.000		-		0.000	0.000	40.721	-
		Subtotal	74.433	8.575		8.136		8.588		-		8.588	Continuing	Continuing	N/A

Remarks

The JNLW Management Support was previously incorporated into the various cost categories instead of being displayed in the corresponding section of the R-3. The Management Services section of the R-3 now reflects the amounts for civilian salaries and contractor program management. The funding fluctuates across the R-2A categories based on the demand signals of the Services, USSOCOM, and the USCG.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	571.790	26.695		28.466		28.435		-		28.435	Continuing	Continuing	N/A

Remarks

Joint Program funds are prioritized and provided to the USA, USAF, USN, USMC, SOCOM, and USCG in support of NLW research and development efforts. Each Cost Category Item does not correlate to an individual project/effort. They fund multiple non-lethal projects/efforts that are incrementally funded throughout the fiscal year as each service identifies the project/effort requiring funding. October award dates reflect the start of incremental funding and does not indicate that the full amount will be awarded in October.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603851M / *Joint Non-Lethal Weapons Testing*	**Project (Number/Name)** 2319 / *Non-Lethal Weapons*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2319				
Counter Vehicle: Radio Frequency Vehicle Stopping (RFVS) Technologies: Critical Design Review	1	2019	2	2020
Counter Vessel: Vessel Stopping Prototype (VSP) Technology Development: Preliminary Design Review	1	2019	1	2020
Counter Vessel: Vessel Stopping Prototype (VSP) Technology Development: Critical Design Review	1	2020	2	2021
Counter Vessel: Vessel Stopping Prototype (VSP) Technology Development: Advanced Demonstration Model (ADM) Development and Integration on Alternative Platform	1	2019	4	2023
Counter Vessel: Vessel Stopping Prototype (VSP) Technology Development: Land-Based Validation and Verification Testing	1	2023	4	2023
Counter Vessel: Vessel Stopping Prototype (VSP) Technology Development: ADM Integration on Primary Platform	1	2023	4	2024
Millimeter Wave (mmW) Radio Frequency (RF): Active Denial Technologies (ADT): ADM Military Utility Assessment (MUA)	1	2019	1	2020
Counter Personnel: Long Range Suppression Prototype: Ballistics and qualification testing	1	2019	3	2020
Counter Personnel: Long Range Suppression Prototype: Counter Materiel: 40mm NL Round: Qualification Testing	1	2021	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,232.955	99.123	51.341	33.612	-	33.612	25.284	15.451	11.246	11.472	Continuing	Continuing
2329: *JPALS*	1,232.955	99.123	51.341	33.612	-	33.612	25.284	15.451	11.246	11.472	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 238

A. Mission Description and Budget Item Justification

A. Mission Description and Budget Item Justification

The Joint Precision Approach and Landing System (JPALS) is the primary precision approach and landing system for CVN and LHA/D ships to support aircraft without SPN-46 Automatic Carrier Landing Systems (ACLS) capability including F-35B, F-35C, MQ-25A and future platforms. JPALS ship systems are required to provide CVN and LHA/D ships a primary precision approach capability during night and instrument flight conditions, including coupled approach capability to a hover transition point for LHA/D ships, and coupled approach to the deck (auto-land) capability aboard CVN ships. JPALS also provides the over-the-air inertial alignment capability for CVN and LHA/D ships to support aircraft platforms without Link-4A capability, including F-35, MQ-25A and future platforms. JPALS efforts include addressing broadened CyberSecurity requirements to remain compliant with software CyberSecurity directives and Information Assurance mandates.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in high fidelity and realistic operating environments.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	101.566	51.341	32.871	-	32.871
Current President's Budget	99.123	51.341	33.612	-	33.612
Total Adjustments	-2.443	0.000	0.741	-	0.741
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.443	0.000			
• Program Adjustments	0.000	0.000	0.539	-	0.539
• Rate/Misc Adjustments	0.000	0.000	0.202	-	0.202

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*

Change Summary Explanation

Technical: N/A

Schedule: N/A

Financial: FY 2021 increase of $741K is for CyberSecurity requirements.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*				**Project (Number/Name)** 2329 / *JPALS*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2329: *JPALS*	1,232.955	99.123	51.341	33.612	-	33.612	25.284	15.451	11.246	11.472	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 238												

A. Mission Description and Budget Item Justification

This budget reflects the Department of Defense certified Component Cost Position of the restructured Joint Precision Approach and Landing System (JPALS) program that funds the developmental, testing, and integration activities to implement and field JPALS ship systems that deliver the primary precision approach, landing, on-deck inertial alignment, surveillance, and auto-land capability for current and future low observable manned and unmanned platforms onboard all CVN and LHA/D ships. JPALS provides for development, integration, installation, and test of JPALS on CVN and LHA/D ships in accordance with the Joint Requirements Oversight Council (JROC) March 2016 approved JPALS Capability Development Document (CDD). JPALS Engineering Development Model (EDM) articles have been delivered to support JPALS EMD activities.

JPALS EDMs have been installed at shore based test facilities and (temporarily) on CVN and LHA/D ships to support F-35B/C developmental and operational testing and MQ-25A concept refinement, system requirements identification, allocation, surrogate risk reduction, and test. Two JPALS EDMs were procured in FY 2017 to support testing and F-35 shipboard operational deployments. JPALS will continue to invest in software development in direct support of precision approach and auto-land capabilities for the F-35B/C, MQ-25A, and future air platforms. JPALS effort includes addressing broadened CyberSecurity requirements to remain compliant with software CyberSecurity directives and Information Assurance mandates. Remaining costs are associated with the completion of the test and support to fielded EDM units.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: JPALS Ship Systems and Test	93.537	45.540	27.702	0.000	27.702
Articles:	-	-	-	-	-
Description: JPALS provides for development, integration, installation, and test of Sea-Based JPALS on CVN and LHA/D ships.					
FY 2020 Plans: Begin Operational Test (OT). Continue to support F-35 operational deployments. Conduct Interactive Electronic Technical Manuals (IETM) Validation and Verification, complete Maintenance Demonstration.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Close out Operational Test (OT), Initial Operational Test and Evaluation (IOT&E) Phase II. Continue to support F-35 operational deployments. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $17.838M from FY 2020 to FY 2021 is due to EMD phase ramping down.					
Title: Joint Strike Fighter (JSF) F-35B Marine Corp STOVL and F-35C Navy Carrier Variant Support	4.020	4.101	4.180	0.000	4.180
Articles:	-	-	-	-	-
Description: Provide technical development, shore based, and ship based support for F-35B and F-35C JPALS Integration and Developmental Test (DT) and Operational Test (OT) events. Provide JPALS system certification and documentation to certify shipboard all weather precision approach capability for F-35 operational test and deployments. ***FY 2020 Plans:*** Continue support of operational deployments of JPALS Ultra High Frequency Data Broadcast (UDB) capable F-35 aircraft including delivery, installation, and ship rider technical support of the JPALS Early Operational Capability (EOC) units onto ships. Continue planning of JPALS two-way, autoland, and M-code implementation into F-35 aircraft. Begin development of JPALS two-way and autoland implementation into F-35 aircraft. ***FY 2021 Base Plans:*** Continue support of operational deployments of JPALS UDB capable F-35 aircraft including delivery, installation, and ship rider technical support of the JPALS Early Operational Capability (EOC) units onto ships. Continue development of JPALS two-way and autoland implementation into F-35 aircraft. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $.079M from FY 2020 to FY 2021 is due to inflation.					
Title: MQ-25 Support	1.566	1.700	1.730	0.000	1.730
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: Provide technical support, lab support, requirements identification, allocation and test activities for MQ-25. Support MQ-25 concept refinement, requirements development, integration specifications, and risk reduction activities for JPALS integration. Support MQ-25 concept refinement and JPALS integration and developmental activities. ***FY 2020 Plans:*** Continue JPALS algorithm integration support and testing. Prepare JPALS system integration lab at Patuxent River for MQ-25 shore testing. ***FY 2021 Base Plans:*** Continue JPALS algorithm integration support and testing. Continue preparation of JPALS system integration lab at Patuxent River for MQ-25 shore testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $.030M from FY 2020 to FY 2021 is due to inflation.					
Accomplishments/Planned Programs Subtotals	99.123	51.341	33.612	0.000	33.612

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2867: *JPALS*	38.094	85.445	100.751	-	100.751	51.640	9.999	4.135	4.232	0.631	294.927

Remarks

D. Acquisition Strategy

Technology Development phase was conducted jointly by NAVAIRSYSCOM (PMA-213), USAF Electronic Systems Command (Global Air) and multiple industry partners. This effort provided the concept of operations, performance specifications and technology readiness levels necessary to provide the foundation from which to launch the Increment 1 System Development and Demonstration (SDD) phase development. Joint Precision Approach and Landing System (JPALS) reached MS-B on 14 July 2008 and the SDD phase development contract was awarded on 17 July 2008. Tasking consisted of sea-based JPALS, related ship and airborne reference systems, end-to-end software algorithms, necessary ship installation hardware, test equipment, system simulation software, and other RDT&E deliverable products. The SDD contract was awarded after full and open competition. JPALS is being developed by the Navy with an open system architecture in order to facilitate the compatible integration of many different aircraft and avionics architectures. JPALS provides for development, integration, installation, and test of Sea-Based JPALS to meet Initial

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

Operation Capability of CVN and LHA/D ships in accordance with the JPALS Capability Development Document (CDD). Additionally, this requirement provides critical enabling technology for Joint Strike Fighter (JSF) F-35B Marine Corps Short Take-Off and Vertical Landing (STOVL) and F-35C Navy Carrier Variant, ship-based MQ-25A, and future Navy and Marine Corps air platforms.

As a result of the DON Resource and Requirements Review Board approved PALC Roadmap, the JPALS production phase was deferred to include design improvements to provide manned and unmanned aircraft with autoland capabilities. The current Engineering and Manufacturing Development (EMD) contract was modified in FY14 to add detailed requirements and design trade studies to identify specific system design improvements. An extension for pre-Milestone B efforts was awarded in fourth quarter FY15.

A Development RFP Release Decision Point (DRRDP) Defense Acquisition Board (DAB) was completed and the RFP for JPALS EMD 16 was released on 24 November 2015. A Milestone B (MS B) DAB was completed 02 June 2016. The MS B Acquisition Decision Memorandum (ADM) was approved 27 June 2016, which granted entry into the EMD phase for the restructured JPALS program and officially completed all actions required to exit Nunn-McCurdy. JPALS now has an approved Acquisition Program Baseline (APB) and has been designated an Acquisition Category (ACAT) 1C program. Sole Source contract was awarded to Raytheon in fourth quarter FY16. Completed Milestone C in April 2019.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603860N / *JNT Precision Approach & Ldg Sys*	Project (Number/Name) 2329 / *JPALS*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Ship Integration	WR	NAWCAD : Pax River, MD	67.872	9.995	Nov 2018	3.653	Nov 2019	1.575	Nov 2020	-		1.575	Continuing	Continuing	Continuing
Primary Hardware Development - EMD Phase I	C/CPIF	Raytheon : Fullerton, CA	410.181	0.000		0.000		0.000		-		0.000	0.000	410.181	410.181
Primary Hardware Development - New EMD Contract	C/CPIF	Raytheon : Fullerton, CA	128.883	60.860	Nov 2018	30.073	Nov 2019	21.021	Nov 2020	-		21.021	30.136	270.973	270.973
JPALS Modifications for ARC-210	C/CPFF	RCI : Cedar Rapids, IA	5.104	1.849	Nov 2018	1.650	Nov 2019	0.758	Nov 2020	-		0.758	0.758	10.119	10.119
Risk Reduction for Auto-land - FFRDC Support	FFRDC	JHU : Laurel, MD	0.493	0.000		0.000		0.000		-		0.000	0.000	0.493	-
Prior Year Prod Dev no longer funded in the FYDP	TBD	Various : Various	249.870	0.000		0.000		0.000		-		0.000	0.000	249.870	-
		Subtotal	862.403	72.704		35.376		23.354		-		23.354	Continuing	Continuing	N/A

Remarks

The Primary Hardware Development contract with Raytheon is a CPIF contract. FY 2020 funding re-aligned from Ship Integration to Systems Engineering Support due to reduced EDM ship integration activities and increased System Engineering efforts in FY 2020.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering Support	WR	NAWCAD : Pax River, MD	192.203	16.375	Nov 2018	7.035	Nov 2019	5.605	Nov 2020	-		5.605	Continuing	Continuing	Continuing
Integrated Logistics Support	WR	NAWCAD : Pax River, MD	30.542	2.682	Nov 2018	0.725	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Prior Year Support Costs non longer funded in FYDP	Various	Various : Various	21.514	0.000		0.000		0.000		-		0.000	0.000	21.514	-
		Subtotal	244.259	19.057		7.760		5.605		-		5.605	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract

Remarks

FY 2020 increased from FY 2020 President's Budget Request is due to management of EDM units, Software Integration Lab (SIL) efforts, and correction of deficiencies found during test.

Decrease in Systems Engineering support and Integrated Logistics support between FY 2020 and FY 2021 is due to EMD phase ramping down.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAWCAD : Pax River, MD	76.283	2.772	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	4.945	0.638	Nov 2018	0.726	Nov 2019	0.605	Nov 2020	-		0.605	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	NAWCAD : Pax River, MD	0.000	0.000		6.387	Nov 2019	2.994	Nov 2020	-		2.994	0.000	9.381	-
		Subtotal	81.228	3.410		7.113		3.599		-		3.599	Continuing	Continuing	N/A

Remarks

Decrease in Operational Test & Evaluation between FY 2020 and FY 2021 is due to completion of Initial Operational Test and Evaluation (IOT&E) Phase II, and Initial Operational Capability (IOC).

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NAWCAD : Pax River, MD	25.752	3.050	Nov 2018	0.917	Nov 2019	0.899	Nov 2020	-		0.899	Continuing	Continuing	Continuing
PM Support-MSS	C/CPFF	Amelex : Pax River, MD	14.844	0.829	May 2019	0.133	Jan 2020	0.130	Jan 2021	-		0.130	1.069	17.005	17.005
PM Support-MSS	C/CPFF	Avian : Pax River, MD	1.592	0.000		0.000		0.000		-		0.000	0.000	1.592	1.592

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
PM Support-MSS	C/CPFF	SAIC : Pax River, MD	2.487	0.000	Nov 2018	0.000		0.000		-		0.000	0.000	2.487	2.487
Travel	WR	NAVAIR : Pax River, MD	0.390	0.073	Nov 2018	0.042	Nov 2019	0.025	Nov 2020	-		0.025	Continuing	Continuing	Continuing
		Subtotal	45.065	3.952		1.092		1.054		-		1.054	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1,232.955	99.123		51.341		33.612		-		33.612	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

JPALS Program Schedule

Distribution Statement. D: Distribution authorized to Department of Defense and their contractors in order to protect technical data or information from automatic dissemination. Other requests for this document shall be referred to Program Executive Officer, Tactical Aircraft Programs (PEO(T)), Naval Air Traffic Management Systems (PMA-213), 46579 Expedition Drive, Expedition IV, Suite 301, Lexington Park, MD 20653.

Notes:
1. EDM Locations – 1 (Raytheon), 2 (PAX Schoolhouse), 3 (PAX CSIL)

Legend:
- Critical Path to JPALS IOC
- Critical Path to F-35 JPALS EOC
- O =Objective, T =Threshold

EDM Procurement
Lot Buys
Projected Test/Cert
Production Unit

Revision Date: 25 October 2019

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603860N / *JNT Precision Approach & Ldg Sys*	**Project (Number/Name)** 2329 / *JPALS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
JPALS				
Acquisition Milestones: MS C	3	2019	3	2019
Acquisition Milestones: Initial Operating Capability (IOC)	1	2021	1	2021
Systems Development: Engineering and Manufacturing Development	1	2019	4	2022
Systems Development: Reviews: System Verification Review (SVR)	1	2019	1	2019
Systems Development: Reviews: System Verification Review (SVR) 2	4	2019	4	2019
Systems Development: Reviews: Integrated Logistics Assessment (ILA)	2	2019	2	2019
Systems Development: Contract Awards: LRIP Contract Award	3	2019	3	2019
Test & Evaluation: Operational Test and Evaluation (IOT&E) Phase II	3	2020	1	2021
Test & Evaluation: JPALS Operational Test Readiness Review (OTRR) II	2	2020	2	2020
Production Milestones: Production Readiness Review (PRR)	1	2019	1	2019

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	101.334	138.988	135.919	128.845	-	128.845	87.011	50.664	40.806	38.240	Continuing	Continuing
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	0.000	6.750	38.012	-	38.012	29.952	15.462	6.506	3.251	Continuing	Continuing
3402: *Surface Navy Laser Weapon System (SNLWS)*	47.330	81.048	89.234	56.266	-	56.266	47.198	29.353	29.925	30.527	Continuing	Continuing
9823: *Lasers for Navy applicat*	54.004	32.954	19.935	34.567	-	34.567	9.861	5.849	4.375	4.462	Continuing	Continuing
9999: *Congressional Adds*	0.000	24.986	20.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.986

A. Mission Description and Budget Item Justification

This program element will transition Directed Energy and Electric Weapon Systems (DE&EWS) technology from Science and Technology (S&T) research to the Technology Maturation and Risk Reduction phase, ultimately leading to acquisition initiation for the Surface/Subsurface Navy.

DE&EWS consist of multiple breakthrough technologies including: laser weapons that provide for speed-of-light engagements at tactically significant ranges resulting in savings realized by minimizing the use of defensive missiles and projectiles; electromagnetic launch of projectiles that will significantly increase firing ranges imposing greater cost to adversaries of ballistic and air defense missile engagements; enhance the land attack mission; and fielding of high power radio frequency systems for non-kinetic electronic attack and active denial technology, allowing for non-lethal determination of threat intent beyond small arms fire ranges.

Development of DE&EWS includes: Weapons Grade High Energy Lasers, Electromagnetic Railgun (EMRG) Weapon Systems, High Power Radio Frequency Weapon/ Sensor Systems, and other systems/capabilities.

Project 2731 - High Energy Laser Counter ASCM Project (HELCAP): Defeating Anti-Ship Cruise Missiles (ASCMs) with a laser weapon system presents several technical challenges (e.g. high atmospheric turbulence, target acquisition and identification, target tracking, aim point maintenance, automatic aim point placement, jitter control). The High Energy Laser Counter ASCM Project (HELCAP) will assess, develop, experiment, and demonstrate the various laser weapon system technologies and methods of implementation (e.g. laser sources, mission analysis, lethality, advanced beam control with atmospheric mitigation, target and tracking sensors, control systems) required to defeat ASCMs in a crossing engagement.

FY2021 funding will provide for systems engineering, mission analysis, and the design completion, fabrication, and integration of major components of a HELCAP prototype system. Planning and preparations for FY2022-FY2023 system experimentation and demonstrations utilizing the prototype system will also continue.

Project 3402 - The Surface Navy Laser Weapon System (SNLWS) program supports the National Defense Strategy of building a more lethal force by leveraging mature technology to deliver proven laser weapon capability to the Fleet as part of the Navy Laser Family of Systems (NLFoS) initiative with the objective of providing the fleet

with near-term laser weapon capabilities. Additionally, accelerated learning through incorporation of laser weapon Concept of Operations (CONOPs), employment, and maintenance will enable the rapid development and integration of these capabilities with the Navys existing weapon systems. This NLFoS initiative will also develop and validate warfighting requirements for laser weapons to address a variety of threats and to mature technologies and system integration readiness. HELIOS provides a low cost-per-shot capability to address Anti-Surface Warfare and Counter-Intelligence, Surveillance and Reconnaissance (C-ISR) gaps with the ability to dazzle and destroy Unmanned Aerial Systems (UAS) and defeat Fast Inshore Attack Craft (FIAC) while integrated into the AEGIS Combat System on a Flt IIA Destroyer. SNLWS provides industry-developed and government integrated capability to the Fleet in as short a timeframe as possible, thereby addressing the National Defense Strategy direction to foster a culture of innovation. SNLWS includes the development of a laser weapon system in the 60 kW or higher class. Competition was utilized for system development and production efforts. SNLWS leverages mature technology that will deliver a mature laser weapon system capability to the Fleet. SNLWS development leverages the Laser Weapon System (LaWS)/Solid State Laser Quick Reaction Capability (SSL QRC) and Solid State Laser Technology Maturation (SSL TM)/Laser Weapon System Demonstrator (LWSD) efforts.

The FY 2021 funding supports completion of the system build, review and delivery of the Technical Data Package, logistics support material and training, and Packaging, Handling, Storage and Transportation (PHS&T) of one system for conduct of land based testing and subsequent delivery pier side for shipboard installation in a DDG 51 Flt IIA ship during AEGIS Modernization, and conduct of System Operational Verification Testing (SOVT).

Project 9823 - Lasers for Navy Applications: Optical Dazzling Interceptor Navy (ODIN) development provides near-term, directed energy, shipboard Counter-Intelligence, Surveillance, and Reconnaissance (C-ISR) capabilities to dazzle Unmanned Aerial Systems (UASs) and other platforms that address urgent operational needs of the Fleet. FY 2018 was the first year of funding which supports the design, development, procurement and installation of 8 ODIN standalone units over the FYDP, for deployment on DDG 51 Flt IIA surface combatants. The program supports the non-recurring engineering, development, procurement of long lead material, assembly and checkout, system certification, platform integration/installation and sustainment for these ODIN standalone units.

The FY 2021 funding completes procurement, assembly, checkout, integration, T&E and installation of Units 4 and 5; continues procurement, assembly, checkout, integration and T&E of Units 6, 7 and 8; and provides Operation & Sustainment (O&S) of Units 1-5. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR) is required.

Project 9999 (PU C440/C547) - Congressional Adds - Railgun Program: Congress added funding in FY2019 and FY2020 for ship-based program/technical development and ship integration related risk reduction. Electromagnetic railgun provides increased capability for the following mission sets: Naval Surface Fire Support (NSFS), Integrated Air and Missile Defense (IAMD), Fast Attack Craft and Fast Inshore Attack Craft (FAC/FIAC), and future potential for Anti-Surface Warfare (ASuW). This funding supports the testing and refinement of pulse current transfer, mount, and hypervelocity projectile component development. In addition, this project supports the continuing effort to define and evolve requirements related to mount and platform interface management and maturations of specifications for tactical railgun weapon system.

Project 9999 (PU C453) - Congressional Add - Surface Navy Laser Weapon System (SNLWS) Program Re-phasing: Congress added funding in FY 2019 for re-phasing of the SNLWS development and fielding effort. This funding supports procurement of HELIOS long lead materials in FY 2019 related to early award of the contract to Lockheed Martin Aculight.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*

Project 9999 (PU C516) - Congressional Add - High Energy Laser (HEL) Weapon System for Counter-Unmanned Ariel System (C-UAS) Area defense is a Congressionally directed effort to develop/build a minimized footprint, laser-agonistic beam director and beam control system (M-BD/BCS) to support Commercial Off The Shelf (COTS) lasers >10KW for possible application to Joint Light Tactical Vehicle (JLTV) sized vehicles.

FY2020 funding will provide for systems engineering, design, and fabrication of this M-BD/BCS.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	142.814	118.169	80.903	-	80.903
Current President's Budget	138.988	135.919	128.845	-	128.845
Total Adjustments	-3.826	17.750	47.942	-	47.942
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-2.250			
• Congressional Rescissions	-	-			
• Congressional Adds	-	20.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.296	0.000			
• SBIR/STTR Transfer	-3.530	0.000			
• Program Adjustments	0.000	0.000	26.557	-	26.557
• Rate/Misc Adjustments	0.000	0.000	21.385	-	21.385

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Electromagnetic Railgun*	9.647	0.000
Congressional Add: *SNLWS Program Rephasing*	15.339	0.000
Congressional Add: *High Energy Laser Weapon System for C-UAS Area Defense*	0.000	10.000
Congressional Add: *Railgun*	0.000	10.000
Congressional Add Subtotals for Project: 9999	24.986	20.000
Congressional Add Totals for all Projects	24.986	20.000

Change Summary Explanation

The FY 2019 net funding decrease in the amount of $3.826 million consists of a $3.530 million SBIR/STTR/FTT Assessment; and a $.296 million Below Threshold Reprogramming (BTR) required to cover higher priority requirements.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*

The FY20 net funding increase in the amount of $17.75 million consists of a Congressional Directed Reduction against HELCAP in the amount of $2.25 million and two Congressional Adds: $10 million for the Electromagnetic Rail Gun Program and $10 million for the HEL Weapon System for C-UAS.

FY20 Schedule change for SNLWS: FQT shifted left; from early FY21 to late FY20 on the schedule.

FY21 Program Adjustments of $47.942 million accounts for an $18.957 million increase for the High Energy Laser Counter ASCM Project (HELCAP) PU 2731 to procure and integrate all major elements of a prototype system to address laser technology for ACSM threats; and a $28.95 million increase for Lasers for Navy Applications PU 9823 in support of the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units as a result of realized cost growth; and a $.035 million rate adjustment.

9823 Lasers for Navy Applications - Program change rationale - A Program Adjustment in the amount of $28.95 million in FY21 and $3.5 million in FY22 was provided to Lasers for Navy Applications PU 9823 in support of the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units as a result of realized cost growth. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR) is required.

Product Development: The cost savings originally estimated from production of multiple units by government vice industry have not been realized. The FY 2020 President's Budget request cost per ODIN system (material only) was estimated at approximately $3.63M (8 units = $29M); DON 21 cost per unit (material only) was realized at approximately $5.18M (6 units = $31.1M).

- ODIN is the first of its kind laser system. Non-recurring engineering (NRE) costs increased significantly due to new technology development efforts required for the following system components: lasers, fast steering mirrors, line replaceable units, control software, telescopes with mounted optics, and motor control units and drive assemblies for the gimbal and fine track cameras.

- Software development estimates increased (i.e., 20K estimated lines of code to 42K estimated lines of code, a $7M increase), due to system complexities, capabilities, and concept of employment.

Support: Platform Integration including Installation Control Drawings (ICDs), Ship Installation Drawings (SIDs) and system installation costs were realized at three times the original cost estimate. Below-deck work required for ODIN installations is more extensive than originally programmed.

Test & Evaluation (T&E): Testing of newly developed capabilities required a much higher quantity and quality of aircraft and targets for testing; and subsequent data analysis to validate requisite system capabilities.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	0.000	6.750	38.012	-	38.012	29.952	15.462	6.506	3.251	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This project is not a new start in FY20 as efforts associated with RHEL PH II now titled HELCAP were ongoing in PE 0603801N. Due to technology maturation, a portion of HELCAP program efforts now fall into BA04.

A. Mission Description and Budget Item Justification

The High Energy Laser Counter ASCM Project (HELCAP) will expedite the development, experimentation, integration and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) by addressing the remaining technical challenges, e.g.: atmospheric turbulence, automatic target identification and aim point selection, precision target tracking with low jitter in high clutter conditions, advanced beam control, and higher power HEL development. HELCAP will assess, develop, experiment, and demonstrate the various laser weapon system technologies and methods of implementation required to defeat ASCMs in a crossing engagement.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: High Energy Laser Counter ASCM Project (HELCAP)	0.000	6.750	38.012	0.000	38.012
Articles:	-	-	-	-	-

Description: The High Energy Laser Counter ASCM Project (HELCAP) will expedite the development, experimentation, integration and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) by addressing the remaining technical challenges, e.g.: atmospheric turbulence, automatic target identification and aim point selection, precision target tracking with low jitter in high clutter conditions, advanced beam control, and higher power HEL development. HELCAP will assess, develop, experiment, and demonstrate the various laser weapon system technologies and methods of implementation required to defeat ASCMs in a crossing engagement.

HELCAP will leverage the knowledge gained in the Navy Laser Family of Systems (NLFoS) efforts:
- Alternative Laser Sources for higher powers, also known as the Ruggedized High Energy Laser (RHEL) activities;

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Solid State Laser Tech Maturation activities that provides initial key enabling technical solutions in high power lasers and beam control, and will provide opportunities for single ship operational and sustainment learning; - Surface Navy Laser Weapon System Increment 1 (SNLWS Inc. 1) project that provides the initial combat system integration and installation knowledge for Aegis platforms, and multi-ship battle force operations knowledge; - Optical Dazzling Interdictor Navy (ODIN) that provides Counter-ISR technical and fleet operational knowledge. This leveraged knowledge and new HELCAP technical solutions to the C-ASCM problem will enable a fully informed decision to rapidly field an integrated, fleet ready, HEL Weapon. HELCAP activities being conducted with advanced technology development (BA 03) funds under PE 0603801N Innovative Naval Prototypes (INP) include technology assessments, laser lethality investigations, and advanced beam control. HELCAP activities being conducted within this program element (PE) include: the laser weapon control system; test site auxiliary prime power and cooling; adapting an OSD 300 kW+ laser source for transport and integration with the prototype system; integrating the beam control testbed from the BA 03 effort; integrating all remaining prototype system elements; and performing experimentation and detect-to-defeat demos conducted within this program element (PE). ***FY 2020 Plans:*** The FY 2020 funding supports automated laser weapon control activities, as well as the initiation of planning and establishment of test assets and test site preparations to enable FY 2022-2023 counter ASCM detect to defeat demonstrations. FY 2020 tasks include: - Perform Systems Engineering activities to ensure that the advanced technology development (BA 03) HELCAP products being produced under PE 0603801N appropriately interface with automated laser weapon control and planned counter ASCM detect to defeat demonstrations. - Perform additional mission analysis to ensure counter ASCM detect to defeat demos are representative of future concepts of operations. - Perform automated laser weapon control system design and fabricate tasks including laser weapon control, laser weapon console, and target acquisition handover. Activities may include requirements flow-down, design reviews, interface documents, and identification of long lead procurements,					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Initiate planning to enable FY 2022-2023 counter ASCM detect to defeat demonstrations. This may include requirements development, draft integrated test plans, confirm test site selection and initial approvals, and identification of long lead test articles. - Initiate establishment of test asset procurements and site preparation to enable FY 2022-2023 counter ASCM detect to defeat demonstrations. OCO: N/A.					
FY 2021 Base Plans: FY2021 funding will provide for systems engineering, mission analysis, and the design completion, fabrication, and integration of major components of a HELCAP prototype system. Planning and preparations for FY2022-FY2023 system experimentation and demonstrations utilizing the prototype system will also continue. FY2021 tasks include: - Perform additional mission analysis to ensure counter ASCM detect to defeat demos are representative of future concepts of operations - Continue to perform Systems Engineering activities to ensure that all elements of the prototype system meet interface and performance requirements for planned counter ASCM detect to defeat experimentation and demonstrations. Prototype system elements include the beam control testbed, 300 kW+ laser source, prototype control system, and auxiliary prime power and cooling. - Complete design and fabricate laser weapon control, prime power, and cooling hardware. - Select one of the laser sources being developed under an OSD laser scaling initiative and adapt it for transport and interface with the other elements of the prototype system - Integrate all prototype system and auxiliary elements including beam control, laser source, laser weapon control, prime power, and cooling. - Continue T&E planning to enable FY22-23 counter ASCM detect to defeat experimentation and demonstrations. This may include requirements development, draft integrated test plans, safety, initial approvals, and identification of long lead test articles. - Continue test asset procurements and site preparation to enable FY22-23 counter ASCM detect to defeat experimentation and demonstrations.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding for HELCAP efforts increases from $6.75M to $38M in order to procure and initiate integration of major elements of the prototype system. This includes the laser weapon control system; test site auxiliary prime power and cooling; and adapting an OSD 300 kW+ laser source for transport and integration with the prototype system. Additionally, the beam control test bed developed under PE 0603801N will be integrated into the prototype system.					
Accomplishments/Planned Programs Subtotals	0.000	6.750	38.012	0.000	38.012

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTE/0603801N/2731: *High Energy Laser Counter ASCM Project*	0.000	0.000	29.500	-	29.500	14.000	4.000	0.000	0.000	0.000	47.500

Remarks

D. Acquisition Strategy

The HELCAP is an initiative that provides a flexible prototype system for government experimentation and demonstration of a high-energy laser system capable of defeating an anti-ship cruise missile. Key elements of the prototype system include the beam control testbed, 300 kW+ laser source, prototype control system, and auxiliary prime power and cooling. The industry provider of the beam control testbed (developed under PE 0603801N) was selected through a competitive process and is being designed to accept technology insertion from other industry providers. The 300+ kW laser source will be acquired by selecting one of the laser sources being developed under an OSD laser scaling initiative and adapting it for transport and interface with the other elements of the prototype system. The Naval Surface Warfare Center Dahlgren (NSWCDD) will design and fabricate the control system and auxiliary prime power and cooling systems. NSWCDD government and contractor engineers will then integrate all above elements that make up the prototype and auxiliary systems and perform FY22-23 counter ASCM detect to defeat experimentation and demonstrations at government test sites.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prototype System Controls, Target Tracking, and Deconfliction (Government team)	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		2.500	Oct 2019	3.905	Oct 2020	-		3.905	Continuing	Continuing	Continuing
Prototype System Controls, Target Tracking, and Deconfliction (Contractor Team)	C/CPFF	Booz Allen Hamilton : Dahlgren VA	0.000	0.000		1.750	Dec 2019	1.300	Nov 2020	-		1.300	Continuing	Continuing	Continuing
HELCAP Mission Analysis	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		1.000	Oct 2019	1.000	Oct 2020	-		1.000	Continuing	Continuing	Continuing
HELCAP Mission Analysis	C/CPFF	JHU/APL : Laurel MD	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	Continuing	Continuing	Continuing
Design government owned interfaces between the OSD Laser Source and Prototype System	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		0.000		0.907	Oct 2020	-		0.907	Continuing	Continuing	Continuing
Adapt OSD Laser Source for Transport and Interface with Prototype System	C/CPFF	TBD : Not Specified	0.000	0.000		0.000		7.000	Nov 2020	-		7.000	Continuing	Continuing	Continuing
Prototype and Support System Integration	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		0.000		4.450	Oct 2020	-		4.450	Continuing	Continuing	Continuing
Procure and Assemble Prototype System Power and Cooling Customized Trailers	C/CPFF	TBD : Not Specified	0.000	0.000		0.000		8.000	Nov 2020	-		8.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		5.250		27.562		-		27.562	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
HELCAP Systems Engineering, Safety,	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		1.250	Oct 2019	3.250	Oct 2020	-		3.250	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603925N / *Directed Energy and Electric Weapon System*	Project (Number/Name) 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management (Government team)															
HELCAP Systems Engineering, Safety, Program Management (Contractor team)	C/CPFF	Multiple : Dahlgren VA	0.000	0.000		0.000		2.900	Oct 2020	-		2.900	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		1.250		6.150		-		6.150	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Planning for FY22-23 experimentation and ASCM detect to defeat demonstrations	WR	NSWC Dahlgren & NSWC Port Hueneme : Dahlgren VA & Port Hueneme CA	0.000	0.000		0.000	Oct 2019	1.300	Oct 2020	-		1.300	Continuing	Continuing	Continuing
Test site long lead assets and preparations for FY22-23 experimentation ASCM detect to defeat demonstration	C/CPFF	Holloman Air Force Base & NSWC Port Hueneme : Alamogardo NM & San Nicolas Island CA	0.000	0.000		0.000	Oct 2019	1.500	Jan 2021	-		1.500	Continuing	Continuing	Continuing
Stand Alone Tracker, Adaptive Optics and Other Experimentation	WR	NSWC Dahlgren : Dahlgren VA	0.000	0.000		0.000		1.000	Oct 2020	-		1.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		3.800		-		3.800	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
HELCAP Program Management /Engineering Support	C/CPFF	Booz Allen Hamilton : Dahlgren, VA	0.000	0.000		0.250	Oct 2019	0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.250		0.500		-		0.500	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		6.750		38.012		-		38.012	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
High Energy Laser Counter ASCM Project (HELCAP)				
Laser Weapon Control Design and Fabricate: HELCAP: Laser Weapon Control Design and Fabricate	1	2020	3	2021
Laser Weapon Control System Integration: HELCAP: Laser Weapon Control System Integration	4	2021	2	2022
Adapt OSD Laser Source for Transport and Interface with Prototype System: HELCAP: Adapt OSD Laser Source for Transport and Interface with Prototype System	1	2021	3	2022
OSD Laser Source Integration: HELCAP: OSD Laser Source Integration	3	2022	4	2022
Prime Power and Cooling Design and Fabricate: HELCAP: Prime Power and Cooling Design and Fabricate	1	2020	3	2021
Prime Power and Cooling Integration: HELCAP: Prime Power and Cooling Integration	4	2021	2	2022
Mission Analysis: HELCAP: Mission Analysis	1	2020	4	2022
ASCM detect to defeat experimentation and demonstration planning: HELCAP: ASCM detect to defeat experimentation and demonstration planning	1	2020	2	2022
ASCM detect to defeat experimentation and demonstration test site long lead assets and preparation: HELCAP: ASCM detect to defeat experimentation and demo test site assets and preparation	1	2020	2	2022
ASCM detect to defeat experimentation: HELCAP: ASCM detect to defeat experimentation	1	2021	4	2022
ASCM detect to defeat demonstration hardware integration and test: HELCAP: ASCM detect to defeat demonstration hardware integration and test	3	2022	1	2023
ASCM detect to defeat demonstrations test execution: HELCAP: ASCM detect to defeat demonstrations test execution	2	2023	4	2023
ASCM detect to defeat demonstration post-test documentation: HELCAP: ASCM detect to defeat demonstration post-test documentation	4	2023	2	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3402: *Surface Navy Laser Weapon System (SNLWS)*	47.330	81.048	89.234	56.266	-	56.266	47.198	29.353	29.925	30.527	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 3402 - The Surface Navy Laser Weapon System (SNLWS) program supports the National Defense Strategy of building a more lethal force by leveraging mature technology to deliver proven laser weapon capability to the Fleet as part of the Navy Laser Family of Systems (NLFoS) initiative with the objective of providing the fleet with near-term laser weapon capabilities. Additionally, accelerated learning through incorporation of laser weapon Concept of Operations (CONOPs), employment, and maintenance will enable the rapid development and integration of these capabilities with the Navy's existing weapon systems. This NLFoS initiative will also develop and validate warfighting requirements for laser weapons to address a variety of threats and to mature technologies and system integration readiness. HELIOS provides a low cost-per-shot capability to address Anti-Surface Warfare and Counter-Intelligence, Surveillance and Reconnaissance (C-ISR) gaps with the ability to dazzle and destroy Unmanned Aerial Systems (UAS) and defeat Fast Inshore Attack Craft (FIAC) while integrated into the AEGIS Combat System on a Flt IIA Destroyer. SNLWS provides industry-developed and government integrated capability to the Fleet in as short a timeframe as possible, thereby addressing the National Defense Strategy direction to foster a culture of innovation. SNLWS includes the development of a laser weapon system in the 60 kW or higher class. Competition was utilized for system development and production efforts. SNLWS leverages mature technology that will deliver a mature laser weapon system capability to the Fleet. SNLWS development leverages the Laser Weapon System (LaWS)/Solid State Laser Quick Reaction Capability (SSL QRC) and Solid State Laser Technology Maturation (SSL TM)/Laser Weapon System Demonstrator (LWSD) efforts.

The FY 2021 funding supports completion of the system build, review and delivery of the Technical Data Package, logistics support material and training, and Packaging, Handling, Storage and Transportation (PHS&T) of one system for conduct of land based testing and subsequent delivery pier side for shipboard installation in a DDG 51 Flt IIA ship during AEGIS Modernization, and conduct of System Operational Verification Testing (SOVT).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SNLWS Prime Contractor Efforts	58.632	53.818	25.000	0.000	25.000
Articles:	-	-	-	-	-
FY 2020 Plans: - Conduct Critical Design Review (CDR) to assess the system detailed design. - Complete integration of sub-systems to include High Energy Laser Weapon System combined with a C-ISR capability for countering UAS-mounted sensors. - Preparation for and initiation of test events associated with contractor testing and verification of system for delivery.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct test events associated with FQT and verification of system for delivery. - Develop and deliver required contract deliverables/documentation, including life cycle support and training documentation. - Conduct SNLWS Technical Interchange Meetings (TIMs) with PEO IWS and designated field activities. - Provide programmatic and engineering support to SNLWS Integrated Product Teams (IPTs) and Working Groups (WGs). - Design, build, construct and integrate ship representative land based test site enclosure. ***FY 2021 Base Plans:*** - Complete integration of sub-systems to include High Energy Laser Weapon System combined with a C-ISR capability for countering UAS-mounted sensors. - Conduct test events associated with land based test. - Develop and deliver required contract deliverables/documentation, including life cycle support and training documentation. - System Delivery pier side. - Conduct SNLWS Technical Interchange Meetings (TIMs) with PEO IWS and designated field activities. - Provide programmatic and engineering support to SNLWS Integrated Product Teams (IPTs) and Working Groups (WGs). ***FY 2021 OCO Plans:*** N/A. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease in prime contractor funding in FY 21 is a result of the HELIOS system procurement under the base contract being funded in FY 20. The FY 21 funding will be utilized to fund the requisite options to support the system.					
Title: SNLWS Government and Support Engineering Services	22.416	35.416	31.266	0.000	31.266
Articles:	-	-	-	-	-
FY 2020 Plans: - Deliver completed Weapons Domain Laser Controller (WDLC) as GFE to vendor. - Deliver completed Laser Weapon Control System (LWCS) as GFE to vendor. - Deliver completed Deconfliction Safety Software (DSS) as GFE to vendor. - Deliver completed Laser Authorization Key (LAK) as GFE to vendor.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete analysis of Government Furnished Equipment (GFE) performance and implementation of software fixes. - Support conduct of Critical Design Review (CDR). - Continue review of all contractor provided engineering, design, production readiness, and test documentation. - Conduct Technical Interchange Meetings (TIMs) with contractor and government personnel. - Provide programmatic and engineering support to government-led Integrated Product Teams (IPTs) and Working Groups (WGs). - Support execution of planned test events and conduct analysis of test results. - Support Factory Qualification Test (FQT) for components/subsystems/systems. - Review/comment/approve deliverables provided by the contractor. - Update and implement programmatic and technical documentation developed to support all requisite cost, schedule, and performance reporting requirements. - Prepare drawings, support ship checks, support AEGIS Integration, procure long lead material in support of and preparation for land based testing and Shipboard Installation. ***FY 2021 Base Plans:*** - Continue review of all contractor provided engineering, design, production readiness, and test documentation. - Conduct Technical Interchange Meetings (TIMs) with contractor and government personnel. - Provide programmatic and engineering support to government-led Integrated Product Teams (IPTs) and Working Groups (WGs). - Continue AEGIS Combat System software engineering, development, and integration; conduct Levels 1-5 integration and testing. - Provide insight and oversight for development of life cycle support material and training documentation. - Initiate DDG 51 Flight IIA Ship Integration and Installation. - Provide support for contractor led land based test events and provide analysis of results for verification and validation of requirements. ***FY 2021 OCO Plans:*** N/A. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease in funding from FY20 to FY21 is a result of the level of effort decreasing for development/ oversight, with primary efforts focused on installation, checkout and fleet testing of the system shipboard.					
Accomplishments/Planned Programs Subtotals	81.048	89.234	56.266	0.000	56.266

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The acquisition strategy permits accelerated fielding of laser weapon systems in the Fleet and provides a demand signal for the industrial base to expand the capacity to develop and manufacture this advanced technology. The acquisition strategy consists of the baseline development and production of one unit followed by options to acquire system quantities at firm fixed price that will address operational needs of the Fleet in the requisite timeframe to offset future threats and maintain technological superiority over potential adversaries. SNLWS provides for industry-developed and government integrated capability to the Fleet in as short a timeframe as possible, thereby addressing the National Defense Strategy direction to foster a culture of affordability. SNLWS includes the development of an advanced laser weapon system in the 60 kW or higher class. Competition was utilized for system development and production efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SNLWS Development	C/CPIF	Lockheed Martin Aculight : Bothell, WA	32.000	58.010	Oct 2018	44.505	Oct 2019	0.000		-		0.000	0.000	134.515	-
		Subtotal	32.000	58.010		44.505		0.000		-		0.000	0.000	134.515	N/A

Remarks

FY20 funding was realigned from product development to T&E in order to provide the requisite T&E support of the final product which includes fixture, facility and targets. The base product development completes in FY20.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SNLWS Systems Engineering, Program Management, GFE/GFI	WR	NSWC Dahlgren : Dahlgren, VA	9.066	9.558	Nov 2018	10.061	Nov 2019	7.988	Nov 2020	-		7.988	Continuing	Continuing	Continuing
SNLWS Ship Installation, Integration & Documentation	C/CPAF	BIW : Bath, ME	0.103	1.106	Jan 2019	3.340	Jan 2020	2.234	Jan 2021	-		2.234	Continuing	Continuing	Continuing
SNLWS Combat System Integration/Licenses	C/CPFF	Lockheed Martin : Moorestown, NJ	1.433	6.817	Nov 2018	1.750	Oct 2019	1.000	Dec 2020	-		1.000	Continuing	Continuing	Continuing
SNLWS Systems Engineering	WR	NSWC Crane : Crane, IN	0.270	0.162	Nov 2018	0.162	Dec 2019	0.162	Nov 2020	-		0.162	Continuing	Continuing	Continuing
SNLWS Systems Engineering	WR	NSWC PHD : Port Hueneme, CA	0.477	0.280	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS Systems Engineering	WR	NIWC Pacific : San Diego, CA	0.146	0.199	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS Systems Engineering	WR	NPS : Monterey, CA	0.150	0.050	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS Systems Engineering	MIPR	MIT LL : Lexington, MA	0.005	0.000		0.000		0.000		-		0.000	0.000	0.005	-
SNLWS Systems Engineering	C/CPFF	PSU EOC : Freeport, PA	0.500	0.300	Nov 2018	0.200	Feb 2020	0.200	Dec 2020	-		0.200	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SNLWS Technical Director	WR	NSWC Crane : Crane, IN	0.280	0.324	Nov 2018	0.324	Dec 2019	0.324	Dec 2020	-		0.324	Continuing	Continuing	Continuing
SNLWS Product Support	WR	NSWC PHD : Port Hueneme, CA	0.182	0.475	Nov 2018	2.113	Jan 2020	3.000	Nov 2020	-		3.000	Continuing	Continuing	Continuing
SNLWS Installation APM	WR	NSWC Dahlgren DNA : Dam Neck, VA	0.168	0.075	Jul 2019	0.379	Nov 2019	0.300	Nov 2020	-		0.300	Continuing	Continuing	Continuing
SNLWS Radar Cross Section Engineering	WR	NSWC Carderock : Potomac, MD	0.000	0.029	Feb 2019	0.000		0.000		-		0.000	0.000	0.029	-
SNLWS Environmental Engineering	WR	NUWC Newport : Newport, RI	0.000	0.031	May 2019	0.000		0.000		-		0.000	0.000	0.031	-
SNLWS System Installation	C/CPAF	Executing Shipyard : TBD	0.000	0.000		5.000	Jan 2020	7.500	Jan 2021	-		7.500	Continuing	Continuing	Continuing
SNLWS Engineering / Sustainment Support	C/CPIF	Lockheed Martin Aculight : Bothell, WA	0.000	0.000		4.936	Jul 2020	25.000	Dec 2020	-		25.000	Continuing	Continuing	Continuing
SNLWS Installation Engineering	C/CPAF	Third Party Planning (3PP) : Not Specified	0.000	0.005	Sep 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS Laser Range Hazard Analysis	WR	NSWC Corona : Corona, CA	0.000	0.021	Dec 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS PARASENSE	C/CPFF	Delta : Alexandria, VA	0.000	0.000		0.040	Jan 2020	0.150	Dec 2020	-		0.150	Continuing	Continuing	Continuing
SNLWS Platform Integration/ILS/Installation Support	C/CPFF	CACI : Washington, DC	0.000	0.000		0.184	Jan 2020	0.199	Jan 2021	-		0.199	Continuing	Continuing	Continuing
		Subtotal	12.780	19.432		28.489		48.057		-		48.057	Continuing	Continuing	N/A

Remarks

Executing shipyard for installation is still TBD.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SNLWS Test & Evaluation	WR	NIWC Pacific : San Diego, CA	0.122	0.000		0.000	Nov 2019	0.000	Nov 2020	-		0.000	Continuing	Continuing	Continuing
SNLWS Test & Evaluation	WR	NSWC PHD : Port Hueneme, CA	0.133	0.657	Nov 2018	0.911	Jan 2020	2.250	Jan 2021	-		2.250	Continuing	Continuing	Continuing
SNLWS Test & Evaluation	WR	NSWC Crane : Crane, IN	0.000	0.150	Nov 2018	1.183	Dec 2019	0.600	Nov 2020	-		0.600	Continuing	Continuing	Continuing
SNLWS Test & Evaluation	WR	NSWC Dahlgren : Dahlgren, VA	0.707	0.152	Nov 2018	0.500	Nov 2019	0.750	Nov 2020	-		0.750	Continuing	Continuing	Continuing
SNLWS Test & Evaluation	C/CPIF	Lockheed Martin Aculight : Bothell, WA	0.000	0.622	Jun 2019	4.377	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
SNLWS Test & Evaluation	WR	NSWC Dahlgren DNA : Dam Neck, VA	0.000	0.000		0.100	Nov 2019	0.100	Nov 2020	-		0.100	Continuing	Continuing	Continuing
SNLWS Test & Evaluation (Targets)	TBD	TBD : TBD	0.000	0.000		3.982	Jan 2020	2.200	Jan 2021	-		2.200	Continuing	Continuing	Continuing
SNLWS Test Site Preparation	WR	SCSC Wallops : Wallops Island, VA	0.000	0.030	Jul 2019	2.500	Nov 2019	0.000		-		0.000	0.000	2.530	-
SNLWS Test Site Preparation	WR	NASA Wallops : Wallops Island, VA	0.000	0.020	Jul 2019	0.180	Jan 2020	0.000		-		0.000	0.000	0.200	-
SNLWS Test & Evaluation	WR	NAWC CL : China Lake, AZ	0.000	0.000		0.300	Nov 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
		Subtotal	0.962	1.631		14.033		6.000		-		6.000	Continuing	Continuing	N/A

Remarks

FY20 funding was realigned from product development to provide the requisite T&E support of the final product which includes fixture, facility, targets, and testing at Wallops.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SNLWS Program Management/Engineering Support	C/CPFF	GRYPHON Technologies : Washington, D.C.	0.265	0.500	Apr 2019	0.500	Mar 2020	0.000		-		0.000	0.000	1.265	-
SNLWS Program Management/Engineering Support	C/CPIF	SPA : Washington, D.C.	0.950	1.011	Dec 2018	1.212	Feb 2020	1.213	Jan 2021	-		1.213	Continuing	Continuing	Continuing
SNLWS Travel	Sub Allot	NAVSEA : Washington, D.C.	0.014	0.150	Feb 2019	0.150	Feb 2020	0.150	Feb 2021	-		0.150	Continuing	Continuing	Continuing
SNLWS Program Management	C/CPFF	TMB : Washington, D.C.	0.162	0.170	Mar 2019	0.000		0.000		-		0.000	0.000	0.332	-
SNLWS Program Management	C/CPFF	BFM PSS TBD : TBD	0.000	0.000		0.200	Feb 2020	0.700	Dec 2020	-		0.700	Continuing	Continuing	Continuing
SNLWS Program Management	C/CPFF	Strategic Insight : Washington, D.C.	0.197	0.144	Jan 2019	0.145	Feb 2020	0.146	Dec 2020	-		0.146	Continuing	Continuing	Continuing
		Subtotal	1.588	1.975		2.207		2.209		-		2.209	Continuing	Continuing	N/A

Remarks

SNLWS Program Management award is TBD due to the planned competitive award of follow-on contract.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	47.330	81.048		89.234		56.266		-		56.266	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 3402 / *Surface Navy Laser Weapon System (SNLWS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3402				
SNLWS: Preliminary Design Review	2	2019	2	2019
SNLWS: Initial Baseline Review (IBR)	2	2019	2	2020
SNLWS: GFE to vendor LWCS, DSS, WDLC	3	2019	2	2020
SNLWS: Critical Design Review (CDR)	2	2020	2	2020
SNLWS: Factory Qualification Test (FQT)	4	2020	4	2020
SNLWS: Developmental Test (DT)	1	2021	1	2021
SNLWS: Deliver to Pier	1	2021	1	2021
SNLWS: Installation, Fleet Testing and Sustainment	4	2021	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*				**Project (Number/Name)** 9823 / *Lasers for Navy applicat*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
9823: *Lasers for Navy applicat*	54.004	32.954	19.935	34.567	-	34.567	9.861	5.849	4.375	4.462	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 9823 - Lasers for Navy Applications: Optical Dazzling Interceptor Navy (ODIN) development provides near-term, directed energy, shipboard Counter-Intelligence, Surveillance, and Reconnaissance (C-ISR) capabilities to dazzle Unmanned Aerial Systems (UASs) and other platforms that address urgent operational needs of the Fleet. FY 2018 was the first year of funding which supports the design, development, procurement and installation of ODIN standalone units over the FYDP, for deployment on DDG 51 Flt IIA surface combatants. The program supports the non-recurring engineering, development, procurement of long lead material, assembly and checkout, system certification, platform integration/installation and sustainment for these ODIN standalone units.

The FY 2021 funding was provided to complete procurement, assembly, checkout, integration, T&E and installation of Units 4 and 5; continues procurement, assembly, checkout, integration and T&E of Units 6, 7 and 8; and provide Operation & Sustainment (O&S) of Units 1-5. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR)is required.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Optical Dazzling Interdictor, Navy (ODIN)	32.954	19.935	34.567	0.000	34.567
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete installation and checkout of Units 1, 2 and 3 - Continue to provide/conduct Operator and Maintainer training - Continue to update/provide Operation and Maintenance Manuals - Continue to update/provide Maintenance Index Pages/Maintenance Requirements Cards (MIPs/MRCs) - Commence Operation and Sustainment of Units 1 and 2 - Continue assembly, integration, and checkout of units 4 and 5 - Complete Test & Evaluation of unit 4 - Initiate Test & Evaluation of unit 5 - Commence Installation of Unit 4 - Initiate procurement of Units 6, 7 and 8 (LLM) - Initiate system integration, test and certifications, system operability, and safety for Units 6, 7 and 8					
FY 2021 Base Plans: - Commence Installation of Unit 5					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Initiate Operation and Sustainment of Unit 3 - Continue system integration, test and certifications, system operability, and safety for Units 6, 7 and 8 - Initiate shipboard documentation and training development for Units 6, 7 and 8 - Complete installation, shipboard test and checkout, conduct system turnover, and support shipboard operations of unit 4 - Complete procurement of Units 6 and 7 - Initiate assembly, integration and checkout of unit 8 - Complete assembly, checkout, integration, and testing of Units 6 and 7. Each unit consists of: Beam Director (Telescope, Optics, Fast Steering Mirrors); Lower Power Lasers (2); Sensors (Coarse Track, Fine Track, ISR Imaging); Computer Rack, Network Switches; Cables; and Operator Laptop. - Operate and sustain Units 1 - 5. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase of $14.632 million from FY2020 to FY2021 supports the realized $34.594 million requirement needed for the procurement, assembly, checkout, integration, T&E, and installation; and provide Operation & Sustainment (O&S) of ODIN Units 1-8. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR) is required.					
Accomplishments/Planned Programs Subtotals	32.954	19.935	34.567	0.000	34.567

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The ODIN is a government designed, developed, and produced system that will provide stand alone units for use on DDG 51 class ships. This effort will transition the developed ODIN capabilities to the Fleet, while informing the development of future prototyping capabilities and program of record efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hardware & Software - Material Buys	C/FFP	NSWC Dahlgren : Dahlgren, VA	16.842	9.635	Nov 2018	3.949	Nov 2019	7.056	Dec 2020	-		7.056	Continuing	Continuing	Continuing
Engineering/Development/ Assembly	WR	NSWC Dahlgren : Dahlgren, VA	10.059	4.495	Oct 2018	2.698	Oct 2019	6.246	Nov 2020	-		6.246	Continuing	Continuing	Continuing
Software Development/ System Rqmts & Design	WR	NSWC Dahlgren : Dahlgren, VA	4.294	2.320	Oct 2018	0.170	Oct 2019	0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
Engineering Development	C/CPFF	PSU EOC : Freeport, PA	2.420	2.552	Nov 2018	2.395	Nov 2019	2.395	Dec 2020	-		2.395	Continuing	Continuing	Continuing
Engineering/Development	WR	NSWC PHD : Port Hueneme, CA	0.485	0.287	Nov 2018	0.000		0.000		-		0.000	0.000	0.772	-
Engineering/Development	WR	NSWC Crane : Crane, IN	0.300	0.020	Nov 2018	0.000		0.000		-		0.000	0.000	0.320	-
Engineering/Development	WR	NRL : Washington, D.C.	0.260	0.060	Dec 2018	0.000		0.000		-		0.000	0.000	0.320	-
		Subtotal	34.660	19.369		9.212		16.197		-		16.197	Continuing	Continuing	N/A

Remarks

A Program Adjustment in the amount of $28.95 million in FY21 and $3.5 million in FY22 was provided to Lasers for Navy Applications PU 9823 in support of the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units as a result of realized cost growth. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR) is required.

The cost savings originally estimated from production of multiple units by government vice industry have not been realized. The FY 2020 President's Budget request cost per ODIN system (material only) was estimated at approximately $3.63M (8 units = $29M); DON 21 cost per unit (material only) was realized at approximately $5.18M (6 units = $31.1M).

- ODIN is the first of its kind laser system. Non-recurring engineering (NRE) costs increased significantly due to new technology development efforts required for the following system components: lasers, fast steering mirrors, line replaceable units, control software, telescopes with mounted optics, and motor control units and drive assemblies for the gimbal and fine track cameras.

- Software development estimates increased (i.e., twenty thousand estimated lines of code to forty two thousand estimated lines of code, a $7M increase), due to system complexities, capabilities, and concept of employment.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Platform Integration/ ILS/ Installation	C/CPFF	CACI : Washington, D.C.	0.101	0.194	Dec 2018	0.046	Jan 2020	0.047	Jan 2021	-		0.047	Continuing	Continuing	Continuing
Platform Integration/ILS/ Installation	C/CPFF	SWRMC : San Diego, CA	0.000	0.743	Apr 2019	0.905	Feb 2020	1.205	Dec 2020	-		1.205	Continuing	Continuing	Continuing
Safety, Product Support, Security & Operations	WR	NAMRU : San Antonio TX	0.000	0.010	Mar 2019	0.000		0.000		-		0.000	0.000	0.010	-
Safety, Product Support, Security & Operations	WR	AFRL : Wright-Patterson AFB, OH	0.000	0.160	Mar 2019	0.000		0.000		-		0.000	0.000	0.160	-
Installation Engineering	C/CPAF	Third Party Planning (3PP) : Not Specified	0.000	0.010	Apr 2019	0.010	Apr 2020	0.014	Apr 2021	-		0.014	Continuing	Continuing	Continuing
Spares	WR	NSWC Dahlgren : Dahlgren, VA	0.711	0.000		0.150	Feb 2020	0.150	Feb 2021	-		0.150	Continuing	Continuing	Continuing
Installation Engineering	WR	NSWC Dahlgren DNA : Dam Neck, VA	0.000	0.000		0.025	Dec 2019	0.025	Nov 2020	-		0.025	Continuing	Continuing	Continuing
Platform Integration/ILS/ Installation	WR	NSWC Dahlgren : Dahlgren, VA	4.342	2.112	Nov 2018	1.140	Oct 2019	1.480	Nov 2020	-		1.480	Continuing	Continuing	Continuing
Platform Integration	C/CPAF	BIW : Bath, ME	0.244	0.526	Jan 2019	0.300	Jan 2020	0.300	Jan 2021	-		0.300	Continuing	Continuing	Continuing
Platform Integration	C/CPFF	Lockheed Martin : Moorestown, NJ	0.265	0.000		0.000		0.000		-		0.000	0.000	0.265	-
Systems Engineering	WR	NIWC Pacific : San Diego, CA	0.910	0.221	Nov 2018	0.000		0.000		-		0.000	0.000	1.131	-
Safety, Product Support, Security & Operations	WR	NSWC Dahlgren : Dahlgren, VA	5.123	0.985	Nov 2018	0.150	Oct 2019	0.150	Nov 2020	-		0.150	Continuing	Continuing	Continuing
Platform Integration	WR	NSWC Crane : Crane, IN	0.156	0.000		0.000		0.000		-		0.000	0.000	0.156	-
Platform Integration/ILS/ Installation & Spares	WR	NSWC PHD : Port Hueneme, CA	0.840	3.639	Nov 2018	5.474	Oct 2019	12.626	Nov 2020	-		12.626	Continuing	Continuing	Continuing
Packaging, Handling, Storage & Transportation, De-Install, Refurbishment	WR	NSWC Dahlgren : Dahlgren, VA	1.243	0.091	Nov 2018	0.040	Oct 2019	0.040	Nov 2020	-		0.040	Continuing	Continuing	Continuing
Platform Integration	WR	NIWC Pacific : San Diego, CA	0.000	0.000		0.000		0.048	Nov 2020	-		0.048	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Platform Integration/ILS/ Installation	C/CPFF	HRMC : Pearl Harbor, HI	0.000	0.000		0.124	Feb 2020	0.000		-		0.000	0.000	0.124	-
		Subtotal	13.935	8.691		8.364		16.085		-		16.085	Continuing	Continuing	N/A

Remarks

An additional $34.825 million dollars was required in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units. DON identified an additional $28.950 million in FY2021 and $3.5M in FY2022. It should be noted that in order to fully fund the procurement, assembly, checkout, integration, T&E, installation and sustainment of 8 units, a FY 2020 $9.975 million Below Threshold Reprogramming (BTR)is required.

Platform Integration including Installation Control Drawings (ICDs), Ship Installation Drawings (SIDs) and system installation costs were realized at twice the cost originally estimated. Below-deck work required for ODIN installations is more extensive than originally programmed.

The ODIN Platform Integration/ILS/Installation TBD is due to planned competitive award of follow-on contract.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test Planning & Execution	WR	NAWC AD : Patuxent River, MD	0.000	0.160	Mar 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Test Planning & Execution	WR	NSWC PHD : Port Hueneme, CA	0.880	0.698	Nov 2018	0.575	Nov 2019	0.500	Nov 2020	-		0.500	Continuing	Continuing	Continuing
Test Planning & Execution	WR	NSWC Dahlgren : Dahlgren, VA	2.467	2.629	Nov 2018	1.200	Oct 2019	1.200	Nov 2020	-		1.200	Continuing	Continuing	Continuing
Test Planning & Execution	WR	NSWC Crane : Crane, IN	0.622	0.320	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Test Planning & Execution	WR	NIWC Pacific : San Diego, CA	0.000	0.504	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	3.969	4.311		1.775		1.700		-		1.700	Continuing	Continuing	N/A

Remarks

Testing of newly developed capabilities required a much higher quantity and quality of aircraft and targets for testing; and subsequent data analysis to validate requisite system capabilities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Mgmt/Support	C/CPFF	BFM PSS TBD : TBD	0.000	0.000		0.025	Feb 2020	0.275	Dec 2020	-		0.275	Continuing	Continuing	Continuing
Program Mgmt/Supportt	C/BA	Strategic Insight : Washington, D.C.	0.000	0.076	Jan 2019	0.077	Feb 2020	0.078	Dec 2020	-		0.078	Continuing	Continuing	Continuing
Program Mgmt/Support	C/CPFF	TMB : Washington, D.C.	0.000	0.025	Feb 2019	0.000		0.000		-		0.000	0.000	0.025	-
Program Mgmt/Support	C/CPFF	GRYPHON Technologies : Washington, D.C.	0.748	0.250	Apr 2019	0.250	Mar 2020	0.000		-		0.000	0.000	1.248	-
Travel	Allot	NAVSEA : Washington, D.C.	0.126	0.052	Mar 2019	0.052	Feb 2020	0.052	Feb 2021	-		0.052	Continuing	Continuing	Continuing
Program Mgmt/Support	C/CPIF	SPA : Washington, D.C.	0.566	0.180	Dec 2018	0.180	Feb 2020	0.180	Dec 2020	-		0.180	Continuing	Continuing	Continuing
		Subtotal	1.440	0.583		0.584		0.585		-		0.585	Continuing	Continuing	N/A

Remarks

ODIN Program Management award is TBD due to planned competitive award of follow-on contract.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	54.004	32.954		19.935		34.567		-		34.567	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9823 / *Lasers for Navy applicat*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9823				
Assembly, Checkout, Integration Units 1 and 2	1	2019	4	2019
Test & Evaluation, Installation Units 1 and 2	1	2019	3	2020
Component Procurement, Assembly, Checkout, Integration Units 3, 4 and 5	4	2019	1	2021
Operation and Sustainment Units 1 and 2	1	2020	4	2025
Component Procurement, Assembly, Checkout, Integration Units 6, 7 and 8	1	2020	1	2022
Test & Evaluation, Installation Unit's 3, 4 and 5	2	2020	1	2022
Operation and Sustainment Units 3, 4, 5	1	2021	4	2025
Test & Evaluation, Installation Units 6, 7 and 8	1	2022	4	2022
Operation and Sustainment Units 6, 7 and 8	2	2022	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	24.986	20.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.986
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 9999 (PU C453) - Surface Navy Laser Weapon System (SNLWS) Program Re-phasing: Congress added funding in FY19 for re-phasing of the SNLWS development and fielding effort. This funding supports procurement of HELIOS long lead materials related to early award of the contract to Lockheed Martin Aculight.

Project 9999 (PU C440/C457) - Congressional Adds - Railgun Program: Congress added funding in FY19 and FY20 for ship-based program/technical development and ship integration related risk reduction. Electromagnetic railgun provides increased capability for the following mission sets: Naval Surface Fire Support (NSFS), Integrated Air and Missile Defense (IAMD), Fast Attack Craft and Fast Inshore Attack Craft (FAC/FIAC), and future potential for Anti-Surface Warfare (ASuW). This funding supports the testing and refinement of pulse current transfer, mount, and hypervelocity projectile component development. In addition, this project supports the continuing effort to define and evolve requirements related to mount and platform interface management and maturations of specifications for tactical railgun weapon system.

Project 9999 (PU C516) - Congressional Add - High Energy Laser (HEL) Weapon System for Counter-Unmanned Ariel System (C-UAS) Area defense is a Congressionally directed effort to develop/build a minimized footprint, laser-agonistic beam director and beam control system (M-BD/BCS) to support Commercial Off The Shelf (COTS) lasers >10KW for possible application to Joint Light Tactical Vehicle (JLTV) sized vehicles.

FY2020 funding will provide for systems engineering, design, and fabrication of this M-BD/BCS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Electromagnetic Railgun	9.647	0.000
FY 2019 Accomplishments: -Upgraded Electric Weapon systems Integration Lab (EWSIL) with hardware/ software necessary to support 5MA (mega-amp) testing and conduct 5MA Articulating Pulse Current Transfer (APCT) test events. -Completed 2MA APCT slip ring testing. -Completed design and fabrication work necessary to add cooling and elevation evaluation capabilities to EWSIL. -Conducted design and fabrication work necessary for prototyping of low-loss coaxial buswork. -Build and refined prototype design for blowback mitigation system for use with railgun system. -Updated the SEP, CM Plan, TRAP and maturation of specifications for tactical RGWS. -Conducted risk Management and coordination and support of sub-system and system level design reviews		

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2019**	**FY 2020**
-Performed Topside Integration Platform and System Trade Studies. -Supported the design, development and testing of armatures for HVP from a Railgun -Conducted Magnetic Pulse Generator (MPG) testing, mitigation designs and testing requirements Dev., Test Planning, Ctr. Oversight -Supported railgun system materials testing and analysis at Naval Post-graduate School ***FY 2020 Plans:*** N/A		
Congressional Add: SNLWS Program Rephasing ***FY 2019 Accomplishments:*** - Procured the following long lead materials: Beam Director subsystem and Beam Control subsystem. ***FY 2020 Plans:*** N/A.	15.339	0.000
Congressional Add: High Energy Laser Weapon System for C-UAS Area Defense ***FY 2019 Accomplishments:*** N/A. ***FY 2020 Plans:*** Systems Engineering, design, and fabrication of minimized footprint, laser-agnostic beam director and beam control system (M-BD/BCS).	0.000	10.000
Congressional Add: Railgun ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** -Continue conducting risk Management and coordination in support of sub-system and system level design reviews. -Continue performing Controls Integration, Pulsed Power Integration Studies, and System Trade Studies. -Continue supporting the design, development and testing of armatures for HVP from a Railgun. -Continue conducting Magnetic Pulse Generator (MPG) testing, mitigation designs and testing requirements development, Test Planning, Ctr. Oversight. -Conduct Pulse Current Transfer (PCT) maturation and risk reduction. -Continue supporting railgun system materials testing and analysis at Naval Post-graduate School.	0.000	10.000
Congressional Adds Subtotals	24.986	20.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

D. Acquisition Strategy

Project 9999 (PU C453) - The SNLWS program supports the National Defense Strategy of building a more lethal force by leveraging mature technology to deliver proven laser weapon capability to the Fleet as part of the Navy Laser Family of Systems (NLFoS) initiative with the objective of providing the fleet with near-term laser weapon capabilities. Additionally, accelerated learning through incorporation of laser weapon CONOPS, employment, and maintenance will enable the rapid development and integration of these capabilities with the Navy's existing weapons systems. This NLFoS initiative will also develop and validate warfighting requirements for laser weapons to address a variety of threats and to mature technologies and system integration readiness. HELIOS provides a low cost-per-shot capability to address Anti-Surface Warfare and Counter-Intelligence, Surveillance and Reconnaissance (C-ISR) gaps with the ability to dazzle and destroy Unmanned Aerial Systems (UAS) and defeat Fast Inshore Attack Craft (FIAC) while integrated into a Flt IIA Destroyer, to include AEGIS integration. SNLWS provides industry-developed and government integrated capability to the Fleet in as short a timeframe as possible, thereby addressing the National Defense Strategy direction to foster a culture of affordability. SNLWS includes the development of an advanced laser weapon system in the 60 kW or higher class. Competition was utilized for system development and production efforts. The acquisition strategy permits accelerated fielding of laser weapon systems in the Fleet and provides a demand signal for the industrial base to expand the capacity to develop and manufacture this advanced technology. The acquisition strategy consists of the baseline development and production of one unit followed by options to acquire system quantities at firm fixed price that will address operational needs of the Fleet in the requisite timeframe to offset future threats and maintain technological superiority over potential adversaries.

Project 9999 (PU C440/C457) - Leverage Naval Surface Warfare Center and UARC resources and competencies to support electromagnetic railgun system engineering activities to mature technologies in support of transition to a Program of Record. These study and prototype activities provide influence on prototype design and test to optimize readiness and capability for transition to a Navy tactical application.

Project 9999 (PU C516) - The High Energy Laser Weapon System for C-UAS Area Defense is an initiative that provides a flexible prototype sub-system for government experimentation and demonstration of a minimized footprint, laser-agonistic beam director and beam control system. MZA of Dayton, OH is the industry provider of this capability.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
C453- SNLWS Development	C/CPIF	Lockheed Martin Aculight : Bothell, WA	0.000	14.990	Nov 2018	0.000		0.000		-		0.000	0.000	14.990	-
C440-HVP/RGS Interface Development	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.850	May 2019	0.000		0.000		-		0.000	0.000	0.850	-
C440- APCT Hardware Fabrication	MIPR	DOTC : DOTC	0.000	0.860	Sep 2019	0.000		0.000		-		0.000	0.000	0.860	-
C440- PCT/Breech Interface and Blowback Mitigation Fabrication	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.200	Sep 2019	0.000		0.000		-		0.000	0.000	0.200	-
C547- Health Monitoring Sensor Development	FFRDC	Virginia Tech : Virginia Tech	0.000	0.000		0.100	May 2020	0.000		-		0.000	0.000	0.100	-
C516 - Minimized Beam Directorr/Beam Control Sys	C/CPFF	MZA : Dayton, OH	0.000	0.000		10.000	Jun 2020	0.000		-		0.000	0.000	10.000	-
		Subtotal	0.000	16.900		10.100		0.000		-		0.000	0.000	27.000	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
C453- Support SNLWS Development	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.349	Feb 2019	0.000		0.000		-		0.000	0.000	0.349	-
C440-APCT Development Support and Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	1.800	Sep 2019	0.000		0.000		-		0.000	0.000	1.800	-
C440-Mount Component Development, SE Support, and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.625	May 2019	0.000		0.000		-		0.000	0.000	0.625	-
C440-Blowback Mitigation	FFRDC	APL : Laurel, MD	0.000	0.200	Apr 2019	0.000		0.000		-		0.000	0.000	0.200	-
C440-Mount Platform Interface Development,	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.442	May 2019	0.000		0.000		-		0.000	0.000	0.442	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Requirements and Specification Management															
C440-Topside Integration / Platform Studies, SE Support, and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.266	May 2019	0.000		0.000		-		0.000	0.000	0.266	-
C440- System Trade Studies	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.266	May 2019	0.000		0.000		-		0.000	0.000	0.266	-
C547- Advanced Armature and Muzzle Design and Development, SE Support, and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		1.850	Mar 2020	0.000		-		0.000	0.000	1.850	-
C547- Mount and Controls Development, SE Support, and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		1.450	Mar 2020	0.000		-		0.000	0.000	1.450	-
C547- Corrosion Prevention and Control Requirements and Specification Management	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.275	Mar 2020	0.000		-		0.000	0.000	0.275	-
C547- Pulse Power Ship Integration Development, SE Support, and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		1.950	Mar 2020	0.000		-		0.000	0.000	1.950	-
C547- System Trade Studies	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.200	Mar 2020	0.000		-		0.000	0.000	0.200	-
C547- Railgun and HVP Interface Development and Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.225	Mar 2020	0.000		-		0.000	0.000	0.225	-
C547- Program Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.500	Mar 2020	0.000		-		0.000	0.000	0.500	-
		Subtotal	0.000	3.948		6.450		0.000		-		0.000	0.000	10.398	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
C440- APCT Test Execution	WR	NSWC Dahlgren : Dahlgren, VA	0.000	1.778	Sep 2019	0.000		0.000		-		0.000	0.000	1.778	-
C440- HVP Risk Reduction and Railgun Testing	WR	NSWC Dahlgren : Dahglren, VA	0.000	0.100	Sep 2019	0.000		0.000		-		0.000	0.000	0.100	-
C440- Railgun Materials Testing	WR	Naval Post Graduate School : San Diego, CA	0.000	0.900	Mar 2019	0.000		0.000		-		0.000	0.000	0.900	-
C547- PCT and Pulse Power Test Execution	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		1.150	Mar 2020	0.000		-		0.000	0.000	1.150	-
C547- HVP Risk Reduction and Railgun Testing	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		1.650	Mar 2020	0.000		-		0.000	0.000	1.650	-
C547- Railgun Testing Materials	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.450	Mar 2020	0.000		-		0.000	0.000	0.450	-
C547- Corrosion Prevention and Control Testing and Analysis	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.200	Mar 2020	0.000		-		0.000	0.000	0.200	-
		Subtotal	0.000	2.778		3.450		0.000		-		0.000	0.000	6.228	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
C440- Program Technical Oversight	WR	NSWC Dahlgren : Dahlgren, VA	0.000	1.360	May 2019	0.000		0.000		-		0.000	0.000	1.360	-
		Subtotal	0.000	1.360		0.000		0.000		-		0.000	0.000	1.360	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	24.986		20.000		0.000		-		0.000	0.000	44.986	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Surface Navy Laser Weapon System (SNLWS): Procurement of Long Lead Material	1	2019	1	2019
Electromagnetic Railgun: PCT Dev/Testing	2	2019	4	2020
Electromagnetic Railgun: Mount Component Development	4	2019	1	2020
Electromagnetic Railgun: Mount/Platform Interface	4	2019	4	2020
Electromagnetic Railgun: Topside Integration/Platform Studies	4	2019	4	2020
Electromagnetic Railgun: System Trade Studies	2	2019	4	2020
Electromagnetic Railgun: Projectile/RGS Interface Development	2	2019	4	2020
Electromagnetic Railgun: Naval Post Graduate School Railgun Materials Testing	2	2019	4	2020
Railgun: Railgun Barrel and Mount System Rep-Rate Risk Reduction	2	2020	4	2021
Railgun: Controls Integration	2	2020	4	2021
Railgun: HVP Railgun Integration	2	2020	4	2021
Railgun: Pulsed Power Integration Studies	2	2020	4	2021
Railgun: System Trade Studies	2	2020	4	2021
Railgun: Pulse Current Transfer (PCT) maturation and risk reduction	2	2020	4	2021
Railgun: Naval Post Graduate School Railgun Materials Testing	2	2020	4	2021
Minimized-Beam Director/Beam Control System (M-BD/BCS): Contract Award	3	2020	3	2020
Minimized-Beam Director/Beam Control System (M-BD/BCS): Design Review	4	2020	4	2020
Minimized-Beam Director/Beam Control System (M-BD/BCS): Component Procurement	1	2021	1	2021
Minimized-Beam Director/Beam Control System (M-BD/BCS): Prototype Beam Director and Beam Control Sub-System	3	2021	3	2021
Minimized-Beam Director/Beam Control System (M-BD/BCS): Laser Integration	4	2021	4	2021

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603925N / *Directed Energy and Electric Weapon System*	**Project (Number/Name)** 9999 / *Congressional Adds*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Minimized-Beam Director/Beam Control System (M-BD/BCS): Prototype Subsystem Test & Evaluation	1	2022	1	2022

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	68.087	104.505	112.416	84.190	-	84.190	35.102	25.937	9.870	10.069	0.000	450.176
2069: *F/A-18 Infrared Search and Track (IRST)*	68.087	104.505	112.416	84.190	-	84.190	35.102	25.937	9.870	10.069	0.000	450.176

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): P510

A. Mission Description and Budget Item Justification

The AN/ASG-34(V) F/A-18E/F Infrared Search and Track (IRST) system is a long-wave infrared sensor that provides a passive, out-of-band, alternate fire control system capable of detecting, tracking and engaging airborne targets, at long range, in a heavy electronic attack or radar-denied environment. The IRST system can autonomously, or in combination with other sensors, support the guidance of beyond-visual-range missiles including AIM-120C/D and AIM-9X Block II. The F/A-18E/F IRST system is an evolutionary Navy acquisition program with Block I and Block II capabilities. The Block I system provided a basic airborne IRST capability, supported integration of the sensor onto a fuel tank and into the aircraft, and supported aeromechanical flight test required for full flight envelope clearance and carrier qualification. IRST Block I is in the Production and Deployment phase following a successful Milestone C decision in December 2014, and is supporting continued integration with the F/A-18E/F Advanced Mission Computer software through flight testing with SCS H14 and H16.

This budget request supports development and testing of a redesigned Infrared Receiver (IRR) and processor, enabling full Capabilities Development Document capability over a larger field of regard.

IRST was previously reflected under Program Element 0204136N F/A-18 Squadrons and has been transferred to Program Element 0604014N F/A-18 Infrared Search and Track.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	108.689	113.456	83.645	-	83.645
Current President's Budget	104.505	112.416	84.190	-	84.190
Total Adjustments	-4.184	-1.040	0.545	-	0.545
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-1.040			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.184	0.000			
• Program Adjustments	0.000	0.000	0.182	-	0.182

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	

• Rate/Misc Adjustments	0.000	0.000	0.363	-	0.363

Change Summary Explanation

Technical: Not applicable.

Schedule:
Completion of Block II ECP Hardware Development to account for Qualification Testing that goes out to 2QFY22.
Completion of Sensor Hardware Conversion and Upgrades (Block I/II Prototype & EDM) moved in 4QFY20 to 2QFY21
Completion of King Air Integration Lab (KAIL), now referred to as Test Bed Operations, Integration Lab Block II Phase I moved from 2QFY19 to 1QFY19
Completion of Block II Test Asset Lab and Flight Testing moved from 1QFY21 to 3QFY21
Updated Block II schedule to reflect PRR in 1QFY21
Completion of Block II EDM Test Assets moved from 4QFY20 to 2QFY21
Incorporated Gate 6 to Acquisition Milestones in 1QFY20 and 1QFY21
Incorporated Capability Enhancement Requirement in 1QFY23
FRP 1 (Block II Lot 4-Qty 40)4thQFY24 to 2ndQFY25

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*				**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2069: *F/A-18 Infrared Search and Track (IRST)*	68.087	104.505	112.416	84.190	-	84.190	35.102	25.937	9.870	10.069	0.000	450.176
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: P510												

Note

Infrared Search and Track (IRST) was funded in FY16 and prior under PE 0204136N / F/A-18 Squadrons, PU 1662 F/A-18 Improvements. Funding was realigned to a new PU 2069 / F/A-18 IRST in FY17 and then transferred to a new PE 0604014N / F/A-18 IRST under PU 2069 / F/A-18 IRST in FY18.

A. Mission Description and Budget Item Justification

The AN/ASG-34(V) F/A-18E/F Infrared Search and Track (IRST) system is a long-wave infrared sensor that provides a passive, out-of-band, alternate fire control system capable of detecting, tracking and engaging airborne targets, at long range, in a heavy electronic attack or radar-denied environment. The IRST system can autonomously, or in combination with other sensors, support the guidance of beyond-visual-range missiles including AIM-120C/D and AIM-9X Block II. The F/A-18E/F IRST system is an evolutionary Navy acquisition program with Block I and Block II capabilities. The Block I system provided a basic airborne IRST capability, supported integration of the sensor onto a fuel tank and into the aircraft, and supported aeromechanical flight test required for full flight envelope clearance and carrier qualification. IRST Block I is in the Production and Deployment phase following a successful Milestone C decision in December 2014, and is supporting continued integration with the F/A-18E/F Advanced Mission Computer software through flight testing with SCS H14 and H16.

This budget request supports development and testing of a redesign Infrared Receiver (IRR) and processor, enabling full Capabilities Development Document capability over a larger field of regard.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Infra-Red Search and Track (IRST)	104.505	112.416	84.190	0.000	84.190
Articles:	-	-	-	-	-
Description: Technology Development (TD) and Engineering and Manufacturing Development (EMD) of a fully integrated airborne IRST sensor for the F/A-18E/F. Block II is an engineering change to the Block I system which redesigns the Infrared Receiver (IRR) and processor to provide full Capabilities Development Document capability over a larger field of regard. Block II will provide longer-range passive detection and tracking performance which enhances warfighting capability through improved engagement timelines and increased situational awareness.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Continue IRST Block II Development Phase 1 and 2 (EMD) efforts. Continue IRST regression testing with SCS H16. Convert Block I EDM systems to Block II prototype configuration. Continue Block II prototype lab and flight test, and flight worthiness. ***FY 2021 Base Plans:*** Continue IRST Block II Development Phase 2 (EMD) effort. Continue IRST regression testing with SCS H16. Convert Block II prototype to Block II EDM configuration. Conduct Block II EDM lab and flight test, and flight worthiness. Investigate and mitigate obsolescence / DMSMS issues. Conduct engineering and logistics analysis for potential redesigns stemming from Operational Testing (OT) and emerging Super Hornet Block III requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 has a net decrease of $28.226M. This is due to completion of the Block II Phase 1 hardware development contract and planned ramp down of Block II Phase 2 hardware development efforts.					
Accomplishments/Planned Programs Subtotals	104.505	112.416	84.190	0.000	84.190

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• APN/0515: *Infrared Search and Track (IRST)*	0.000	0.000	158.055	-	158.055	209.592	193.459	203.338	21.634	53.618	839.696

Remarks

D. Acquisition Strategy

The F/A-18E/F IRST system is an evolutionary Navy acquisition program with Block I and Block II capabilities.

The Block I system provided a basic airborne IRST capability, supported integration of the sensor onto a fuel tank and into the aircraft, and supported aeromechanical flight test required for full flight envelope clearance and carrier qualification. IRST Block I is in the Production and Deployment phase following a successful Milestone C decision in December 2014, and is supporting continued integration with the F/A-18E/F Advanced Mission Computer software through flight testing with SCS H14 and H16.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Development (Hardware/Software) Infra-Red Search and Track	Various	Boeing : St. Louis, MO	30.733	49.228	Dec 2018	46.138	Dec 2019	52.582	Dec 2020	-		52.582	30.324	209.005	209.005
Hardware Development	MIPR	USAF (MIT) : Hanscom AFB, MA	0.060	1.020	Jul 2019	0.000		0.000		-		0.000	0.000	1.080	-
Software Development	WR	NAWCWD : China Lake, CA	1.423	3.348	Nov 2018	4.359	Nov 2019	0.000		-		0.000	0.000	9.130	-
Infrared Search and Track Support Equipment Development	WR	NAWCAD : Lakehurst, NJ	0.045	0.050	Nov 2018	0.812	Nov 2019	0.000		-		0.000	0.000	0.907	-
Primary Development	Various	NSMA : Various	24.217	38.334	Nov 2018	40.368	Nov 2019	13.504	Nov 2020	-		13.504	15.773	132.196	-
		Subtotal	56.478	91.980		91.677		66.086		-		66.086	46.097	352.318	N/A

Remarks

FY21 increase in Boeing hardware/software development supports increased software corrections identified during increased flight testing to support Initial Operating Capability in FY21.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	NAWCWD : China Lake, CA	1.143	1.181	Nov 2018	1.205	Nov 2019	0.960	Nov 2020	-		0.960	4.036	8.525	-
Development Support	WR	NAWCAD : Patuxent River, MD	1.637	3.136	Nov 2018	3.261	Nov 2019	1.802	Nov 2020	-		1.802	6.344	16.180	-
Development Support	WR	NSWC : Indian Head, MD	0.000	0.060	Nov 2018	0.062	Nov 2019	0.000		-		0.000	0.000	0.122	-
Development Support	WR	NAWCWD : Pt. Mugu, CA	0.000	0.022	Dec 2018	0.023	Nov 2019	0.000		-		0.000	0.000	0.045	-
Development Support	WR	FRC Southeast : Jacksonville, FL	0.900	0.890	Nov 2018	0.908	Nov 2019	0.513	Nov 2020	-		0.513	1.999	5.210	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	C/CPFF	NRL : Washington, DC	0.339	0.350	Dec 2018	0.357	Dec 2019	0.364	Dec 2020	-		0.364	1.529	2.939	2.939
Development Support	WR	NAVSUP : Mechanicsburg, PA	0.020	0.042	Jan 2019	0.043	Jan 2020	0.000		-		0.000	0.000	0.105	-
Development Support	WR	NAWCWD : Lakehurst, NJ	0.000	0.000		0.000		0.456	Nov 2020	-		0.456	1.917	2.373	-
Obsolescence Redesign	Various	Various : Various	0.250	0.255	Dec 2018	0.260	Dec 2019	0.000		-		0.000	1.582	2.347	-
		Subtotal	4.289	5.936		6.119		4.095		-		4.095	17.407	37.846	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NAWCAD : Patuxent River, MD	1.429	1.696	Dec 2018	3.816	Nov 2019	3.532	Nov 2020	-		3.532	8.222	18.695	-
Developmental Test & Evaluation	WR	NAWCWD : China Lake, CA	4.824	2.183	Nov 2018	5.349	Nov 2019	5.055	Nov 2020	-		5.055	4.343	21.754	-
Operational Test & Evaluation	Various	OPTEVFOR : VX-9	0.100	1.720	Jul 2019	4.435	Jul 2020	4.592	Jul 2021	-		4.592	1.420	12.267	-
		Subtotal	6.353	5.599		13.600		13.179		-		13.179	13.985	52.716	N/A

Remarks

Increase in FY21 due to H16

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Various	NAVAIR : Patuxent River, MD	0.020	0.020	Oct 2018	0.020	Oct 2019	0.025	Oct 2020	-		0.025	0.105	0.190	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support - MISC	Various	NAWCAD : Patuxent River, MD	0.947	0.970	Oct 2018	1.000	Oct 2019	0.805	Oct 2020	-		0.805	3.384	7.106	-
		Subtotal	0.967	0.990		1.020		0.830		-		0.830	3.489	7.296	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	68.087	104.505		112.416		84.190		-		84.190	80.978	450.176	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Infra-Red Search and Track				
Acquisition Milestones: Milestones: Full Rate Production Decision Review (FRP DR)	3	2021	3	2021
Acquisition Milestones: Milestones: Gate 6 / CSB (IPR)	1	2020	1	2020
Acquisition Milestones: Milestones: Gate 6 / CSB (IPR 1)	1	2021	1	2021
Acquisition Milestones: Milestones: Block II ECP Milestone C	1	2019	1	2019
Acquisition Milestones: Milestones: Initial Operating Capability (IOC)	4	2021	4	2021
Acquisition Milestones: Milestones: Material Support Date	1	2024	1	2024
System Development: Engineering and Manufacturing Development: Block II ECP Hardware Development & Qualification Testing	1	2019	1	2022
System Development: Engineering and Manufacturing Development: Sensor Hardware Conversion and Upgrades (Block I/II Prototype & EDM)	1	2019	2	2021
System Development: Engineering and Manufacturing Development: Capability Enhancement Requirement	1	2023	4	2025
System Development: Development Testing: Test Bed Operations Integration Lab Block II Phase I	2	2019	2	2019
System Development: Development Testing: Test Bed Operations Integration Lab Block II Phase II	3	2019	3	2019
System Development: Development Testing: Block II Test Asset Lab and Flight Testing	2	2019	3	2021
System Development: Reviews: Block II ECP System CDR	1	2019	1	2019
System Development: Reviews: Technology Readiness Review (TRR)	1	2020	1	2020
System Development: Reviews: Block II ECP Delta PCA	2	2021	2	2021
System Development: Reviews: Block II ECP PRR	1	2021	1	2021
Test and Evaluation: Aircraft Software Release: SCS H14 Fleet Release	4	2019	4	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604014N / *F/A-18 Infrared Search and Track (IRST)*	**Project (Number/Name)** 2069 / *F/A-18 Infrared Search and Track (IRST)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Test and Evaluation: Aircraft Software Release: SCS H16 Fleet Release	3	2021	3	2021
Test and Evaluation: Integration Testing: SCS H16 IRST Integration Testing Block II	2	2019	4	2020
Test and Evaluation: Operational Testing: SCS H14 Operational Testing Block I	2	2019	4	2019
Test and Evaluation: Operational Testing: FOT&E (VCD)	1	2022	3	2023
Test and Evaluation: Operational Testing: SCS H16 Operational Testing	2	2020	4	2020
Production Milestones: Contract Awards: Block II LRIP 4 (APN)	2	2020	2	2020
Production Milestones: Contract Awards: Block II LRIP 5 (APN)	1	2021	1	2021
Production Milestones: Contract Awards: Block II FRP 1 (APN)	1	2022	1	2022
Production Milestones: Contract Awards: Block II FRP 2 (APN)	1	2023	1	2023
Production Milestones: Contract Awards: Block II FRP 3 (APN)	1	2024	1	2024
Production Milestones: Deliveries: Block II Prototype Test Assets (RDTE)	4	2019	2	2020
Production Milestones: Deliveries: Block II EDM Test Assets (RDTE)	1	2021	1	2021
Production Milestones: Deliveries: LRIP 2 (Block I Lot 2 - Qty 12)	2	2019	1	2020
Production Milestones: Deliveries: LRIP 3 (Block II Lot 1 - Qty 6)	2	2021	3	2021
Production Milestones: Deliveries: LRIP 4 (Block II Lot 2 - Qty 12)	2	2022	2	2023
Production Milestones: Deliveries: LRIP 5 (Block II Lot 3 - Qty 25)	2	2023	2	2024
Production Milestones: Deliveries: FRP 1 (Block II Lot 4 - Qty 40)	2	2024	4	2024
Production Milestones: Deliveries: FRP 2 (Block II Lot 5 - Qty 40)	1	2025	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	19.217	37.000	54.699	-	54.699	46.700	41.826	42.962	43.823	Continuing	Continuing
3255: *AI Dev Ops*	0.000	0.000	15.000	24.979	-	24.979	14.980	9.981	9.985	10.185	Continuing	Continuing
3256: *Warfighting Pilots*	0.000	0.000	2.000	2.998	-	2.998	3.998	4.998	5.999	6.119	Continuing	Continuing
3425: *Digital Warfare*	0.000	19.217	20.000	26.722	-	26.722	27.722	26.847	26.978	27.519	Continuing	Continuing

A. Mission Description and Budget Item Justification

Overseen by the OPNAV N9, the Digital Warfare (DW) line is focused on defining and delivering the Naval Operational Architecture (NOA) for Distributed Maritime Operations (DMO). The NOA consists of networks, infrastructure, data, and tools and analytics to support improved lethality and decision making in DMO. The DW line funds integrated model-based systems engineering (MBSE) and analysis of the mission and multi-mission requirements for intel, tactical and, operational level of war capabilities, and the development of reference architectures, data models, and operationally relevant implementations that enable the definition and allocation of digital requirements into existing and new programs of record (PORs). The DW line also funds digital environments, including the Integrated Modeling Environment (IME) and artificial intelligence development operations (AI Dev Ops), to enable cross-functional/organizational teams to collaborate on developing and implementing the NOA.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	20.000	50.120	55.744	-	55.744
Current President's Budget	19.217	37.000	54.699	-	54.699
Total Adjustments	-0.783	-13.120	-1.045	-	-1.045
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-13.120			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.783	0.000			
• Program Adjustments	0.000	0.000	-1.000	-	-1.000
• Rate/Misc Adjustments	0.000	0.000	-0.045	-	-0.045

Change Summary Explanation

The FY 2020 funding request for Project 3425 was reduced by (-$3.120) million to account for the availability of prior year execution balances.

The FY 2020 funding request for Project 3255 was reduced by (-$10.000) million to account for unjustified growth.
The FY 2021 funding request for project 3425 was reduced by (-$1.045) million to account for the availability of prior year execution balances.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*

Overall increase from FY20 to FY21 is due to the standing up of domain teams and software tools required to support the domain teams.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604027N / *Digital Warfare*	Project (Number/Name) 3255 / *AI Dev Ops*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3255: *AI Dev Ops*	0.000	0.000	15.000	24.979	-	24.979	14.980	9.981	9.985	10.185	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project 3255 AI DevOps consists of complementary lines of effort focused on developing and delivering AI technology applications at the Fleet, Force, and Unit levels. Fleet implementation is focused on delivering architectures, data models, and software tools to support the ability of the Maritime Operations Center (MOC) Director to make better, faster decisions at the operational level of war. Force implementation is focused on delivering architectures, data models, and software tools to support Strike/Task Group commander situational awareness, maneuver, positioning, and fires coordination. Unit level implementation is focused on providing tactical submarine operators modern Artificial Intelligence (AI) and Machine Learning (ML) techniques (developed in coordination with Project Maven under USD[I]) to address undersea warfare problems. This project directly supports our National Defense Strategy for building a more lethal force by investing in Advanced Autonomous Systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Artificial Intelligence Development Operations (AI DevOps)	0.000	15.000	24.979	0.000	24.979
Articles:	-	-	-	-	-

FY 2020 Plans:
-$8M to maintain the Project Harbinger effort started under the Algorithmic Warfare Cross-Functional Team (AWCFT).
The $8M includes acoustic data acquisition and transfer ($0.4M), data labeling efforts ($1.5M), data engineering lab ($1M), algorithm development and computing infrastructure ($3.6M), algorithm integration ($1.2M), and fielding to fleet ($0.3M). Increase above the $5.2M in AWCFT FY19 funding is for algorithm development and integration. Digital Warfare Office (DWO) works directly with Undersea Warfighting Development Center (Groton) and COMSUBFOR (Norfolk) for Harbinger and has already tested it on a VACL SSN. This is in direct support of our National Defense Strategy to build a more lethal force using Advanced Autonomous Systems and the CNO's Design 2.0 LOE Green Paragraph 5.
-$2M for data architecture team (funds people) to develop a robust and sustainable data strategy for Naval operations to include all sensor data (acoustic, ISR, EW, etc). This expertise does not currently exist in the DoN.
-$15M for a DWO project to apply AI/DevOps to the operational level of war. It will develop planning and execution decision aids in support of U.S. Pacific Fleet and the Navy's Distributed Maritime Operations (DMO) Concept. The project will clean and integrate existing Navy data, leveraging and expanding upon the AI DevOps components established for Project Harbinger. It includes data acquisition and transfer ($1.1M), data labeling efforts ($2.5M), data engineering lab ($2M), algorithm development and computing infrastructure ($7.3M), algorithm integration ($1.9M), and fielding to fleet ($0.2M). This is in direct support of our National Defense

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3255 / *AI Dev Ops*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Strategy to build a more lethal force using Advanced Autonomous Systems and the CNO's Design 2.0 LOE Blue Paragraph 6. ***FY 2021 Base Plans:*** - Expand the AI DevOps pipeline (data acquisition and transfer, data labelling, data engineering, algorithm development and computing infrastructure and fielding to fleet) to additional fleet, force, and unit applications and data sources. - Fleet implementation - Deliver architectures, data models, and software tools to support the ability of the Maritime Operations Center (MOC) Director to make better, faster decisions at the operational level of war. - Force implementation - Deliver architectures, data models, and software tools to support Strike/Task Group commander situational awareness, maneuver, positioning, and fires coordination. - Unit level implementation - Sustain and expand AI DevOps pipeline for undersea warfare to include additional undersea platforms, including IUSS, surface ships, and aircraft. - Evolve the data strategy to support these additional applications and the NOA. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $9.979M from FY 2020 to FY 2021 - Full operating capability realized in FY21 with mission area teams at full strength for the entire year, establishing and evolving common architectures to realize the Navy Operational Architecture, and full operating capability of descriptive MBSE toolsets.					
Accomplishments/Planned Programs Subtotals	0.000	15.000	24.979	0.000	24.979

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

DW is a non-acquisition effort that informs and matures Navy decisions, which in turn impacts acquisition programs.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3255 / *AI Dev Ops*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AI DEVOPS - Fleet	Various	JHU/APL : Various	0.000	0.000		1.500	Feb 2020	2.000	Oct 2020	-		2.000	Continuing	Continuing	Continuing
AI DEVOPS - Fleet	Various	See Note B : Various	0.000	0.000		0.750	Nov 2019	1.000	Oct 2020	-		1.000	Continuing	Continuing	Continuing
AI DEVOPS - Fleet	Various	See Note C : Various	0.000	0.000		1.000	Feb 2020	3.500	Nov 2020	-		3.500	Continuing	Continuing	Continuing
AI DEVOPS - Fleet	Various	See Note D : Various	0.000	0.000		1.080	Feb 2020	0.479	Oct 2020	-		0.479	0.000	1.559	-
AI DEVOPS - Fleet	Various	AFRL : Rome NY	0.000	0.000		5.520	Nov 2019	9.800	Nov 2020	-		9.800	0.000	15.320	-
AI DEVOPS - Unit	Various	See Note E : Various	0.000	0.000		0.000	Nov 2019	0.100	Nov 2020	-		0.100	0.000	0.100	-
AI DEVOPS - Unit	Various	See Note F : Various	0.000	0.000		0.000	Dec 2019	0.100	Dec 2020	-		0.100	0.000	0.100	-
AI DEVOPS - Unit	Various	NIWC PAC : Various	0.000	0.000		4.400	Nov 2019	3.400	Dec 2020	-		3.400	0.000	7.800	-
AI DEVOPS	Various	See Note G : Various	0.000	0.000		0.000	Nov 2019	3.600	Nov 2020	-		3.600	0.000	3.600	-
AI DEVOPS	Various	See Note A : Various	0.000	0.000		0.750	Nov 2019	1.000	Nov 2020	-		1.000	0.000	1.750	-
		Subtotal	0.000	0.000		15.000		24.979		-		24.979	Continuing	Continuing	N/A

Remarks

Note A: FFRDCs (MIT LL, others) - $750K
Note B: UARCs (UT ARL, GTRI, others) - $750K
Note C: Commercial Industry (Lockheed Martin Manassas, others) - $1.0M
Note D: Warfare Centers (NUWC Newport, others) - $1.080M FY20 - .021K FY21

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		15.000		24.979		-		24.979	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3255 / *AI Dev Ops*

2021PB - 0604027N - 3255

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3255 / *AI Dev Ops*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
AI DEVOPS				
Data Acquisition:	1	2020	4	2021
Data Clearinghouse:	1	2020	4	2021
Data Labeling:	1	2020	4	2021
Algorithm Integration:	1	2020	4	2022
Algorithm Integration: Fielding to Fleet:	1	2020	4	2022
Data Engineering Lab:	1	2020	4	2025
Algorithm Development and Infrastructure:	1	2020	4	2025
Navy Data Architecture Team:	2	2020	4	2025
User Validation Tool Development:	3	2020	4	2021
Obtain IA Authority To Operate:	3	2020	4	2021
Develop Training Requirements:	3	2020	1	2021
CC4ISR Requirements Gathering:	4	2020	2	2021
NIFC INC III Requirements Gathering:	4	2020	2	2021
CC4ISR Data Engineering (ELEKTRA & MINERVA):	2	2020	4	2021
NIFC INC III Data Engineering (ELEKTRA & MINERVA):	2	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*				**Project (Number/Name)** 3256 / *Warfighting Pilots*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3256: *Warfighting Pilots*	0.000	0.000	2.000	2.998	-	2.998	3.998	4.998	5.999	6.119	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

DW requires extensive information exchanges and message compatibility in order to fully exploit kinetic weapons / target pairing tools. These tools and the related weapons require a robust and extensive set of data to properly engage a target. The Warfighting Pilot effort begins the process of creating message and data standards that will drive Navy to a uniform set of message standards and data. In order to fully leverage and improve the information exchange and weapon employment opportunities, regardless of data link or message type used, a standardized data and message standard is required to maximize todays sensors for over-the-horizon combat identification & targeting.

DWO funds will support the technical development and fleet demonstration efforts necessary to establish the viability of a common multi-domain Track Data Standard solution. The result will be a fully defined and documented message standard that will be capable of implementation across multiple data link systems. The funds will also support the development of operational and systems. physics based models for various kinetic long range weapon.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: New Accomplishment/Planned Program Entry	0.000	2.000	2.998	0.000	2.998
Articles:	-	-	-	-	-
FY 2020 Plans: Build messaging standards to support LR CID&T Tactical Level of War (TLW) & Operational Lever of War (OLW) requirements. -Identify and deliver, in an operationally relevant manner, technologies related to message delivery and source data fusion. -Document field data for message standards. -Coordinate with message standards governance elements across DoD to enable the resulting standard inclusion into existing systems and weapons. -Support ingest of LR CID&T data to OLW & TLW planning tools. -Develop plan and test new track message using existing fleet events. -Digital Platform - Demonstrate common environment for warfare system computing. -Digital Platform - Demonstrate common track management for digital transformation across multiple systems.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3256 / *Warfighting Pilots*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Demonstrate integration of Combat Systems (CS) & Command & Control (C2) infrastructure and data sets through a scalable cloud computing services environment in support of TLW & OLW planning and execution tools. -Digital Platform - Adapting the operating environment for different SWAP profiles and mission requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $1M from FY 2020 to FY 2021 - Demonstrate integration of Combat Systems (CS) & Command & Control (C2) infrastructure and data sets through a scalable cloud computing services environment in support of TLW & OLW planning and execution tools.					
Accomplishments/Planned Programs Subtotals	0.000	2.000	2.998	0.000	2.998

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3256 / *Warfighting Pilots*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Warfighting Pilots	TBD	Warfare CTR : Various	0.000	0.000		2.000	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Warfighting Pilots	C/CPFF	JHU/APL : Laurel, MD	0.000	0.000		0.000		0.498	Dec 2020	-		0.498	Continuing	Continuing	Continuing
Warfighting Pilots	C/CPFF	NUWC : West	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Warfighting Pilots	C/CPFF	IWS : NAVSEA	0.000	0.000		0.000		1.250	Nov 2020	-		1.250	Continuing	Continuing	Continuing
Warfighting Pilots	C/CPFF	C4I : NAVAIR	0.000	0.000		0.000		1.250	Nov 2020	-		1.250	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		2.000		2.998		-		2.998	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		2.000		2.998		-		2.998	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3256 / *Warfighting Pilots*

2021PB - 0604027N - 3256

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3256 / *Warfighting Pilots*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3256				
Track Message Development: Message Standard Data Collection:	4	2020	1	2021
Track Message Development: CID&T Data Flow Models:	2	2020	2	2021
Track Message Development: Draft Standard Development:	2	2020	2	2021
Track Message Development: Message Detail:	4	2020	4	2021
Weapon Meta Models: Meta Model Data Collection:	2	2020	1	2021
Weapon Meta Models: Model Development Spiral 1:	4	2020	4	2020
LR CID&T Message Development: Data Flow / Analysis:	2	2020	4	2020
LR CID&T Message Development: ICP Development:	3	2020	3	2020
LR CID&T Message Development: NEWCIM Development:	4	2020	4	2020
Data-model/strategy for inclusion of nontraditional sources:	2	2022	1	2025
Track and data-link fusion:	4	2022	2	2025
Distributed common operational picture:	4	2022	2	2024
Model of Multi-nodal integration:	1	2023	4	2025
Digital Platform: Architecture for extending and scaling computing environment:	3	2021	4	2024
Digital Platform: Digital operating environment standardization:	2	2020	4	2022
Digital Platform: Common Track Manager:	2	2020	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0604027N / *Digital Warfare*				Project (Number/Name) 3425 / *Digital Warfare*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3425: *Digital Warfare*	0.000	19.217	20.000	26.722	-	26.722	27.722	26.847	26.978	27.519	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Digital Warfare (DW) was previously funded in Naval Information Warfare Systems Command (NAVWAR) PE 0604231N (Tactical Command System), NAVSEA PE 0603582N (Combat System Integration), and NAVAIR 0605217N (Common Avionics) under DW Proj 3425 for FY18 and prior. FY20 and out funding was transferred from NAVWAR and NAVAIR and consolidated under NAVSEA. Mission functions and tasking remain unchanged due to this transfer. FY19 funding was transferred under NAVSEA.

A. Mission Description and Budget Item Justification

The DW technical initiatives directly support the Chief of Naval Operations (CNO) vision of inherent interoperability across the Navy enabling faster deployment of capabilities to the warfighter. Realizing this vision requires refinement of the Navy's Operational Architecture as defined in Design 2.0, assessing current Program Of Record (PoR) contribution to it,identifying gaps in capability, and establishing the roadmap to realization.

Naval Air Systems Command (NAVAIR), Naval Sea Systems Command (NAVSEA), Naval Information Warfare Systems Command (NAVWAR), Program Executive Offices (PEOs),warfare and system centers, University Affiliated Research Centers (UARCs)/Federally Funded Research and Development Centers (FFRDCs), and industry partners will support
the Digital Warfare Office (DWO) under the Office of the Chief of Naval Operations (OPNAV) N2N6. In order to develop capability from the top down, the DWO will develop requirements for System of Systems (SoS) to include all of the associated interoperability requirements. Due to the complexity of this work, the DWO will evolve the traditional
requirements development methodology to a MBSE methodology that will encompasses associated model extensions, reports, views, configuration management, model development support, and documentation. This work will be completed by a series of teams, each focused on a separate threat domain, and made up of system modelers, fleet representatives, PoR
representatives, architecture, and interoperability experts.

The products generated by these teams will include NOA elements for prioritized mission and wafare domain areas, coordinated requirements recommendations, and potential areas for Science and Technology (S&T) and experimentation to fill gaps. The DWO will include emerging digital technologies including human/ machine teaming, data science, and artificial intelligence. In addition to traditional mission engineering, the teams will develop cross-cutting reference models and reusable library patterns to further define and refine the OA as well as provide a model interoperability component library for use by the SYSCOMS.

DWO funding supports development of requirements modeling and data science experimentation environment at multiple security level. This environment will host the authoritative source of truth for Naval Echelon I requirements development, PoR requirements and architecture, and provide a virtual location for the engineering workforce to collaborate. The DWO will support experimentation to provide necessary fidelity in the requirements allocation process, focusing on areas that may provide solutions across multiple domains.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SYSCOM/PEO DW Support	19.217	20.000	26.722	0.000	26.722
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue to develop functional baseline architecture of Navy capabilities. Provide SME support for the domain functional decomposition based on prioritized mission areas to include Anti-Submarine Warfare, Surface Warfare, Electronic Warfare, Air Warfare, and Strike Warfare. Develop an overarching Data Technical Baseline (DTB) and DTB profiles for Program of Records (PoRs). Generate PoR requirements based on functional models. - Support the distributed Model Based Systems Engineering (MBSE) and data science environment over multiple security enclaves. Test and deploy additional industry standard tools as required. Continue to scale to meet user demand. - Develop tool extensions to complement Joint Capabilities Integration and Development System (JCIDS) and Program Objective Memorandum (POM) processes. - Curate existing models in the modeling environment. - Continue to support fleet experimentation to provide necessary fidelity in the requirements allocation process, focusing on areas that may provide solutions across multiple domains. - Provide Subject Matter Expert support for data science teams in data exploration and analysis, information and knowledge extraction techniques, and application to mission area data requirements in support of enterprise productivity and warfighting pilots. Apply Machine Learning techniques to support human/machine teaming for decision making.					
FY 2021 Base Plans: - Continue to develop functional baseline operational architecture of Navy capabilities. Define the Naval Operational Architecture(OA) both as a standalone construct and in the context of warfighting mission areas. Provide SME support for the domain functional decomposition based on prioritized mission areas to include Anti-Submarine Warfare, Surface Warfare, Electronic Warfare, Air Warfare, and Strike Warfare. Develop an overarching Data Technical Baseline (DTB) and DTB profiles for PoRs. Generate PoR requirements based on functional models. - Support the distributed Model Based Systems Engineering (MBSE) and data science environment over multiple security enclaves. Test and deploy additional industry standard tools as required. Continue to scale to meet user demand. - Develop tool extensions to complement Joint Capabilities Integration and Development System (JCIDS) and Program Objective Memorandum (POM) processes. - Curate existing models in the modeling environment.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue to support fleet experimentation to provide necessary fidelity in the requirements allocation process, focusing on areas that may provide solutions across multiple domains. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase of $6.722M from FY 2020 to FY 2021 - Full operating capability realized in FY21 with mission area teams at full strength for the entire year, establishing and evolving common architectures to realize the Navy Operational Architecture, and full operating capability of descriptive MBSE toolsets.					
Accomplishments/Planned Programs Subtotals	19.217	20.000	26.722	0.000	26.722

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Digital Warfare - FY19 and Prior	C/CPFF	JHU/APL : Laurel, MD	0.000	19.217	Oct 2019	0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	MIPR	MITRE : McLean, VA	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	C/CPFF	GTRI : San Diego, CA	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	WR	NAWCs : Various	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	WR	SSCs : Various	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	WR	NRL : Washington, DC	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	C/CPFF	G2OPS : San Diego, CA	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - FY19 and Prior	C/CPFF	Various : Various	0.000	0.000		0.000	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Digital Warfare - Integrated Model Environment (IME)	Various	NAVAIR : Pax River, VA	0.000	0.000		2.747	Nov 2019	4.078	Nov 2020	-		4.078	Continuing	Continuing	Continuing
Digital Warfare - Integrated Model Environment (IME)	Various	See Note A : Various	0.000	0.000		1.012	Nov 2019	1.501	Oct 2020	-		1.501	Continuing	Continuing	Continuing
Digital Warfare - Integrated Model Environment (IME)	Various	See Note B : Various	0.000	0.000		0.751	Nov 2019	1.115	Oct 2020	-		1.115	Continuing	Continuing	Continuing
Digital Warfare - Operational Architecture	Various	MITRE : McLean, VA	0.000	0.000		1.127	Nov 2019	1.673	Dec 2020	-		1.673	Continuing	Continuing	Continuing
Digital Warfare - Operational Architecture	Various	See Note C : Various	0.000	0.000		2.029	Dec 2019	3.011	Oct 2020	-		3.011	Continuing	Continuing	Continuing
Digital Warfare - Operational Architecture	Various	See Note D : Various	0.000	0.000		0.601	Nov 2019	0.892	Nov 2020	-		0.892	Continuing	Continuing	Continuing
Digital Warfare - Effort 4	Various	See Note E : Various	0.000	0.000		2.762	Nov 2019	4.099	Nov 2020	-		4.099	Continuing	Continuing	Continuing
Digital Warfare - Effort 4	Various	See Note F : Various	0.000	0.000		0.563	Dec 2019	0.836	Dec 2020	-		0.836	Continuing	Continuing	Continuing
Digital Warfare - Effort 4	Various	See Note G : Various	0.000	0.000		0.620	Nov 2019	0.920	Oct 2020	-		0.920	Continuing	Continuing	Continuing
Digital Warfare - Effort 4	Various	See Note H : Various	0.000	0.000		0.563	Nov 2019	0.836	Oct 2020	-		0.836	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Digital Warfare - MOC, CIC, TFCC	Various	See Note I : Various	0.000	0.000		0.816	Nov 2019	1.204	Nov 2020	-		1.204	Continuing	Continuing	Continuing
Digital Warfare - Other (Studies, MBSE, I&I, NCIP)	Various	Industry : Various	0.000	0.000		0.409	Jun 2020	0.557	Oct 2020	-		0.557	Continuing	Continuing	Continuing
		Subtotal	0.000	19.217		14.000		20.722		-		20.722	Continuing	Continuing	N/A

Remarks

Note A: Warfare Centers (NIWC LANT, NIWC PAC, others) - $1.012M
Note B: Commercial Industry (G2OPS, MITRE, others) - $751K
Note C: Warfare Centers (NSWC DD, NAWC AD, NUWC Keyport, NUWC Newport, NIWC PAC, others) - $2.029M
Note D: Commercial Industry (G2OPS, others) - $601K
Note E: Warfare Centers (NSWC DD, NIWC PAC, others) - $2.262M
Note F: UARCS (JHU/APL, others) - $563K
Note G: Research Laboratories (NRL, IDT, others) - $620K
Note H: Commercial Indusry (Lockheed Martin, G2OPS, others) - $563K
Note I: Warfare Centers (NSWC DD, NIWC PAC, NAWC AD, others) - $1.012M

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Digital Warfare - DISC Digital Transformation & Integration	Various	Various : Various	0.000	0.000		2.900	Dec 2019	3.000	Dec 2020	-		3.000	0.000	5.900	-
Digital Warfare - DISC Digital Transformation & Integration	Various	Various : DTIC IAC	0.000	0.000		2.600	Dec 2019	2.500	Dec 2020	-		2.500	0.000	5.100	-
		Subtotal	0.000	0.000		5.500		5.500		-		5.500	0.000	11.000	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Digital Warfare - DISC Digital Transformation & Integration	Various	Various : Various	0.000	0.000		0.500	Nov 2019	0.500	Nov 2020	-		0.500	0.000	1.000	-
		Subtotal	0.000	0.000		0.500		0.500		-		0.500	0.000	1.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	19.217		20.000		26.722		-		26.722	Continuing	Continuing	N/A

Remarks

FY 2020 funding request for project 3425 was reduced by (-$3.120) million to account for the availability of prior year execution balances.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3425.S24				
MBSE Patterns Spiral 1 (OA):	3	2020	3	2021
MBSE Patterns Spiral 2 (OA):	3	2021	3	2022
MBSE Patterns Spiral 3 (OA):	3	2022	3	2023
MBSE Patterns Spiral 4 (OA):	3	2023	3	2024
OA Curation:	3	2020	4	2025
Undersea Spiral 3 (Sensors):	3	2019	3	2020
Undersea Spiral 2 (Unit):	1	2020	4	2020
Undersea Spiral 2 (Unit) 2:	1	2021	4	2021
Undersea Req Curation/Threat Updates:	3	2019	4	2023
Surface Spiral 1 (MOC C2):	1	2019	4	2019
Surface Spiral 2 (SUW C2):	3	2019	3	2020
Surface Spiral 3 Force 1:	3	2020	3	2021
Surface Spiral 4 Force 2:	3	2021	4	2022
Surface Req Curation/Threat Updates:	3	2019	4	2023
IW/EW Spiral 1 (C2):	1	2019	4	2019
IW/EW Spiral 2 (C2):	3	2019	1	2021
IW/EW Req Curation/Threat Updates:	4	2019	3	2021
Air Spiral 1 (C2):	2	2019	2	2020
Air Spiral 2:	2	2020	2	2021
Air Spiral 3 Air/Tactical:	1	2022	1	2023
Air Req Curation/Threat Updates:	2	2020	4	2021
Land Spiral 1 Fleet MOC:	2	2020	2	2021

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604027N / *Digital Warfare*	**Project (Number/Name)** 3425 / *Digital Warfare*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Land Spiral 2 Fleet MOC:	3	2021	3	2022
Land Spiral 3 Fleet MOC:	3	2022	3	2023
Land Req Curation/Threat Updates:	3	2022	3	2023
MBSE/Data Science Environment:	1	2019	4	2025
Digital Warfare: Program Magt/ Governance Process/ Technical Exchanges:	1	2020	4	2025
Digital Warfare: Integrated Modeling Environment (IME):	1	2020	4	2025
Digital Warfare: Capability Demonstrations:	2	2020	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	16.062	47.261	53.942	-	53.942	51.503	97.987	62.975	17.316	Continuing	Continuing
2482: *Small Unmanned Undersea Vehicles*	0.000	0.000	0.000	4.597	-	4.597	7.597	7.897	7.998	0.000	0.000	28.089
2483: *Medusa*	0.000	0.000	0.000	0.000	-	0.000	1.900	28.039	31.653	0.000	0.000	61.592
3123: *SMCM UUV*	0.000	16.062	22.747	20.656	-	20.656	16.397	20.133	8.860	2.561	Continuing	Continuing
3785: *Razorback*	0.000	0.000	9.780	28.689	-	28.689	25.609	41.918	14.464	14.755	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	14.734	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.734

Note

Razorback FY19 and prior funding in PE 0604218N. Project 3785 Razorback realigned from PE 0604218N starting in FY 2020. SAFECAP realigned from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning in FY20.
Small UUV programs realigned from PE to PE0604028N Project 2482 beginning in FY21.

A. Mission Description and Budget Item Justification

Small and Medium Unmanned Undersea Vehicles (UUVs) are a segment of the Navy's Family of UUVs defined as having a diameter between 3 inches and 10 inches for small UUVs and a diameter of 10 inches to 21 inches for medium UUVs. The UUVs can be launched by submarines, surface ships, or larger UUVs, and can be recovered by surface ships and submarines. This class of UUVs can have one or more types of sensors to perform multiple missions including Intelligence Preparation of the Operational Environment (IPOE), battlespace awareness, and mine warfare.

Multi Mission Small UUV Program - This Small Class Unmanned Undersea Vehicle program will field a light-weight, highly portable and mission configurable UUV for use by the Navy Explosive Ordnance Disposal (EOD), Naval Special Warfare (NSW), Submarine UUV Squadron (UUVRON), the Naval Oceanographic Community (NMOC), and United States Marine Corps operators. The program will deliver a baseline UUV capability and implement an incremental development approach, including phases for prototyping, integration, demonstration and fielding of Small Diameter UUVs to integrate with mission packages from each community.

Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV) - The Knifefish program develops advanced medium class UUVs to support clandestine mine detection capability against volume, bottom, and buried mines. Equipment includes vehicles and associated systems support equipment. In parallel, Block Upgrade design efforts aligned to Fleet needs are ongoing to support insertion of incremental capability when the technology is ready. Planned Block Upgrade candidates being considered include increased detection range capability, communications upgrades, on-board sonar processing and target recognition, command and control improvements, increased operational depth, and other smaller tasks, as well as future payloads as required.

Littoral Battlespace Sensing - Autonomous Undersea Vehicle Submarine Variant (LBS-AUV(S)), also known as Razorback, is a medium class UUV capable of persistent, autonomous, ocean sensing and data collection in support of Navy Intelligence Preparation of the Operational Environment (IPOE) mission. Razorback is

deployed from host submarines in two variants: from the Dry Deck Shelter (DDS) or from the torpedo tube. The DDS deployed Razorback variant has been procured beginning in FY17 with Fleet operational deployments beginning in FY20. Development of requirements and submarine integration efforts commenced in FY 2019 for the torpedo tube launch and recover (TTL&R) variant, which will be competitively sourced to industry by FY21.

In order to deploy Razorback, or other small or medium class UUVs from a host submarine platform with sufficient endurance to perform a desired mission, high energy density sources such as lithium ion batteries are used. Consequently, safety is paramount and mitigation systems must be in place to prevent or stop a high energy casualty event. SAFECAP is being developed as an active mitigation strategy that includes a shock qualified capsule that aides in the launch and recovery of small and medium sized vehicles through the torpedo tube. It also contains a Battery Casualty Detection System that constantly monitors battery health and status, providing early warning signs of a battery short via an alarm. In the event of a casualty, the capsule and vehicle portion of SAFECAP are flooded via the fire hose connections and the event is extinguished.

MEDUSA is a medium class UUV capable of offensive mining capabilities deployed from a submarine. It may potentially carry other advanced payloads in the future to meet additional mission needs. MEDUSA features torpedo tube launch capability, long range, high payload placement accuracy, and can handle heavy payloads. A prototype system will be demonstrated in FY20 using dummy payloads via an in-water launch from a host submarine. Lessons learned from the prototype and demonstration will inform a competitive award to Industry in FY23 to develop and produce tactical systems. The MEDUSA prototype and Industry variant differ from the Razorback Torpedo Tube Launch and Recovery (TTL&R) variant in size (MEDUSA is approximately 21 inches in diameter, impulsed from the torpedo tube, and expendable once the payload is deployed). Razorback TTL&R is expected to be less than 15 inches in diameter, launch and recover from the torpedo tube, and be capable of swappable payloads to conduct a variety of missions.

B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	16.717	32.527	53.991	-	53.991
Current President's Budget	16.062	47.261	53.942	-	53.942
Total Adjustments	-0.655	14.734	-0.049	-	-0.049
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	14.734			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.655	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	-0.049	-	-0.049

Congressional Add Details ($ in Millions, and Includes General Reductions)

	FY 2019	**FY 2020**
Project: 9999: *Congressional Adds*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Congressional Add: *MCM UUV UON*	0.000	14.734
Congressional Add Subtotals for Project: 9999	0.000	14.734
Congressional Add Totals for all Projects	0.000	14.734

Change Summary Explanation

Program Changes:
FY 2019 - -$655K Small Business Innovation Research (SBIR)
FY 2020 - +$14,734K Congressional action: Navy requested transfer from OPN line 30 for MCM UUV UON
FY 2021 - -$49K Miscellaneous reductions
Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2482: *Small Unmanned Undersea Vehicles*	0.000	0.000	0.000	4.597	-	4.597	7.597	7.897	7.998	0.000	0.000	28.089
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

As part of the UUV Family of Systems (FoS) the Small UUV Program of Record (SUPOR) develops advanced small class UUVs to support myriad missions across warfare domains. The missions include: Expeditionary Mine Countermeasures, Expeditionary data collection and surveillance, Intelligence Preparation of the Environment (IPOE). Equipment includes vehicles and associated systems support equipment. In order to meet a wide range of mission areas with a common platform, this effort maximizes Modular Open Systems Architecture to enable rapid development of a range of sensors and tools and for fleet operators to easily change configurations to meet dynamic threat environments and missions. Planned block upgrades include increased detection range capability, communications upgrades, on-board sonar processing and target recognition, autonomy and command and control improvements, additional launch and recovery abilities, increased operational depth, and payloads as required.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SMALL UNMANNED UNDERWATER VEHICLES	0.000	0.000	4.597	0.000	4.597
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: FY 2021 funding formally initiates the Small UUV Program of Record (PoR). Efforts include delivery of initial Small UUV prototypes and initiation of developmental testing and evaluation with participation of Fleet stakeholders.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Increase from FY 2020 to FY 2021 will allow for development, test and evaluation of the next generation small UUV. This effort will leverage advances in commercial technologies to provide a common baseline small UUV that will fulfill capability needs of several Navy user communities through an open architecture approach in a competitive selection process.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	4.597	0.000	4.597

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Small UUV Program is planned to be implemented and executed as a Middle Tier Acquisition Program in accordance with (IAW) Middle Tier Acquisition and Agility Interim Guidance approved by the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RDA) on 24 April 2018 and the most recent update provided on 19 January 2019. Industry solicitations will be released based on on-going market research and technology investment efforts to determine best-in-class small UUV prototypes which will then be tested and evaluated against approved requirements to demonstrate operation effectiveness and suitability.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	C/CPFF	TBD : TBD	0.000	0.000		0.000		1.925	Nov 2020	-		1.925	0.000	1.925	-
Systems Engineering	C/CPFF	NSWC, Activities : Various	0.000	0.000		0.000		0.490	Nov 2020	-		0.490	0.000	0.490	-
		Subtotal	0.000	0.000		0.000		2.415		-		2.415	0.000	2.415	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technical Support	C/CPFF	Various : TBD	0.000	0.000		0.000		0.144	Nov 2020	-		0.144	0.000	0.144	-
		Subtotal	0.000	0.000		0.000		0.144		-		0.144	0.000	0.144	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NIWC : San Diego	0.000	0.000		0.000		1.135	Nov 2020	-		1.135	0.000	1.135	-
Developmental Test & Evaluation	WR	NUWC : Newport	0.000	0.000		0.000		0.787	Nov 2020	-		0.787	0.000	0.787	-
		Subtotal	0.000	0.000		0.000		1.922		-		1.922	0.000	1.922	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	WR	NSWCIHEODTD : Indian Head, MD	0.000	0.000		0.000		0.116	Nov 2020	-		0.116	0.000	0.116	-
		Subtotal	0.000	0.000		0.000		0.116		-		0.116	0.000	0.116	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		4.597		-		4.597	0.000	4.597	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2482 / *Small Unmanned Undersea Vehicles*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2482				
SMALL UNMANNED UNDERWATER VEHICLE: Small UUV Prototype Deliveries	2	2021	2	2021
SMALL UNMANNED UNDERWATER VEHICLE: Small UUV Test & Evaluation	3	2021	4	2023
SMALL UNMANNED UNDERWATER VEHICLE: Small UUV MCM Production Deliveries	3	2023	4	2025
SMALL UNMANNED UNDERWATER VEHICLE: Block Upgrades for Unique Mission Package Integration	1	2024	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 2483 / *Medusa*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2483: *Medusa*	0.000	0.000	0.000	0.000	-	0.000	1.900	28.039	31.653	0.000	0.000	61.592
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

MEDUSA is a medium class UUV capable of offensive mining capabilities deployed from a submarine. It may potentially carry other advanced payloads in the future to meet additional mission needs. MEDUSA features torpedo tube launch capability, long range, high payload placement accuracy, and can handle heavy payloads. A prototype system will be demonstrated in FY20 using dummy payloads via an in-water launch from a host submarine. Lessons learned from the prototype and demonstration will inform a competitive award to Industry in FY23 to develop and produce tactical systems. The MEDUSA prototype and Industry variant differ from the Razorback TTL&R in size (MEDUSA is approximately 21 inches in diameter, impulse from the torpedo tube, and expendable once the payload is deployed. Razorback TTL&R is expected to be less than 15 inches in diameter, launch and recover from the torpedo tube, and be capable of swappable payloads to conduct a variety of missions).

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3123: *SMCM UUV*	0.000	16.062	22.747	20.656	-	20.656	16.397	20.133	8.860	2.561	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Prior year funding in PE 0603502N.

A. Mission Description and Budget Item Justification

As part of the UUV Family of Systems (FoS) and in support of the Mine Countermeasures (MCM) Mission Package (MP), the Knifefish Surface Mine Countermeasures Unmanned Undersea Vehicle (SMCM UUV) program develops advanced medium class UUVs to support clandestine mine detection capability against volume, bottom, and buried mines. Equipment includes vehicles and associated systems support equipment. In parallel, Block Upgrade design efforts aligned to Fleet needs are ongoing to support insertion of incremental capability when the technology is ready. Planned Block Upgrade candidates being considered include increased detection range capability, communications upgrades, on-board sonar processing and target recognition, command and control improvements, increased operational depth, and other smaller tasks, as well as potential future payloads as required.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Knifefish Development	9.072	17.820	14.098	0.000	14.098
Articles:	-	-	-	-	-
FY 2020 Plans: Continue engineering and acquisition efforts for competitive production award. Conduct LCS Independence variant integration testing. Verify and test correction of deficiencies from Developmental Testing/Operational Assessment (DT/OA). Complete development for Block 1 (increased operating depth limit, mine case burial estimation, Net-Centric Sensor Analysis for Mine Warfare (NSAM) interoperability) capability and integrate into the Knifefish system. Begin prototype fuel cell integration and transition from ONR for a future Block Upgrade. Continued maintenance of EDM vehicles and support systems in support of Block upgrade and LCS integration testing.					
FY 2021 Base Plans: Begin development of Block 2 upgrade including integration of modular Skyfish payload to detect and classify deeply buried mines. Conduct initial test of Block 2 systems deep buried mine detection capability and vehicle operations in deep water. Verify NSAM interoperability. Integrate fuel cell onto a Knifefish vehicle for shore based operations. Integrate Knifefish with LCS Freedom variant. Conduct testing of LRIP systems.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 decrease in development due to completion of E&MD phase and testing.					
Title: Knifefish Support	3.748	3.165	4.212	0.000	4.212
Articles:	-	-	-	-	-
FY 2020 Plans: Provide engineering support for Block 1 upgrade development, LCS integration, and prototype fuel cell efforts. Provide acquisition support of competitive procurement activities. ***FY 2021 Base Plans:*** Provide engineering support for completion of Block 2 upgrade, LCS integration in support of LRIP testing, and integrate prototype fuel cell onto vehicle. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increase due to engineering support for block upgrades and fuel cell integration efforts.					
Title: Knifefish Test and Evaluation	2.460	0.800	1.384	0.000	1.384
Articles:	-	-	-	-	-
FY 2020 Plans: Complete initial integration testing from the LCS Independence variant. Conduct testing from LCS, and other testing from Vessel of Opportunity (VOO), as required. Conduct testing related to Block Upgrade efforts. ***FY 2021 Base Plans:*** Conduct testing from LCS, early testing of Block 2 upgrades, test prototype vehicle with fuel cell. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increase due to conducting LRIP testing and block upgrade testing.					
Title: Knifefish Management Services	0.782	0.962	0.962	0.000	0.962
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Conduct acquisition and management of development, test, and program activities supporting Block 1 and fuel cell efforts, and competitive procurement activities. ***FY 2021 Base Plans:*** Conduct acquisition and management of development, test, and program activities supporting LCS testing, Block 2 upgrades, and fuel cell development. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	16.062	22.747	20.656	0.000	20.656

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2622: *Minesweeping Replacement*	32.367	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
• OPN/1601: *LCS MCM Mission Modules*	98.901	64.789	218.822	-	218.822	222.754	234.330	243.187	247.949	1,111.812	2,666.795
• OPN/1611: *Small & Medium UUV*	0.000	25.601	67.709	2.946	70.655	45.036	30.081	61.422	64.963	Continuing	Continuing

Remarks

OPN 1601 and OPN 1611 funding lines account for several programs, of which the Knifefish program is only a portion.

D. Acquisition Strategy

The Knifefish program, initiated in FY 2011 and competitively sourced to General Dynamics Mission Systems (GDMS), develops SMCM UUVs equipped with advanced Low Frequency Broadband (LFBB) sonar to provide volume, bottom, and buried mine detection capability, when operated from the Littoral Combat Ship (LCS) Mine Countermeasures Mission Package (MCM MP) or Vessel of Opportunity (VOO). An Engineering Development Model (EDM) system was fabricated and tested through Developmental Testing (DT). After incorporating fixes and upgrades discovered during DT and from Fleet operator inputs, an Operational Assessment (OA) was completed from a VOO in order to inform the Milestone C (MS C) decision and Low Rate Initial Production (LRIP) award of five Knifefish systems. Initial integration testing with the LCS was completed prior to MS C. Following Block 1 testing, a full and open competitive production contract will be awarded. The overall approach is to deliver systems through incrementally increasing capability via three Block Upgrades, balancing technology development maturity against a manageable level of risk to the program. New capability Block Upgrades will not transition to the production system until stable requirements are established, demonstrated, and verified for each respective Block. Knifefish is designated as an ACAT II program.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Knifefish Development & Engineering Support	C/CPIF	General Dynamics AIS : McLeansville, NC	0.000	8.520	Dec 2018	2.694	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Hardware/Software Development - Support Equipment	WR	NSWC, PC : PANAMA CITY, FL	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Knifefish Block 1 Development Contractor	C/CPIF	GDMS : McLeansville, NC	0.000	0.552	Nov 2018	13.326	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Knifefish Block 1 Development	TBD	Various : Various	0.000	0.000		1.800	Jan 2020	0.000		-		0.000	0.000	1.800	-
Knifefish Block 2 Development Contractor	C/CPIF	GDMS : McLeansville, NC	0.000	0.000		0.000		12.748	Dec 2020	-		12.748	0.000	12.748	-
Knifefish Block 2 Development	TBD	Various : Various	0.000	0.000		0.000		1.350	Dec 2020	-		1.350	0.000	1.350	-
		Subtotal	0.000	9.072		17.820		14.098		-		14.098	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support	WR	NSWC, PC : PANAMA CITY, FL	0.000	2.211	Dec 2018	1.450	Dec 2019	1.788	Dec 2020	-		1.788	Continuing	Continuing	Continuing
Engineering Support	WR	NUWC, Newport : NEWPORT, RI	0.000	0.974	Dec 2018	0.850	Dec 2019	1.081	Nov 2020	-		1.081	Continuing	Continuing	Continuing
Engineering Support	WR	Various : Various	0.000	0.563	Dec 2018	0.865	Dec 2019	1.343	Nov 2020	-		1.343	Continuing	Continuing	Continuing
		Subtotal	0.000	3.748		3.165		4.212		-		4.212	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government T&E Support	WR	Various : Various	0.000	0.145	Jan 2019	0.000		0.267	Dec 2020	-		0.267	0.000	0.412	-
Test and Evaluation	WR	COMOPTEVFOR : NORFOLK, VA	0.000	0.115	Dec 2018	0.415	Dec 2019	0.400	Nov 2020	-		0.400	0.000	0.930	-
Government T&E Support	WR	NSWC, PC : PANAMA CITY, FL	0.000	2.200	Nov 2018	0.385	Dec 2019	0.717	Nov 2020	-		0.717	0.000	3.302	-
		Subtotal	0.000	2.460		0.800		1.384		-		1.384	0.000	4.644	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPFF	Various : WASHINGTON, DC	0.000	0.682	Feb 2019	0.887	Feb 2020	0.887	Dec 2020	-		0.887	0.000	2.456	-
Travel	WR	NAVSEA : WNY, DC	0.000	0.100	Dec 2018	0.075	Dec 2019	0.075	Nov 2020	-		0.075	0.000	0.250	-
		Subtotal	0.000	0.782		0.962		0.962		-		0.962	0.000	2.706	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0603502N.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	16.062		22.747		20.656		-		20.656	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Knifefish				
Project Unit Moved from Program Element 0603502N:	1	2019	1	2019
Knifefish Acquisition Program: Milestones: Milestone C	4	2019	4	2019
Knifefish Acquisition Program: Milestones: Block 1 Initial Operational Capability	3	2022	3	2022
Knifefish Acquisition Program: Milestones: Knifefish Full Rate Production Decision	4	2022	4	2022
Knifefish Acquisition Program: Test Events: VOO DT/OA	1	2019	3	2019
Knifefish Acquisition Program: Test Events: LCS Independence Variant Integration	3	2020	4	2020
Knifefish Acquisition Program: Test Events: LCS Freedom Variant Integration	2	2021	2	2021
Knifefish Acquisition Program: Test Events: Block 0 testing	2	2021	3	2021
Knifefish Acquisition Program: Test Events: Block 1 IOT&E	1	2022	2	2022
Knifefish Acquisition Program: Test Events: Block 2 FOT&E	3	2024	3	2024
Knifefish Production: LRIP Block 0: Contract Award	4	2019	4	2019
Knifefish Production: LRIP Block 0: BLK 0 LRIP	4	2019	3	2021
Knifefish Production: LRIP Block 1: Contract Award	3	2021	3	2021
Knifefish Production: LRIP Block 1: BLK 1 LRIP	3	2021	3	2023
Knifefish Production: Full Rate: Contract Award	1	2023	1	2023
Knifefish Production: BLK 2 FRP	2	2023	4	2025
Knifefish Block Upgrade: Block 1 Integration: Design	1	2019	4	2020
Knifefish Block Upgrade: Block 2 Design and Integration: Design	1	2021	4	2022
Knifefish Block Upgrade: Block 3 Design and Integration: Design	1	2023	4	2024
Knifefish Block Upgrade: Block 3 Design and Integration: FRP	1	2025	4	2025
Knifefish Block Upgrade: Fuel Cell: Shore Based Prototype	1	2021	3	2022

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3123 / *SMCM UUV*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Knifefish Block Upgrade: Fuel Cell: VOO Configuration	4	2022	4	2024
Knifefish Block Upgrade: Fuel Cell: Safety Certification	1	2025	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3785: *Razorback*	0.000	0.000	9.780	28.689	-	28.689	25.609	41.918	14.464	14.755	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2019 and prior funding in PE 0604218N. Project 3785 Razorback realigned from PE 0604218N starting in FY 2020.

Shock and Fire Enclosure Capsule (SAFECAP) is a continuation effort being transferred from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning FY 2020.

A. Mission Description and Budget Item Justification

A part of the Family of UUVs, Littoral Battlespace Sensing - Autonomous Undersea Vehicle, Submarine variant (LBS-AUV(S)) or Razorback is a medium class UUV capable of persistent, autonomous, ocean sensing and data collection in support of Navy Intelligence Preparation of the Operational Environment (IPOE) mission. Razorback is deployed from host submarines in two variants: from the Dry Deck Shelter (DDS) or from the torpedo tube. The DDS deployed Razorback variant has been procured beginning in FY 2017 with Fleet operational deployments planned for FY21. Development of requirements and submarine integration efforts commenced in FY 2019 for the torpedo tube launch and recover (TTL&R) variant, which will be competitively sourced to industry by FY21. Razorback TTL&R leverages risk reduction efforts for torpedo launch and recovery and host submarine integration performed under PE 0604029N UUV Core Technologies.

In order to deploy Razorback or other small or medium class UUVs from a host submarine platform with sufficient endurance to perform a desired mission, high energy density sources such as lithium ion batteries are used. Consequently, safety is paramount and mitigation systems must be in place to prevent or stop a high energy casualty event. Shock and Fire Enclosure Capsule (SAFECAP) is being developed as an active mitigation strategy that includes a shock qualified capsule that aides in the launch and recovery of small and medium sized UUVs through the torpedo tube, including Razorback. It also contains a Battery Casualty Detection System that constantly monitors battery health and status, providing early warning signs of a battery short. In the event of a casualty, the capsule and vehicle portion of SAFECAP are flooded via fire hose connections and the event is extinguished.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development - Razorback	0.000	4.922	22.318	0.000	22.318
Articles:	-	-	-	-	-
FY 2020 Plans: Develop Razorback Request for Proposal (RFP) to industry for the Torpedo Tube Launch & Recovery (TTL&R) variant. Release RFP to Industry and commence source selection activities.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Award Engineering Development Model (EDM) contract. Manage up to two industry teams designing Razorback TTL&R, conduct Preliminary Design Review (PDR) and begin detailed design. Initiate data products development and analysis for submarine integration including Temporary Alteration (TEMPALT) and Li-ion battery certification efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increased funding supports the award of EDM Contract(s) and PDR.					
Title: Product Development - SAFECAP	0.000	2.004	3.473	0.000	3.473
Articles:	-	-	-	-	-
FY 2020 Plans: SAFECAP transitions from Program Element (PE) 0603561N Project 2033. Perform SAFECAP Capstone Test. VIRGINIA CLASS (VACL) Shock Assessment Continue Early Fault Detection Effort. ***FY 2021 Base Plans:*** Continue integration testing of next gen Sandia National Lab (SNL) Sensors. Continue Early Fault Detection efforts. Commence Shock Test VACL. Commence Capsule Production. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increased funding supports SAFECAP test efforts and the commencement of capsule production.					
Title: Support	0.000	2.250	2.281	0.000	2.281
Articles:	-	-	-	-	-
FY 2020 Plans: Provide acquisition and engineering support for competitive procurement activities and submarine integration efforts, including TEMPALT development and technical reviews, and Li-ion battery certification efforts. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Provide acquisition and engineering support for contract management activities and submarine integration efforts, including TEMPALT development and technical reviews, and Li-ion battery certification efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change.					
Title: Management Services	0.000	0.604	0.617	0.000	0.617
Articles:	-	-	-	-	-
FY 2020 Plans: Provide technical guidance, project planning, program management, financial and contracting management, and travel for RFP release and submarine integration efforts. ***FY 2021 Base Plans:*** Provide technical guidance, project planning, program management, financial and contracting management, and travel for contract administration and submarine integration efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change.					
Accomplishments/Planned Programs Subtotals	0.000	9.780	28.689	0.000	28.689

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN 1611: *Small & Medium UUV*	0.000	25.601	67.709	2.946	70.655	45.036	30.081	61.422	64.963	Continuing	Continuing

Remarks

The above OPN funding line accounts for several programs, of which the RAZORBACK program is only a portion.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

D. Acquisition Strategy

The Razorback torpedo tube launch and recover (TTL&R) variant will be a competitively sourced Medium class UUV to support missions for the Submarine Force. The Razorback TTL&R acquisition strategy leverages collaboration with the Explosive Ordinance Disposal (EOD) community's Maritime Expeditionary Minehunting UUV (MEMUUV) Medium class UUV for contracting order quantity, training, and sustainment efficiencies. Razorback will leverage lessons learned about mission capabilities and submarine integration from previous science and technology efforts, parallel risk reduction and demonstrations of torpedo tube launch and recover under UUV Core Technology PE 0604029N, Project 4053 UxS Platform efforts, the LBS-AUV systems operated by Naval Oceanographic Command (NAVO), and from the Razorback Dry Deck Shelter variant. Requirements generation and initial submarine integration efforts began in FY19, followed by Request for Proposal (RFP) development and release to industry in FY20. SAFECAP development and submarine integration efforts will continue in parallel to requirements and RFP development in order to provide Li-ion battery casualty mitigations to support Razorback vehicles.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development - SAFECAP	WR	NUWC NPT : Newport, RI	0.000	0.000		0.700	Oct 2019	0.650	Nov 2020	-		0.650	Continuing	Continuing	Continuing
Product Development - SAFECAP	C/CPFF	Sandia National Labs : Albuquerque, NM	0.000	0.000		0.750	Oct 2019	1.500	Nov 2020	-		1.500	Continuing	Continuing	Continuing
Product Development - SAFECAP	WR	NSWC CD : West Bethesda, MD	0.000	0.000		0.150	Oct 2019	0.175	Nov 2020	-		0.175	Continuing	Continuing	Continuing
Product Development - SAFECAP	WR	NSWC Crane : Crane, Indiana	0.000	0.000		0.150	Oct 2019	0.175	Nov 2020	-		0.175	Continuing	Continuing	Continuing
RAZORBACK Product Development -	WR	NUWC NPT : Newport, RI	0.000	0.000		4.922	Mar 2020	1.500	Oct 2020	-		1.500	0.000	6.422	-
RAZORBACK EDM Contract	C/CPIF	TBD : TBD	0.000	0.000		0.000		20.818	Dec 2020	-		20.818	0.000	20.818	-
Product Development - SAFECAP	C/CPAF	Hyrdoid, Inc : TBD	0.000	0.000		0.254	Nov 2019	0.373	Nov 2020	-		0.373	0.000	0.627	-
Product Development - SAFECAP	C/CPAF	HII (Advex) : Norfolk, VA	0.000	0.000		0.000		0.600	Nov 2020	-		0.600	0.000	0.600	-
		Subtotal	0.000	0.000		6.926		25.791		-		25.791	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support - RAZORBACK	WR	NUWC Newport : Newport, RI	0.000	0.000		2.250	Nov 2019	2.281	Nov 2020	-		2.281	0.000	4.531	-
		Subtotal	0.000	0.000		2.250		2.281		-		2.281	0.000	4.531	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management - SAFECAP	Various	Varios : Washington DC	0.000	0.000		0.146	Oct 2019	0.147	Nov 2020	-		0.147	Continuing	Continuing	Continuing
Travel - RAZORBACK	Various	NAVSEA HQ : Washington DC	0.000	0.000		0.050	Oct 2019	0.060	Oct 2020	-		0.060	0.000	0.110	-
Management - RAZORBACK	Various	Various : Various	0.000	0.000		0.408	Dec 2019	0.410	Dec 2020	-		0.410	0.000	0.818	-
		Subtotal	0.000	0.000		0.604		0.617		-		0.617	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		9.780		28.689		-		28.689	Continuing	Continuing	N/A

Remarks

Razorback realigned from Program Element (PE) 0604218N Project 2345 to PE 0604028N Project 3785 beginning in FY 2020.

SAFECAP realigned from PE 0603561N Project 2033 to PE 0604028N Project 3785 beginning in FY 2020.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 3785 / *Razorback*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3785				
New Program Element: Schedule Detail	1	2020	1	2020
RAZORBACK Development: Razorback Development Contract: RFP	2	2020	2	2020
RAZORBACK Development: Razorback Development Contract: Source Selection	2	2020	1	2021
RAZORBACK Development: Razorback Development Contract: Contract Award	1	2021	1	2021
RAZORBACK Development: Razorback Development Contract: Preliminary Design Review	3	2021	3	2021
RAZORBACK Development: Razorback Development Contract: Design, Fabricate, and Test	1	2021	1	2024
RAZORBACK Development: RAZORBACK Integration: Submarine Integration	4	2022	1	2024
RAZORBACK Development: RAZORBACK Integration: Follow-on Builds	2	2024	4	2025
RAZORBACK Development: RAZORBACK Integration: TEMPALT	1	2020	4	2024
RAZORBACK Development: Battery Monitoring System: Early Fault Detection System Development	1	2020	4	2021
RAZORBACK Development: SAFECAP Integration and Testing: System Shakedown Testing	1	2023	2	2024
RAZORBACK Development: SAFECAP Mission TEMPALT: TEMPALT	2	2024	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	14.734	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.734
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

MCM UON funding in PE 0604028N is a Congressional Add Line #75

A. Mission Description and Budget Item Justification

Mine Countermeasures (MCM) Urgent Operational Need (UON) was submitted by US Naval Forces Central Command (NAVCENT) and endorsed by US Fleet Forces Command (USFF) in August of 2018. 12 February 2019, OPNAV N9 issued a SECRET letter 3100 Ser N9/19S13905 "Resolution for Clandestine Mine Detection". This effort will deliver a baseline capability and a streamlined development approach including prototyping, integration, testing, demonstration and fielding of a mission package to answer this UON.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: MCM UUV UON	0.000	14.734
FY 2019 Accomplishments: N/A		
FY 2020 Plans: Procure (4) small UUV's and where possible leverage existing medium UUV programs - Preliminary design, integration, testing, and demonstration of mission package - Initiate integration of launch and recovery technologies - Upgrade self-protection autonomy suite - Finalize design changes needed for both the vehicle(s) and host platform for launching and/or recovering - Initiate Rapid Fielding (RF) TEMPALT design packages and approvals		
Congressional Adds Subtotals	0.000	14.734

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	WR	NUWC NPT : Newport, RI	0.000	0.000		1.750	Feb 2020	0.000		-		0.000	0.000	1.750	-
Product Development	WR	NSWC CD : West Bethesda, MD	0.000	0.000		0.500	Feb 2020	0.000		-		0.000	0.000	0.500	-
Product Development	WR	PSNS : Bremerton, WA	0.000	0.000		0.450	Feb 2020	0.000		-		0.000	0.000	0.450	-
Product Development	WR	PNSY : Portsmouth, NH	0.000	0.000		0.550	Feb 2020	0.000		-		0.000	0.000	0.550	-
Product Development	FFRDC	ARL/UT : Austin, TX	0.000	0.000		3.950	Feb 2020	0.000		-		0.000	0.000	3.950	-
Product Development	C/CPAF	Leidos : Lynnwood, WA	0.000	0.000		3.415	Feb 2020	0.000		-		0.000	0.000	3.415	-
Product Development	C/CPAF	L3 : New River, MA	0.000	0.000		4.119	Feb 2020	0.000		-		0.000	0.000	4.119	-
		Subtotal	0.000	0.000		14.734		0.000		-		0.000	0.000	14.734	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		14.734		0.000		-		0.000	0.000	14.734	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604028N / *Small/Medium Unmanned Undersea Vehicles*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Procure Small UUVs: Procure Small UUVs	3	2020	3	2020
Small UUV Acceptance Testing: Small UUV Acceptance Testing	4	2020	2	2021
Torpedo Tube Launch and Recovery (TTLR) Design/Integration Updates: Torpedo Tube Launch and Recovery (TTLR) Design/Integration Updates	2	2020	3	2020
TTLR RF TEMPALT Development: TTLR RF TEMPALT Development	2	2020	4	2020
TTLR Demonstration: TTLR Demonstration	4	2020	4	2020
Preliminary Mission Package Design/Integration: Preliminary Mission Package Design/ Integration	4	2020	2	2021
Upgrade Self-Protection Autonomy Suite: Upgrade Self-Protection Autonomy Suite	4	2020	3	2021
Final Mission Package Design/Integration: Final Mission Package Design/Integration	3	2021	4	2021
TTLR Demonstration w/Mission Package: TTLR Demonstration w/Mission Package	4	2021	4	2021
Mission RF TEMPALT Development: Mission RF TEMPALT Development	3	2021	4	2021
Mission Workup and Training: Mission Workup and Training	3	2021	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	26.406	41.910	40.060	-	40.060	40.735	48.280	40.196	40.441	Continuing	Continuing
3393: *UxS Autonomy, C2*	0.000	11.869	8.563	4.898	-	4.898	4.058	5.662	5.767	5.880	Continuing	Continuing
3395: *UxS Payloads*	0.000	7.763	16.565	5.911	-	5.911	7.264	11.355	11.582	9.336	Continuing	Continuing
3396: *UxS Endurance*	0.000	6.774	16.782	20.906	-	20.906	19.526	19.590	15.685	19.682	Continuing	Continuing
4053: *UxS Platform*	0.000	0.000	0.000	8.345	-	8.345	9.887	11.673	7.162	5.543	Continuing	Continuing

Note

FY 2018 and prior funding in Program Element (PE) 0604536N. Projects moved from PE 0604536N starting in FY 2019. FY 2020 establishes new project descriptions that focus on the key enabling technology areas in support of the entire Family of UUVs.

A. Mission Description and Budget Item Justification

In order to accelerate future capabilities and support steady growth of the Navy's Family of Unmanned Undersea Vehicle (UUVs), UUV Core Technologies will: Drive standardization across the Family of UUVs; Enable Fleet learning and experimentation via Industry involvement and capability demonstrations; Transition mature technologies from the Science and Technology communities and Industry that are aligned to Fleet priorities. This Program Element leverages Office of Naval Research (ONR), Defense Advanced Research Projects Agency (DARPA), and Industry technology development efforts in the key areas of autonomy, communications, command and control (C2), precision navigation endurance and energy, sensors & payloads, payload integration, and host ship/submarine integration and launch and recovery.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	27.483	54.376	52.704	-	52.704
Current President's Budget	26.406	41.910	40.060	-	40.060
Total Adjustments	-1.077	-12.466	-12.644	-	-12.644
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-12.466			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.077	0.000			
• Program Adjustments	0.000	0.000	-12.625	-	-12.625
• Rate/Misc Adjustments	0.000	0.000	-0.019	-	-0.019

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*

Change Summary Explanation

Program Changes:
FY19- -$1,077K Small Business Innovation Research (SBIR)
FY20 - -$12,466K Project 4053 duplicative effort
FY21 - -$12,625K realignment for core technologies wholeness, -$19K miscellaneous rate adjustments
Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604029N / *UUV Core Technologies*	Project (Number/Name) 3393 / *UxS Autonomy, C2*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3393: *UxS Autonomy, C2*	0.000	11.869	8.563	4.898	-	4.898	4.058	5.662	5.767	5.880	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2018 and prior funding in Program Element (PE) 0604536N. Project moved from PE 0604536N starting in FY 2019. Project renamed UxS Autonomy, C2 and precision navigation starting in FY20 (previously titled Adv Undersea Prototyping-Remote Command & Control in FY19 and prior years).

A. Mission Description and Budget Item Justification

The Autonomy and Command and Control (C2) portion of this project funds efforts to develop common standards, interfaces, and systems to support cross-domain (Surface and Sub-Surface, Aviation and Ground) applications. These efforts include advanced development, prototyping and demonstrations to accelerate the design and development of system commonality and interoperability for the cross-domain requirements of the Navy. Autonomy development efforts will demonstrate scalable, adaptable and interoperable warfighting capabilities across various unmanned systems. The advanced development emphasis will encourage innovation and enable rapid integration of UxS capabilities across domains while common standards, interfaces, and systems development occurs in parallel. Autonomy and C2 architectures and interface definitions will be incorporated into near-term and future UUV requests for proposals (RFP) to drive contractor development efforts. The Precision Navigation portion of this project seeks to study and develop innovative undersea navigation capabilities for UUVs. In summary, coordinated autonomy and C2 efforts, coupled with precision navigation solutions, will define, develop and demonstrate capability that advances new technology, and the hardware and software of control systems that will be used to operate multiple and dissimilar Naval UxSs.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	9.639	7.067	4.318	0.000	4.318
Articles:	-	-	-	-	-

FY 2020 Plans:
Autonomy: Update standards and Interface Control Documents as needed, and continue Cyber/Safety/ Standards development. Investigate autonomy metrics and tech insertion process. Demonstrate autonomy software integration with a UUV using simulation and in-water test. Continue support of autonomy lab standup.
C2: Update models for Common Control System (CCS) software extensions and begin detailed design of CCS implementation into first UUV program.
Precision Navigation: Initiate Precision Nav study to identify capability gaps and assess mature technology solutions.

FY 2021 Base Plans:
Autonomy: Continue working with industry to develop the Unmanned Maritime Autonomy Architecture (UMAA) interfaces. The UMAA team will shift into demonstration interfaces on both UUV and USV reference

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3393 / *UxS Autonomy, C2*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
implementations. Autonomy development will begin and be demonstrated on the reference implementations. This development will be applicable across both UUVs and USVs. Automated Target Recognition (ATR) Warfighting Lab: Provide specific ATR advancements starting with the development of complex modeling and simulation of representative ocean environments to produce synthetic data that can augment actual data. Future years will focus on training of ATR algorithms and in-water demonstration on UUVs. COMMS SME: Commence utilization of navy Subject Matter Expert (SME) support to track S&T communications investments across the Navy as well as manage the standup of the UUV operations center (UOC). Common Control System (CCS): Demonstrate CCS software performing mission planning in both a UUV and USV demonstration. The demonstration will provide risk reduction for the software as it is implemented and delivered on various UxV program contracts. These demonstrations will include extending the software baseline to include vehicle specific functionality. Individual baselines for CCS software will transition to sustainment as they are delivered to the Navy. Precision Nav: Provide support to track and manage Navigation efforts identified in previous studies. The study will lead to additional research investment focused areas for future navigation efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease attributed to conclusion of studies and transition of ICDs into RFPs and vehicle programs.					
Title: Support	1.780	1.194	0.100	0.000	0.100
Articles:	-	-	-	-	-
FY 2020 Plans: Autonomy: Update documentation and continue work to integrate common autonomy standards, interfaces, and systems; support modeling/simulation efforts and test bed development. C2: Update CCS documentation and continue to support development and implementation efforts. Precision Nav: Support study documentation. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3393 / *UxS Autonomy, C2*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Funding provides dedicated engineering support to manage Autonomy, C2 and Precision Navigation. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease attributed to conclusion of studies and required support.					
Title: Management Services	0.450	0.302	0.480	0.000	0.480
Articles:	-	-	-	-	-
FY 2020 Plans: Autonomy: Continue guidance, project planning, financial and contracting support, and coordination of common autonomy standards, interfaces, and systems. C2: Continue guidance, project planning, financial and contracting support, and coordination of Common Control System (CCS) analysis and implementation. Precision Nav: Guidance, project planning, financial and contracting support, and coordination of Precision Nav effort. ***FY 2021 Base Plans:*** Provides support for project planning, financial and engineering support in the areas of autonomy, C2 and Precision Navigation. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight increase in required management services for program office support.					
Accomplishments/Planned Programs Subtotals	11.869	8.563	4.898	0.000	4.898

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

UUV Core Technology efforts will accelerate future capabilities and support steady growth of the Navy's Family of Unmanned Undersea Vehicles (UUVs). UUV Core Technologies will: drive standardization across the Family of UUVs; enable Fleet learning and experimentation via industry involvement and capability demonstrations;

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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and transition mature technologies from the Science and Technology communities and Industry which are aligned to Fleet priorities. The program will leverage existing efforts from the Naval Research and Development Enterprise and will utilize rapid contracting approaches such as the Naval Undersea Warfare Center (NUWC) Newport UUV Family of Systems multi-award Indefinite Delivery Indefinite Quantity contract to facilitate Industry involvement. Coordination with UxS platforms will eliminate redundant efforts, encourage innovation, and improve coordination of unmanned systems across multiple domains. The objective of this project (UxS Autonomy, C2) is to develop requirements and standards, define key interfaces, develop innovative navigation solutions, and mandate compliance to common architecture for Autonomy and Common Control System (CCS) to improve unmanned system capability, reliability and affordability through enabling system modularity, permitting standardized test and evaluation, and enabling cross-platform communication and collaborative mission engagement.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3393 / *UxS Autonomy, C2*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UUV Operation Center	WR	NUWC KPT : Keyport, WA	0.000	2.000	Dec 2018	2.000	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Future Capability Studies	WR	Various : Various	0.000	1.635	Dec 2018	0.000		0.000		-		0.000	0.000	1.635	-
Common Control System (CCS) Cross-Domain Architecture Development	Various	Various : Various	0.000	2.653	Dec 2018	1.225	Jan 2020	0.750	Jan 2021	-		0.750	Continuing	Continuing	Continuing
Autonomy Archituture UMAA	Various	Various : Various	0.000	3.351	Dec 2018	3.342	Dec 2019	1.480	Dec 2020	-		1.480	Continuing	Continuing	Continuing
Precision Navigation	Various	Various : Various	0.000	0.000		0.500	Dec 2019	0.000	Dec 2020	-		0.000	Continuing	Continuing	Continuing
UUV COMMS SME	Various	Various : Various	0.000	0.000		0.000		0.500	Dec 2020	-		0.500	0.000	0.500	-
ATR Warfighting Lab	Various	Various : Various	0.000	0.000		0.000		1.588	Dec 2020	-		1.588	0.000	1.588	-
		Subtotal	0.000	9.639		7.067		4.318		-		4.318	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0604536N.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomy, C2 and Nav Eng Support	Various	Various : Various	0.000	0.794	Dec 2018	0.000		0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
Autonomy Support	Various	NAVSEA Activities : Washington, DC	0.000	0.506	Dec 2018	0.280	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Common Control System (CCS) Engineering Support	Various	Various : Various	0.000	0.480	Dec 2018	0.250	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Precision Navigation	Various	Various : Various	0.000	0.000		0.664	Jan 2020	0.000		-		0.000	0.000	0.664	-
		Subtotal	0.000	1.780		1.194		0.100		-		0.100	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0604536N.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Energy Prototype	Various	Various : Various	0.000	0.150	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Autonomy	Various	NAVSEA Activities : Washington, DC	0.000	0.150	Jan 2019	0.115	Dec 2019	0.175	Dec 2020	-		0.175	Continuing	Continuing	Continuing
Common Control System (CCS)	Various	Various : Various	0.000	0.150	Jan 2019	0.115	Feb 2020	0.175	Jan 2021	-		0.175	Continuing	Continuing	Continuing
Precision Navigation	Various	Various : Various	0.000	0.000		0.072	Feb 2020	0.130	Jan 2021	-		0.130	0.000	0.202	-
		Subtotal	0.000	0.450		0.302		0.480		-		0.480	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding in Program Element (PE) 0604536N.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	11.869		8.563		4.898		-		4.898	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3393 / *UxS Autonomy, C2*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UxS Autonomy, C2,				
Project Unit Moved from Program Element 0604536N: New PE	1	2019	1	2019
Autonomy Development: UMAA ICD Development: ICD Development	2	2019	2	2021
Autonomy Development: UMAA ICD Spiral Dev & Reference Implementations:	3	2021	4	2025
Autonomy Development: ATR Warfighting Lab (Autonomy) Lab Stand Up:	1	2021	4	2025
Common Control System Development: Arch Design Description (ADD) Delivery:	3	2019	3	2019
Common Control System Development: UUV DEMO: UUV DEMO	3	2020	4	2021
Common Control System Development: USV DEMO: USV DEMO	2	2020	4	2021
Common Control System Development: ICD Development and Delivery:	1	2020	4	2020
Common Control System Development: Capability Improvements:	1	2021	4	2025
Common Control System Development: CCS Transition:	1	2022	4	2025
Common Control System Development: UOC Integration & Capability Improvements:	1	2019	3	2020
Common Control System Development: Communications Tech Development:	1	2022	4	2025
Precision Navigation: Precision Navigation Assessment: Study	2	2020	4	2020
Precision Navigation: Precision Navigation Assessment: S&T Management	1	2021	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3395 / *UxS Payloads*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3395: *UxS Payloads*	0.000	7.763	16.565	5.911	-	5.911	7.264	11.355	11.582	9.336	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2018 and prior funding in Program Element (PE) 0604536N. Projects moved from PE 0604536N starting in FY 2019. Project renamed UxS Payloads starting in FY20 (previously titled Adv Undersea Prototyping-Explosive Payloads in FY19 and prior years).

A. Mission Description and Budget Item Justification

Funding supports advanced prototyping, integration, and demonstration of undersea payloads initially with Extra Large Unmanned Undersea Vehicles (XLUUV) class vehicles, and then eventually with Large, Medium, and Small UUVs in the Family of UUVs. These efforts leverage developments at the Office of Naval Research (ONR), Defense Advanced Research Project Agency (DARPA), Industry, and other activities for UUV payloads, and work to complete analysis of feasibility, policy, lethality and performance of integrating undersea sensor and weapons systems. The program will design new hardware, investigate and develop new interfaces/systems to increase lethality in both undersea and surface targets and investigate the possibilities of employing non-lethal payloads and other sensor systems across the Family of UUVs, as applicable.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	6.472	13.749	5.121	0.000	5.121
Articles:	-	-	-	-	-
FY 2020 Plans: Hold Technical Reviews for XLUUV advanced payload. Procure materials and fabricate prototypes. Refine Concepts of Operations (CONOPS) for demonstrations, finalize Interface Control Documents (ICDs) and continue ICD delivery, and continue payload autonomy software development. Initiate Automated Target Recognition (ATR) maturation efforts. Begin transition of energy and communications payload from ONR. Perform payload interface development of classified payloads for Medium UUVs.					
FY 2021 Base Plans: Support Payload Integration Group (PIG) - subject matter experts chartered with management of payload interfaces and supporting various payload developers. This work includes development of processes for approval of payloads on-board vehicles. Continue transition of Office of Naval Research (ONR) Future Naval Capability (FNC) effort.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3395 / *UxS Payloads*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue payload efforts for Medium UUVs, including miniaturization of advanced payloads. Continue interface development and integration of prototypes for classified payloads for Medium UUVs, including miniaturization of advanced sensing and communications payloads. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease attributed to ramp down and conclusion of XLUUV payload assessments.					
Title: Support	0.991	2.153	0.200	0.000	0.200
Articles:	-	-	-	-	-
FY 2020 Plans: Support XLUUV and medium UUV payload efforts. Payload Integration Group continues to guide and support standard interface development and assists in technology integration. Provide technical support for ATR development. ***FY 2021 Base Plans:*** Support Medium UUV and remaining XLUUV payload efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease attributed to ramp down of XLUUV efforts.					
Title: Management Services	0.300	0.663	0.590	0.000	0.590
Articles:	-	-	-	-	-
FY 2020 Plans: Continue guidance, project planning, financial and contracting support, and coordination for evaluation and integration of payloads. ***FY 2021 Base Plans:*** Continue guidance, project planning, financial and contracting support, and coordination for evaluation and integration of payloads. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease attributed to ramp down of XLUUV efforts.					
Accomplishments/Planned Programs Subtotals	7.763	16.565	5.911	0.000	5.911

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

UUV Core Technology efforts will accelerate future capabilities and support steady growth of the Navy's Family of Unmanned Undersea Vehicles (UUVs). UUV Core Technologies will: drive standardization across the Family of UUVs; enable Fleet learning and experimentation via Industry involvement and capability demonstrations; and transition mature technologies from the Science and Technology communities and Industry which are aligned to Fleet priorities. The program will leverage existing efforts from the Naval Research and Development Enterprise and will utilize rapid contracting approaches such as the Naval Undersea Warfare Center (NUWC) Newport UUV Family of Systems multi-award Indefinite Delivery Indefinite Quantity contract to facilitate Industry involvement. Coordination with UxS platforms will eliminate redundant efforts, encourage innovation, and improve coordination of unmanned systems across multiple domains. The objective of this project (UxS Payloads) is to evaluate, mature, and integrate advanced, innovative payloads onto UUVs to improve warfighting capabilities. Payloads are defined by Navy Fleet capability needs and are developed by leveraging modular designs through collaborative efforts with Industry, ONR, DARPA, and the entire Naval Research and Development Enterprise. A Payload Integration Group (PIG) will define Government-owned interfaces to ensure efficient and affordable payload integration across the Family of UUVs to support interoperable, innovative solutions. Initial payloads will be integrated and demonstrated on the Extra Large Unmanned Undersea Vehicle (XLUUV) and then be developed for integration into other applicable Family of UUVs after they are demonstrated successfully.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Payload Interface Design	C/CPIF	Various : Various	0.000	4.083	Jan 2019	4.100	Dec 2019	1.121	Dec 2020	-		1.121	0.000	9.304	-
Command and Control	WR	Various : Various	0.000	1.609	Dec 2018	0.000		0.000		-		0.000	0.000	1.609	-
Safety	WR	Various : Various	0.000	0.780	Jan 2019	0.624	Jan 2020	0.000		-		0.000	0.000	1.404	-
Automatic Target Recognition	WR	Various : Various	0.000	0.000		3.000	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Medium Vehicle Payload Development	WR	Various : Various	0.000	0.000		3.025	Dec 2019	1.000	Dec 2020	-		1.000	Continuing	Continuing	Continuing
ONR FNC Project	WR	Various : Various	0.000	0.000		3.000	Dec 2019	3.000	Dec 2020	-		3.000	Continuing	Continuing	Continuing
Payload B	WR	PSUARL : PSUARL	0.000	0.000		0.000		0.000	Dec 2020	-		0.000	0.000	0.000	-
		Subtotal	0.000	6.472		13.749		5.121		-		5.121	Continuing	Continuing	N/A

Remarks

Project renamed UxS Payloads starting in FY20 (previously titled Adv Undersea Prototyping-Explosive Payloads in FY19 and prior years).

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technical Support	WR	Various : Various	0.000	0.991	Dec 2019	0.200	Feb 2020	0.200	Dec 2020	-		0.200	Continuing	Continuing	Continuing
Payload Integration Group	Various	Various : Various	0.000	0.000		1.000	Dec 2019	0.000	Dec 2020	-		0.000	Continuing	Continuing	Continuing
Engineering Support	Various	Various : Various	0.000	0.000		0.600	Nov 2019	0.000	Nov 2020	-		0.000	Continuing	Continuing	Continuing
Integrated Logistic Support	Various	Various : Various	0.000	0.000		0.353	Nov 2019	0.000	Nov 2020	-		0.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.991		2.153		0.200		-		0.200	Continuing	Continuing	N/A

Remarks

Project renamed UxS Payloads starting in FY20 (previously titled Adv Undersea Prototyping-Explosive Payloads in FY19 and prior years).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management & Management Support	WR	Various : Various	0.000	0.300	Nov 2018	0.663	Dec 2019	0.590	Dec 2020	-		0.590	Continuing	Continuing	Continuing
		Subtotal	0.000	0.300		0.663		0.590		-		0.590	Continuing	Continuing	N/A

Remarks

Project renamed UxS Payloads starting in FY20 (previously titled Adv Undersea Prototyping-Explosive Payloads in FY19 and prior years).

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	7.763		16.565		5.911		-		5.911	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UxS Payloads				
Project Unit Moved from Program Element 0604536N: New PE	1	2019	1	2019
XLUUV Payload B: CONOPs and Requirements Development: CONOPs and Requirements	1	2019	2	2019
XLUUV Payload B: XLUUV Interface Development: Schedule Detail	1	2019	2	2020
XLUUV Payload B: Payload Design and Undersea Weapon Development: Phase A concept design- XL UUV Interface development	2	2019	4	2020
Payload Integration Group (PIG): Payload Developer Support: Payload Developer Support	1	2020	4	2025
Payload Integration Group (PIG): Interface and Payload Process Developement: Interface and Payload Process Developement	1	2020	4	2025
Automated Target Recognition (ATR) FNC: ATR Development	1	2020	4	2020
ONR FNC Project: ONR FNC Project	1	2020	4	2022
Medium UUV Payload: Interface Development: ICDs	2	2020	4	2020
Medium UUV Payload: Miniaturization: Development	1	2021	2	2022
Medium UUV Payload: System Testing: Testing	1	2022	1	2024
Medium UUV Payload: Integration: Integration	3	2023	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3396: *UxS Endurance*	0.000	6.774	16.782	20.906	-	20.906	19.526	19.590	15.685	19.682	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY 2018 and prior funding in Program Element (PE) 0604536N. Project moved from PE 0604536N starting in FY 2019. Project 3396 renamed UxS Endurance starting in FY 2020 (previously titled Adv Undersea Prototyping-Non-Lethal Payloads in FY 2019 and prior years).

A. Mission Description and Budget Item Justification

Advanced undersea energy efforts leverage existing independent research and development of energy-dense systems to meet future power requirements for Family of Unmanned Undersea Vehicle (UUV) missions, which are limited by both constraints imposed by the operational environment and the amount of power that can be carried. Efforts under this project include research, development, test, and evaluation of advanced energy solutions. Energy development and transition efforts are applicable to all classes of UUVs for increased endurance and efficiency to extend the reach of unmanned undersea systems. Parallel efforts include development and certification of safe, reliable, high energy density Lithium Ion (Li-Ion) batteries to enable both safe operation and UUV integration onboard host ships and submarines.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	6.699	13.929	18.530	0.000	18.530
Articles:	-	-	-	-	-

FY 2020 Plans:
Execute submarine integration for Li-Ion batteries, including full certification and testing. Commence modeling and simulation and testing of Li-Ion battery and battery management systems to evaluate performance and system safety. Begin cell selection and screening to include requirements/ICD development and quality assurance processes. Release Request for Information (RFI) to identify facilities that could safely screen and/or secure large quantities of lithium ion cells. Certify and integrate a propagation resistant Li-Ion battery system for use on submarine deployed Large Displacement Unmanned Undersea Vehicle (LDUUV).

FY 2021 Base Plans:
Continue transition efforts as a high-density, by-class UUV energy solution, including vehicle integration development
efforts and initial testing. Continue advanced aluminum technology development and integration efforts for XLUUV
systems. Continue modeling and simulation of advanced energy technologies for XLUUV. Continuation of propagation

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
resistant Li-Ion cells effort (i.e., battery architecture, Battery Management System (BMS) design, testing, fabrication. Release Request for Proposal (RFP) for potential Quality Assurance/Quality Control (QA/QC) facilities (government and industry) based off Request for Information (RFI) feedback and down select eligible candidates. Continue cell selection and evaluation to include requirements/ICD development and quality assurance processes. The UUV Operations Center (UOC) provides planning, operational over-watch, reach-back, and command and control capabilities for the family of UUVs and serves as a test-bed environment for continuous experimentation, integration, verification, and training for the S&T and operational communities. Initial planning and standup of the UOC was previously performed in PU 3393. Starting in FY21, this activity will be budgeted for in this project. Complete multiple cyber accreditation packages under Risk Management Framework (RMF) to achieve multiple Authority to Operate (ATO) approvals across different security enclaves (Unclassified and Top Secret Networks) for both operational and test bed environments. Maintain existing computing environment and RMF cyber security accreditations (Secret Network). Integrate fleet identified high-priority data feeds from external systems and data producers into the UOC for use in mission planning and execution. Complete initial demonstration of UUV common command and control system prototype. Complete initial platform integration testing with Orca and Snakehead systems. Support missions opportunities as required for Unmanned Undersea Vehicle Squadron ONE (UUVRON-1) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase attributed to the design and development of propagation resistant Li-Ion batteries and supporting infrastructure as well as the shift of the UUV Operation Center standup and integration activities into this project (previously PU 3393).					
Title: Support	0.075	2.182	1.386	0.000	1.386
Articles:	-	-	-	-	-
FY 2020 Plans: Continue integration and related certification efforts of Li-Ion battery assets. Continue fuel cell effort support. ***FY 2021 Base Plans:***					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue integration and related certification efforts of Li-Ion battery assets. Continue UUV Operation Center Management. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decreased due to reducing Advanced Energy Support (Aluminum Water) activities in FY21.					
Title: Management Services	0.000	0.671	0.990	0.000	0.990
Articles:	-	-	-	-	-
FY 2020 Plans: Provide guidance, project planning, financial and contracting support, and coordination for energy system evaluation and integration. ***FY 2021 Base Plans:*** Provide guidance, project planning, financial and contracting support, and coordination for Li Ion and UUV Operation Center Activities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight increase due to additional financial and planning management services for new Li Ion efforts.					
Accomplishments/Planned Programs Subtotals	6.774	16.782	20.906	0.000	20.906

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

UUV Core Technology efforts will accelerate future capabilities and support steady growth of the Navy's Family of Unmanned Undersea Vehicles (UUVs). UUV Core Technologies will: drive standardization across the Family of UUVs; enable Fleet learning and experimentation via industry involvement and capability demonstrations; and transition mature technologies from the Science and Technology communities and Industry which are aligned to Fleet priorities. The program will leverage existing efforts from the Naval Research and Development Enterprise and will utilize rapid contracting approaches such as the Naval Undersea Warfare Center (NUWC) Newport UUV Family of Systems multi-award Indefinite Delivery Indefinite Quantity contract to facilitate Industry involvement. Coordination with UxS platforms will

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
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eliminate redundant efforts, encourage innovation, and improve coordination of unmanned systems across multiple domains. The objective of this project (UxS Endurance) is to mature advanced energy systems developed by Industry, National Aeronautics and Space Administration (NASA), ONR, DARPA, and the Naval Research and Development Enterprise, and integrate into UUVs for increased endurance, power, and reach; and develop safe, reliable battery solutions, including Li-Ion technologies, on UUVs for integration onto host surface ships and submarines.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Li-Ion Battery Certification	WR	NUWC : Newport, RI	0.000	6.699	Nov 2018	0.000	Dec 2019	0.000	Dec 2020	-		0.000	Continuing	Continuing	Continuing
XL Advanced Energy	TBD	Various : Various	0.000	0.000		5.000	Dec 2019	1.100	Dec 2020	-		1.100	0.000	6.100	-
Propagation Resistant Li-Ion Battery	TBD	Various : Various	0.000	0.000		3.034	Dec 2019	8.330	Dec 2020	-		8.330	0.000	11.364	-
UUV Operations Center (UOC)	TBD	Various : Various	0.000	0.000		5.895	Dec 2019	2.500	Dec 2020	-		2.500	0.000	8.395	-
Li-Ion Battery Screening/ Warehousing	WR	NSWC Crane : Crane, Indiana	0.000	0.000		0.000		6.600	Dec 2020	-		6.600	0.000	6.600	-
		Subtotal	0.000	6.699		13.929		18.530		-		18.530	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding under PE 0604536N. Project 3396 renamed UxS Endurance starting in FY 2020 (previously titled Adv Undersea Prototyping-Non-Lethal Payloads in FY19 and prior years).

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Support	C/FFP	various : Arlington, VA	0.000	0.075	Nov 2018	1.082	Jan 2020	1.386	Dec 2020	-		1.386	Continuing	Continuing	Continuing
Design Analysis	WR	NRL : Washington, DC	0.000	0.000		1.100	Dec 2020	0.000		-		0.000	0.000	1.100	-
		Subtotal	0.000	0.075		2.182		1.386		-		1.386	Continuing	Continuing	N/A

Remarks

FY 2018 and prior funding under PE 0604536N. Project 3396 renamed UxS Endurance starting in FY 2020 (previously titled Adv Undersea Prototyping-Non-Lethal Payloads in FY19 and prior years).

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Task	Various	Various : Various	0.000	0.000		0.671	Dec 2019	0.990	Dec 2020	-		0.990	0.000	1.661	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	0.000		0.671		0.990		-		0.990	0.000	1.661	N/A

Remarks

FY 2018 and prior funding under PE 0604536N.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	6.774		16.782		20.906		-		20.906	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*

2021PB - 0604029N - 3396

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UxS Endurance				
Project Moved from Program Element 0604536N:	1	2019	1	2019
Li-Ion Battery Ship/Sub Certification Effort: Propogation Resistant Architecture Design: Preliminary Design Review	4	2020	4	2020
Li-Ion Battery Ship/Sub Certification Effort: Propogation Resistant Architecture Design: Critical Design Review	4	2021	4	2021
Li-Ion Battery Ship/Sub Certification Effort: Propogation Resistant Architecture Design: Final Certification	4	2022	4	2022
Li-Ion Battery Ship/Sub Certification Effort: Propogation Resistant Architecture Design:	1	2019	2	2024
Li-Ion Battery Ship/Sub Certification Effort: Li-Ion Battery Screening and Warehousing: Request for Information (RFI)	4	2019	4	2019
Li-Ion Battery Ship/Sub Certification Effort: Li-Ion Battery Screening and Warehousing: Statement of Work (SOW)	1	2020	1	2020
Li-Ion Battery Ship/Sub Certification Effort: Li-Ion Battery Screening and Warehousing: Preliminary Design Review	1	2020	1	2020
Li-Ion Battery Ship/Sub Certification Effort: Li-Ion Battery Screening and Warehousing: Critical Design Review	4	2021	4	2021
UUV Operation Center: UUV Integration Activities: UOC Planning	1	2020	1	2021
UUV Operation Center: UUV Integration Activities: UOC UUV Operations	1	2021	2	2024
UUV Operation Center: UUV Integration Activities: Initial ORCA ATO	1	2021	1	2021
UUV Operation Center: UUV Integration Activities: Initial Snakehead ATO	4	2021	4	2021
UUV Operation Center: UUV Integration Activities: Initial RAZORBACK TTL&R ATO	2	2024	2	2024
UUV Operation Center: UUV Integration Activities: High Pri Data Feed Integration	2	2021	2	2021
UUV Operation Center: UUV Integration Activities: Initial Common Control Integration	2	2021	2	2021
Advanced Energy: Extra Large UUV (XLUUV)/ Adv. Energy Development:	1	2020	4	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 3396 / *UxS Endurance*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Advanced Energy: Modeling and Simulation & Experimentation:	2	2019	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604029N / *UUV Core Technologies*	Project (Number/Name) 4053 / *UxS Platform*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4053: *UxS Platform*	0.000	0.000	0.000	8.345	-	8.345	9.887	11.673	7.162	5.543	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

UxS Platform is a continuation of two FY19 UUV Core Technologies efforts from PE 0604029N and was planned to transition to PU 4053 beginning in FY20, however it received a Congressional mark of $12.466M resulting in no funding in FY20

A. Mission Description and Budget Item Justification

This is the sole project unit that enables deployment of operationally relevant Unmanned Undersea Vehicles (UUVs) from submarines.

UxS (Unmanned Systems) Platform is a submarine integration program that delivers rapid innovative research and development prototype efforts for deployable and/or retrievable undersea vehicles from submarines. This includes Subsea & Seabed Warfare (SSW) concepts, offboard systems, and Rapid Fielding Temporary Alterations (RF TEMPALT) for submarines & other platforms. In addition to research and development, the program will support engineering and integration of new and mature technologies to enable rapid prototyping and fielding of capabilities. This will lower the cost risks of incorporating new technologies prior to acquisition and provide rapid solutions to urgent war-fighter needs. Experimentations will be conducted with the Fleet (i.e., Commander, Naval Submarine Forces (COMSUBFOR), Unmanned Undersea Vehicle Squadron One (UUVRON ONE), etc.), enabling an agile environment through at-sea demonstrations, which will provide Fleet and acquisition stakeholders with relevant payload and vehicle employment data to inform Concepts of Operations (CONOPs)and fielding decisions using platforms of opportunity. The program will support transition of high-interest SSW systems from research and development to Programs of Record (PoRs), as appropriate. UxS Platform is comprised of Rapid Innovative R&D Prototype Initiatives, RF TEMPALTs and host platform integration.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	0.000	7.966	0.000	7.966
Articles:	-	-	-	-	-
Description: Rapid Innovative R&D Prototype Initiatives is the development and/or prototyping of rapid technologies efforts that can be incorporated quickly into submarines/vehicles to enhance Fleet capability and operational relevance of UUVs. Initiatives will be determined by senior Navy leadership. All initiatives will be demonstrated to provide proof of concept before transitioning to a Program of Record (POR). Rapid Fielding Temporary Alterations (RF TEMPALTs) is the accelerated technical approval process that will support undersea rapid capability demonstrations (non-tactical) and tactical deployment of unmanned systems from host submarine platforms.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
SSW mission packages will develop vehicle interface standards to include potential hardware for all known UUVs/Remotely Operated Vehicles (ROV)s to enable streamlined development, training and vehicle reconfiguration. This includes development and implementation plans to test, analyze and integrate required SSW mission package(s) for relevant submarine operations to inform future certification into vehicle PoRs ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** Initiate preliminary study to certify the use of NASA 18650 Li-Ion batteries on board a host platform. The program will also include the initiation of submarine (SSN) launch and recovery efforts for small and medium UUVs. Establish TEMPALT Coordination Activity (TCA) and databases for the Rapid Fielding TEMPALT process. Initiate submarine data exfiltration from UUVs development effort. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A					
Title: Management Services	0.000	0.000	0.379	0.000	0.379
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** - Provide guidance, project planning, financial and contracting support, and coordination for development of prototype efforts for deployable and retrievable UUVs and payload concepts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** N/A					
Accomplishments/Planned Programs Subtotals	0.000	0.000	8.345	0.000	8.345

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

UxS Platform is a program that leverages government laboratories, field activities, and industry to enable research and development efforts in support of technology and system development, manufacture, testing, and fielding on submarine host platforms. Engagement with industry will support development of R&D products for enhanced submarine capability via competitively awarded contracts and sole source Concept Formulation (CONFORM) contracts. These contracting vehicles will facilitate requirements development, prototype development, and prototype production support to allow rapid integration of UUVs into submarines. Projects and technology capability solutions will transition for inclusion into
existing ship baselines or initiation as new POR capabilities.

UxS Platform will coordinate with other UUV Core Technology project units to ensure all efforts are accelerating future capabilities, supporting steady growth of the Navy's Family of UUVs, ensuring efforts are not duplicative, encouraging innovation, and improving coordination of unmanned systems across multiple domains.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	WR	NUWC NPT : Newport, RI	0.000	0.000		0.000		1.100	Oct 2020	-		1.100	Continuing	Continuing	Continuing
Product Development	WR	NUWC KPT : Keyport, WA	0.000	0.000		0.000		1.584	Oct 2020	-		1.584	Continuing	Continuing	Continuing
Product Development	WR	NSWC CD : West Bethesda, MD	0.000	0.000		0.000		0.467	Nov 2020	-		0.467	Continuing	Continuing	Continuing
Product Development	FFRDC	ARL/UT : Austin, TX	0.000	0.000		0.000		1.500	Nov 2020	-		1.500	Continuing	Continuing	Continuing
Product Development	WR	PSNS : Bremerton, WA	0.000	0.000		0.000		0.200	Nov 2020	-		0.200	Continuing	Continuing	Continuing
Product Development	WR	PNSY : Portsmouth NH	0.000	0.000		0.000		0.820	Nov 2020	-		0.820	Continuing	Continuing	Continuing
Product Development	C/CPAF	Leidos : Reston, VA	0.000	0.000		0.000		1.383	Nov 2020	-		1.383	Continuing	Continuing	Continuing
Product Development	C/CPAF	L3 : New River, MA	0.000	0.000		0.000		0.912	Nov 2020	-		0.912	0.000	0.912	-
		Subtotal	0.000	0.000		0.000		7.966		-		7.966	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services	WR	Various : Various	0.000	0.000		0.000		0.379	Dec 2020	-		0.379	0.000	0.379	-
		Subtotal	0.000	0.000		0.000		0.379		-		0.379	0.000	0.379	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		8.345		-		8.345	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

2021PB - 0604029N - 4053

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

2021PB - 0604029N - 4053

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
UxS Platform				
Torpedo Tube Launch & Recovery (TT L&R): MouseTrap	1	2021	4	2021
Torpedo Tube Launch & Recovery (TT L&R): RatTrap	4	2021	4	2021
Torpedo Tube Launch & Recovery (TT L&R): SMALL UUV: Dockside Demo	1	2021	1	2021
Torpedo Tube Launch & Recovery (TT L&R): SMALL UUV: CSP Phase III	1	2021	1	2021
Torpedo Tube Launch & Recovery (TT L&R): SMALL UUV: Mission Package (MP) Demonstration	4	2022	4	2022
Torpedo Tube Launch & Recovery (TT L&R): SMALL UUV: At Sea Demo	3	2021	3	2021
Torpedo Tube Launch & Recovery (TT L&R): Medium UUV: Hydro Study & Testing	1	2021	4	2021
Torpedo Tube Launch & Recovery (TT L&R): Medium UUV: Pending Medium L&R Effort Based off FY19 Results	2	2022	3	2025
Torpedo Tube Launch & Recovery (TT L&R): Medium UUV: Initial System Design	4	2021	1	2022
Torpedo Tube Launch & Recovery (TT L&R): UUVRON Demonstrations: Industry Challenge Work up	1	2021	4	2021
Torpedo Tube Launch & Recovery (TT L&R): UUVRON Demonstrations: Industry Challenge #1	3	2022	3	2022
Torpedo Tube Launch & Recovery (TT L&R): UUVRON Demonstrations: Industry Challenge #2	3	2023	3	2023
Torpedo Tube Launch & Recovery (TT L&R): UUVRON Demonstrations: Industry Challenge #3	3	2024	3	2024
Torpedo Tube Launch & Recovery (TT L&R): UUVRON Demonstrations: Industry Challenge #4	3	2025	3	2025
Rapid Fielding (RF) TEMPALTS: Awaiting Additional USD-TAB URCI Approved Projects	1	2021	4	2025
Rapid Fielding (RF) TEMPALTS: Development #1	1	2021	3	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Rapid Fielding (RF) TEMPALTS: RF Approval #1	3	2021	3	2021
Rapid Fielding (RF) TEMPALTS: Development #2	1	2022	3	2022
Rapid Fielding (RF) TEMPALTS: RF Approval #2	3	2022	3	2022
Rapid Fielding (RF) TEMPALTS: Development #3	1	2023	3	2023
Rapid Fielding (RF) TEMPALTS: RF Approval #3	3	2023	3	2023
Rapid Fielding (RF) TEMPALTS: Development #4	1	2024	3	2024
Rapid Fielding (RF) TEMPALTS: RF Approval #4	3	2024	3	2024
Rapid Fielding (RF) TEMPALTS: Development #5	1	2025	3	2025
Rapid Fielding (RF) TEMPALTS: RF Approval #5	3	2025	3	2025
Rapid Fielding (RF) TEMPALTS (continued)				
Undersea Domain-Transition Advisory Board (USD-TAB) RF TEMPALTS: FY21 Mission Installations (2)	4	2021	4	2021
Undersea Domain-Transition Advisory Board (USD-TAB) RF TEMPALTS: FY22 Mission Installations (2)	4	2022	4	2022
Undersea Domain-Transition Advisory Board (USD-TAB) RF TEMPALTS: FY23 Mission Installations (2)	4	2023	4	2023
Undersea Domain-Transition Advisory Board (USD-TAB) RF TEMPALTS: FY24 Mission Installations (2)	4	2024	4	2024
Undersea Domain-Transition Advisory Board (USD-TAB) RF TEMPALTS: FY25 Mission Installations (2)	4	2025	4	2025
TEMPALT Coordination Activity (TCA): NAVSEA Designated RF TEMPALT TCA w/ limited technical authority	1	2021	4	2025
TEMPALT Coordination Activity (TCA): Select and maintain new CM tool	1	2021	4	2025
TEMPALT Coordination Activity (TCA): Finalize and institute local TCA processes and procedures	1	2021	3	2021
Mission Packages: Design Study	1	2021	4	2021
Mission Packages: Contract work ups	1	2022	4	2022
Mission Packages: Issue RFI	1	2022	1	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604029N / *UUV Core Technologies*	**Project (Number/Name)** 4053 / *UxS Platform*

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Mission Packages: Issue RFP	3	2022	3	2022
Mission Packages: RFI Evaluation	2	2022	4	2022
Mission Packages: Contract Award	1	2023	1	2023
Mission Packages: Mission Package Development	1	2023	1	2024
Mission Packages: Payload Integration Group (PIG) Mission Package Integration Testing	1	2024	4	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	21.314	27.495	31.000	12.100	-	12.100	0.000	0.000	0.000	0.000	0.000	91.909
0385: *Rapid Prototype Development*	21.314	23.600	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.914
1036: *TETRA*	0.000	2.095	9.900	2.500	-	2.500	0.000	0.000	0.000	0.000	0.000	14.495
1037: *MK 38 MOD 4*	0.000	1.800	21.100	9.600	-	9.600	0.000	0.000	0.000	0.000	0.000	32.500

A. Mission Description and Budget Item Justification

The Rapid Prototyping, Experimentation, and Demonstration (RPED) Program accelerates and increases our Naval technology advantage. It's aligned to capability gaps and naval warfighting priorities. RPED leverages resources to provide rapid development of technologies into products that deliver urgently needed capability solutions. The FY2021 budget request reflects reduction as the DON pursues alternative funding strategies to support rapid development efforts. In accordance with the 2018 National Defense Strategy (NDS) and leveraging National Defense Authorization Act authorities for Middle Tier Acquisition and Acquisition Agility to support a more agile, lethal, and resilient force by rapidly developing and fielding needed warfighting capabilities. Projects funded in this program are aligned with the tenants of the Chief of Naval Operations Design for Maritime Superiority Version 2.0 to rapidly acquire key platforms and payloads to achieve high velocity outcomes. Concepts and enabling technologies include; directed energy weapons, hypersonics, autonomous and unmanned systems, artificial intelligence, machine learning, and multi-domain operations.

TETRA is a remotely operated vehicle (ROV) with the capacity for multiple mission payloads as key enabler to Subsea and Seabed Warfare (SSW) as identified in the SSW Initial Capabilities Document (ICD) signed March 2019.

The MK 38 MOD 4 30mm gun weapon system (GWS) will provide surface ship defense capability addressing unmanned aerial systems (UAS) and high speed maneuverable unmanned surface vehicle (USV) threats. This is a Maritime Accelerated Acquisition (MAA) starting in FY19 and will field an Initial Capability (IC) in FY22 on DDG-51 ship class with AEGIS Baseline 9 combat system.

Oversight and accountability of projects funded by this program is provided by the DON Accelerated Acquisition Board of Directors (AABoD). Specific projects under this program will be selected and executed in accordance with the DON Accelerated Acquisition Process as described in SECNAVINST 5000.42.

Advanced Component Development and Prototypes (ACD&P) efforts necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment are funded in this PE. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 6 (system/subsystem model or prototype demonstration in a relevant environment) and TRL 7 (system prototype demonstration in an operational environment).

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	28.596	36.197	41.977	-	41.977
Current President's Budget	27.495	31.000	12.100	-	12.100
Total Adjustments	-1.101	-5.197	-29.877	-	-29.877
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-5.197			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.101	0.000			
• Program Adjustments	0.000	0.000	-29.897	-	-29.897
• Rate/Misc Adjustments	0.000	0.000	0.020	-	0.020

Change Summary Explanation

Funding: The funding decrease in FY 2021 for Project 0385 (Rapid Prototype Development) is due to realignment of funding for Project 1036 - TETRA and Project 1037 - MK38 Mod 4 30MM Gun Weapon System. Both projects were designated as Maritime Accelerated Acquisition (MAA) Rapid Prototyping programs in FY 2019. FY 2021 funding decrease is due to ramping down of development efforts for PRJ 1036 and PRJ 1037.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0385: *Rapid Prototype Development*	21.314	23.600	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.914
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Rapid Prototyping, Experimentation, and Demonstration (RPED) Program accelerates and increases our naval technology advantage. It's aligned to capability gaps and naval warfighting priorities. RPED leverages resources to provide rapid development of technologies into products that deliver urgently needed capability solutions. RPED gives Department of the Navy (DON) leadership the ability to respond to urgent and emergent operational needs that require immediate actions to mitigate current threats, offset future threats, and leverage advances in technology that will enable Naval forces to maintain their operational and technological superiority over potential adversaries. In accordance with the 2018 National Defense Strategy (NDS) this program enables a more agile, lethal, and resilient force by rapidly developing and fielding needed warfighting capabilities. Projects funded in this program are aligned with the tenants of the Chief of Naval Operations Design for Maritime Superiority Version 2.0 to rapidly acquire key platforms and payloads to achieve high velocity outcomes. Concepts and enabling technologies include; directed energy weapons, hypersonics, autonomous and unmanned systems, artificial intelligence, machine learning, and multi-domain operations.

Oversight and accountability of projects funded by this program is provided by the DON Accelerated Acquisition Board of Directors (AABoD). Specific projects under this program will be selected and executed in accordance with the DON Accelerated Acquisition Process as described in SECNAVINST 5000.42.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Rapid Prototype Development, Experimentation and Demonstration	23.600	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: The funding decrease from FY 2020 to FY 2021 for Project 0385 (Rapid Prototype Development) reflects the establishment of Project 1036 - TETRA and Project 1037 - MK38 Mod 4 30MM Gun Weapon System and the					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
associated transfer of funds from Project 0385 required to support these projects in FY 2021. Both projects were designated as Maritime Accelerated Acquisition (MAA) Rapid Prototyping programs in FY 2019.					
Accomplishments/Planned Programs Subtotals	23.600	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Projects identified for execution under this project number are non-acquisition programs. Each project will develop a project plan to support project execution. Project plans will include a project schedule and technical requirements and objectives to measure project performance. The selected technical solutions will be demonstrated in operationally relevant environments to assess their ability to meet warfighter requirements. Project deliverables include actual integrated hardware/software prototype systems, CONOPS, requirements, test reports, technical data, and associated doctrine, organization, training, leadership and education, and personnel aspects necessary to support decision making. These deliverables will be used to support project disposition decisions to include transition of technologies to acquisition, further refinement of the technology, or termination and reinvestment of remaining funds to other technologies that add military value.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SURTASS-E Mission System HW/SW Engineering	C/CPFF	Adaptive Methods : Centreville, VA	0.522	0.000		0.000		0.000		-		0.000	0.000	0.522	-
SURTASS-E Mission System HW/SW Integration	SS/CPFF	Johns Hopkins APL : Laurel, MD	4.848	0.000		0.000		0.000		-		0.000	0.000	4.848	-
SURTASS-E Mission System HW/SW Engineering	C/CPFF	L3/CSC : Millersville, MD	0.628	0.000		0.000		0.000		-		0.000	0.000	0.628	-
SURTASS-E Vessel of Opportunity (VOO) Evaluation and Leasing	WR	Military Sealift Command : Norfolk, VA	2.933	0.000		0.000		0.000		-		0.000	0.000	2.933	-
SURTASS-E Common Support Modules Dev Integration	MIPR	PMS 420 : Washington, DC	2.651	0.900	Dec 2018	0.000		0.000		-		0.000	0.000	3.551	-
SURTASS-E Winch Design and Procurement	WR	NAVFAC EXWC : Port Hueneme, CA	0.313	0.000		0.000		0.000		-		0.000	0.000	0.313	-
SURTASS-E Towed Array Test Equipment and VOO Assessment	WR	NSWC : Carderock: Carderock, MD	0.890	0.000		0.000		0.000		-		0.000	0.000	0.890	-
SURTASS-E Towed Array Towing	C/CPFF	Lockheed Martin : Manassas, Va	0.843	3.700	Dec 2018	0.000		0.000		-		0.000	0.000	4.543	-
SURTASS-E C4I Suite Development and Integration	WR	NSWC PCD : Panama City, FL	2.290	0.000		0.000		0.000		-		0.000	0.000	2.290	-
SURTASS-E Acoustic Processing support	WR	NUWC Keyport : Keyport, WA	0.218	0.000		0.000		0.000		-		0.000	0.000	0.218	-
SURTASS-E VOO Installation Hardware	C/CPFF	Oceaneering Intl : San Diego, CA	1.643	0.000		0.000		0.000		-		0.000	0.000	1.643	-
SURTASS-E Towed System Shore Support HW	WR	SSC LANT : Little Creek, VA	0.479	0.000		0.000		0.000		-		0.000	0.000	0.479	-
SURTASS-E Towed Array Towing HW	C/CPFF	Lockheed Martin : Manassas, VA	0.893	0.000		0.000		0.000		-		0.000	0.000	0.893	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SURTASS-E Program Management and Engineering Support	WR	Various : Various	0.163	0.000		0.000		0.000		-		0.000	0.000	0.163	-
SM6 Rocket Motor Design, Integration, and Test	WR	Naval Air Warefare Center, Weapons Division (NAWCW : China Lake, CA	2.000	17.000	Nov 2018	0.000		0.000		-		0.000	0.000	19.000	-
SM6 Engineering Support	WR	Naval Surface Warfare Center (NSWC), Indian Head : Indian Head, MD	0.000	1.000	Nov 2018	0.000		0.000		-		0.000	0.000	1.000	-
SM6 Systems Engineering Support	C/FFP	Johns Hopkins University Applied Physics Laborator : Laurel, MD	0.000	1.000	Dec 2018	0.000		0.000		-		0.000	0.000	1.000	-
AABoD Direct RPED Projects	Various	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	21.314	23.600		0.000		0.000		-		0.000	0.000	44.914	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	21.314	23.600		0.000		0.000		-		0.000	0.000	44.914	N/A

Remarks

Support and Test and Evaluation costs are directly associated with the delivery of the primary product and included in the product development cost category for rapid prototype development, experimentation and demonstration cost categories.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*

2021DON - 0604030N - 0385

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 0385 / *Rapid Prototype Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0385				
SURTASS-E: Concept of Employment (CONEMP) development: Concept of Employment (CONEMP) development	1	2019	3	2019
SURTASS-E: Vessel of Opportunity (VOO) Integration and At-sea Shakedown Testing: Vessel of Opportunity (VOO) Integration and At-sea Shakedown Testing	2	2019	3	2019
SURTASS-E: Operational Demonstration and System Evaluation: Operational Demonstration and System Evaluation	3	2019	4	2019
SURTASS-E: Quick Reaction Assessment: Quick Reaction Assessment	1	2020	1	2020
SURTASS-E: Fully Supported Capability: Fully Supported Capability	2	2020	2	2020
SM-6 Blk 1B Phase 1A: System Design, Integration and Test: System Design, Integration and Test	1	2019	2	2019
SM-6 Blk 1B Phase 1A: Static Firing Events: Static Firing Event 1	2	2019	2	2019
SM-6 Blk 1B Phase 1A: Static Firing Events: Static Firing Event 2	3	2019	3	2019

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1036 / *TETRA*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1036: *TETRA*	0.000	2.095	9.900	2.500	-	2.500	0.000	0.000	0.000	0.000	0.000	14.495
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Funds were transferred from the Rapid Prototype Development Project 0385 (PE0604030N) to this newly established TETRA Project 1036. TETRA was submitted to the Accelerated Acquisition Board of Directors (AABoD) and approved as a Maritime Accelerated Acquisition (MAA) program.

A. Mission Description and Budget Item Justification

TETRA is a remotely operated vehicle (ROV) with the capacity for multiple mission payloads as key enabler to Subsea and Seabed Warfare (SSW) as identified in the SSW Initial Capabilities Document (ICD) signed March 2019. TETRA is planned to be a future optional payload for SSNs and SSGNs by expanding current capabilities not offered by either submarines or unmanned undersea vehicles (UUV) through real time situational awareness and SSW effects. This is a Maritime Accelerated Acquisition (MAA) starting in FY19 and will field an Initial Capability (IC) in FY22.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: TETRA	2.095	9.900	2.500	0.000	2.500
Articles:	-	-	-	-	-
FY 2020 Plans: - Prototype demonstration - Continue Accelerated Acquisition Development - Continue overall vehicle endurance upgrade - Continue modular payload bay development - Begin semi-autonomous Launch & Recovery (L&R) - Conduct Payload Development Preliminary Design Review (PDR) - Conduct Payload Development Critical Design Review (CDR) - Complete fabrication of EDM unit - Procure payloads and begin integration & testing - Begin Cooperative development with IWS5 & PMS425 - Begin VIRIGNIA Class (VCS) Stowage Development - Begin VCS TEMPALT package					
FY 2021 Base Plans: - Continue overall vehicle endurance upgrade					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1036 / *TETRA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete thruster upgrade - Complete modular payload bay development - Complete Automous Recovery and Docking - Complete system certification testing of upgrades - Complete fabrication of initial unit - Procure payloads and begin integration & testing - Continue VCS TEMPALT package - Release Request for Proposal (RFP) to Industry - Begin Integration into Submarine Warfare Federated Tactical Systems (SWFTS) Payload Control System (PCS) ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2020 to FY 2021 decrease due to TETRA efforts ramping down in FY21					
Accomplishments/Planned Programs Subtotals	2.095	9.900	2.500	0.000	2.500

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 0603561N/2096: *Payload Delivery Development*	0.000	0.000	0.000	-	0.000	7.000	14.500	2.000	0.000	0.000	23.500

Remarks

D. Acquisition Strategy

Hardware and software development integration supporting product improvement addressing new mission area.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1036 / *TETRA*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	FFRDC	ARL/UT : Austin, TX	0.000	2.095	Sep 2019	8.730	Mar 2020	0.650	Nov 2020	-		0.650	0.000	11.475	-
Product Development	WR	NUWC NPT : Newport, RI	0.000	0.000		0.440	Feb 2020	0.220	Oct 2020	-		0.220	0.000	0.660	-
Product Development	WR	Portsmouth : Portsmouth, NH	0.000	0.000		0.330	Feb 2020	0.155	Oct 2020	-		0.155	0.000	0.485	-
Product Development	WR	NSWC CD : Carderock, MD	0.000	0.000		0.000		0.155	Oct 2020	-		0.155	0.000	0.155	-
Product Development	C/CPAF	HII : Newport News	0.000	0.000		0.000		1.320	Nov 2020	-		1.320	0.000	1.320	-
		Subtotal	0.000	2.095		9.500		2.500		-		2.500	0.000	14.095	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Testing	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.000		0.400	Feb 2020	0.000		-		0.000	0.000	0.400	-
		Subtotal	0.000	0.000		0.400		0.000		-		0.000	0.000	0.400	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	2.095		9.900		2.500		-		2.500	0.000	14.495	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1036 / *TETRA*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1036 / *TETRA*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 1036				
AA Major Milestones: AA Bod	4	2019	4	2019
AA Major Milestones: TETRA Kickoff	1	2020	1	2020
AA Major Milestones: Prototype Demo	4	2020	4	2020
AA Major Milestones: Payload RFP Issued	2	2021	2	2021
AA Development: Begin Proc/Limited Qualification Testing	4	2019	4	2021
Tetra System Mods: Thruster Upgrades	4	2019	1	2021
Tetra System Mods: Autonomous L&R	4	2019	2	2021
Tetra System Mods: Endurance Improvements	4	2019	2	2021
Payload Development: Modular Payload Bay Develoment	4	2019	3	2021
Payload Development: Updated Vehicle Interface Control Document	3	2021	3	2021
Payload Development: PDR	1	2020	1	2020
Payload Development: CDR	3	2020	3	2020
Payload Development: Procurement	4	2020	3	2021
Payload Development: Limited Integration Testing	3	2021	4	2021
Virginia CL (VCS) TEMPALT Development: New VCS Stowage Development	4	2019	1	2021
Virginia CL (VCS) TEMPALT Development: VCS TEMPALT Development	2	2020	4	2021
Search Integration Into Tech Baseline: Cooperative Development with IWS5 and PMS425	1	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1037 / *MK 38 MOD 4*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1037: *MK 38 MOD 4*	0.000	1.800	21.100	9.600	-	9.600	0.000	0.000	0.000	0.000	0.000	32.500
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

FY19, FY20, and FY21 funds were transferred from the Rapid Prototype Development Project 0385 (PE0604030N) to this newly established MK38 Mod 4 30MM GWS Project 1037 as a Maritime Accelerated Acquisition (MAA) program. MK38 Mod 4 was submitted to the Accelerated Acquisition Board of Directors and approved as a Maritime Accelerated Acquisition (MAA) program.

Project 1037 is the next version of the MK38 Gun Weapon System (GWS) that addresses increased threats in theatre. MK38 Mod 2 is currently in production under the WPN Gun Mount Mods BLI 4217; the MK38 Mod 3 upgrade is currently under development in PE0603795N Project 2038.

A. Mission Description and Budget Item Justification

The MK 38 MOD 4 30mm gun weapon system (GWS) will provide surface ship defense capability addressing unmanned aerial systems (UAS) and high speed maneuverable unmanned surface vehicle (USV) threats. This is a Maritime Accelerated Acquisition (MAA) starting in FY19 and will field an Initial Capability (IC) in FY22 on DDG-51 ship class with AEGIS Baseline 9 combat system.

Additional details can be provided at a higher classification

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: MK 38 MOD 4 30mm Gun Weapon System	1.800	21.100	9.600	0.000	9.600
Articles:	-	-	-	-	-
FY 2020 Plans: -Initiate fire control software development. -Initiate systems engineering and requirements analysis. -Initiate logistics development. -Initiate GWS development. -Initiate combat system integration.					
FY 2021 Base Plans: -Continue fire control software development. -Conduct various systems engineering reviews. -Continue logistics development.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1037 / *MK 38 MOD 4*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Continue GWS development. -Continue combat system integration. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY2020 to FY2021 decrease due to reduced amount of development work in FY2021. Most development & integration effort is focused in FY2020.					
Accomplishments/Planned Programs Subtotals	1.800	21.100	9.600	0.000	9.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Hardware and software development and integration supporting product improvement addressing new threats.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1037 / *MK 38 MOD 4*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MOD 4 GWS Development	WR	NSWC DD : Dahlgren, VA	0.000	0.000		5.000	Feb 2020	6.600	Nov 2020	-		6.600	0.000	11.600	-
Prototype Procurement	WR	NSWC CR : Crane, IN	0.000	0.000		4.700	May 2020	0.000		-		0.000	0.000	4.700	-
Logistics Development	WR	NSWC IHD Picatinny : Picatinny, NJ	0.000	0.000		0.250	Feb 2020	1.000	Nov 2020	-		1.000	0.000	1.250	-
Combat System Integration	WR	NSWC DD : Dahlgren, VA	0.000	0.000		2.200	Feb 2020	2.000	Nov 2020	-		2.000	0.000	4.200	-
Procurement of two (2) 30/40mm MK 44S cannons	WR	NSWC CR : Crane, IN	0.000	0.800	Aug 2019	0.000		0.000		-		0.000	0.000	0.800	-
Fire Control System and Gun Mount Systems Engineering	WR	NSWC DD : Dahlgren, VA	0.000	0.350	Nov 2019	4.300	Feb 2020	0.000		-		0.000	0.000	4.650	-
Operations Gun Mount Systems Engineering	WR	NSWC IHD Picatinny : Picatinny, NJ	0.000	0.350	Oct 2019	0.250	Feb 2020	0.000		-		0.000	0.000	0.600	-
Electro-optical Sensor Systems Engineering and Interface Design	WR	NSWC CR : Crane, IN	0.000	0.300	Nov 2019	1.400	Feb 2020	0.000		-		0.000	0.000	1.700	-
Combat System Interface Update	C/CPFF	TBD : TBD	0.000	0.000		3.000	May 2020	0.000		-		0.000	0.000	3.000	-
		Subtotal	0.000	1.800		21.100		9.600		-		9.600	0.000	32.500	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	1.800		21.100		9.600		-		9.600	0.000	32.500	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1037 / *MK 38 MOD 4*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 1037																												
MOD 4 Gun Weapon System Development																												
Fire Control System Software and Interface Development																												
Combat System Element Integration																												

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604030N / *Rapid Prototyping, Experimentation & Dem*	**Project (Number/Name)** 1037 / *MK 38 MOD 4*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 1037				
MOD 4 Gun Weapon System Development	1	2019	3	2021
Fire Control System Software and Interface Development	1	2020	1	2022
Combat System Element Integration	1	2020	4	2022

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	23.886	57.942	68.310	78.122	-	78.122	88.435	186.902	76.365	30.980	Continuing	Continuing
2094: *Unmanned Underwater Vehicle*	23.886	57.942	68.310	78.122	-	78.122	88.435	186.902	76.365	30.980	Continuing	Continuing

Note

The FY 2021 funding request was reduced by $3.973M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Snakehead Large Displacement Unmanned Undersea Vehicle (LDUUV) is the Navy's Large Displacement UUV effort as part of the Family of UUVs. It is the number one Submarine-launched UUV priority due to the additional endurance and the capability it will bring to the fleet in support of maintaining the Navy's undersea superiority. In order to accelerate and support steady growth of the fleet's family of UUVs, the Snakehead program will design and build a modular, reconfigurable Unmanned Undersea Vehicle (UUV) with Open Architecture (OA) software (SW) focused on introducing a new class (large displacement) of UUVs to the Navy to provide increased endurance, payload hosting, and delivery capability. The Snakehead LDUUV will be modular in design and include hotel functionality (guidance and control, navigation, autonomy, situational awareness, core communications, and power distribution), high energy capacity and power output, highly capable propulsion and maneuvering, and high accuracy mission sensors and communications links. It is intended that modules will have well defined interfaces for the purposes of implementing cost-effective upgrades in future increments to leverage advances in technology. The Snakehead program is a CNO/ASN(RDA) approved Accelerated Acquisition.

The Snakehead LDUUV program features a phased approach to grow capabilities at a manageable level of risk. Phase 1 is a Government developed prototype with significant Industry involvement to develop Techniques, Tactics, and Procedures (TTPs), Concepts of Operation (CONOPS), and risk reductions for submarine integration. One Phase 1 vehicle, with sufficient test spares, will be fabricated for integration onto Dry Deck Shelter (DDS) equipped submarines with testing commencing in FY21. The next phase will be a competitive award to Industry, with increased capabilities and integration onto Modernized DDS and Payload Handling System (PHS) equipped submarines, as well as potential integration onto surface ships. In order to support this accelerated transition to Industry, the required Technical Data Package and contracting documents will be compiled in FY19 and FY20, culminating with a competitive Request for Proposal (RFP) release in FY20. An award to industry will occur in FY21, five years earlier than originally planned, for a single vendor design with options to fabricate up to four vehicles starting in FY23, including opportunity to leverage Commercial Off-the-Shelf (COTS) vehicles for unique mission capabilities.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	60.304	68.310	81.637	-	81.637
Current President's Budget	57.942	68.310	78.122	-	78.122
Total Adjustments	-2.362	0.000	-3.515	-	-3.515
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.362	0.000			
• Program Adjustments	0.000	0.000	-3.973	-	-3.973
• Rate/Misc Adjustments	0.000	0.000	0.458	-	0.458

Change Summary Explanation

Program Changes:
FY19 - -$2,362K Small Business Innovative Research (SBIR)
FY20 - Not applicable.
FY21 - -$3,973 Underexecution adjustment; +$0.458k miscellaneous adjustments

Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2094: *Unmanned Underwater Vehicle*	23.886	57.942	68.310	78.122	-	78.122	88.435	186.902	76.365	30.980	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The FY 2021 funding request has been reduced by $3.973 million to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Snakehead Large Displacement Unmanned Undersea Vehicle (LDUUV) is the Navy's Large Displacement UUV effort as part of the Family of UUVs. It is the number one Submarine-launched UUV priority due to the additional endurance and the capability it will bring to the fleet in support of maintaining the Navy's undersea superiority. In order to accelerate and support steady growth of the fleet's family of UUVs, the Snakehead program will design and build a modular, reconfigurable Unmanned Undersea Vehicle (UUV) with Open Architecture (OA) software (SW) focused on introducing a new class (large displacement) of UUVs to the Navy to provide increased endurance, payload hosting, and delivery capability. The Snakehead LDUUV will be modular in design and include hotel functionality (guidance and control, navigation, autonomy, situational awareness, core communications, and power distribution), high energy capacity and power output, highly capable propulsion and maneuvering, and high accuracy mission sensors and communications links. It is intended that modules will have well defined interfaces for the purposes of implementing cost-effective upgrades in future increments to leverage advances in technology. The Snakehead program is a CNO/ASN(RDA) approved Accelerated Acquisition phased approach to build capabilities at a manageable level of risk in the Navy's class of Large Displacement Unmanned Undersea Vehicles.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: LDUUV Product Development	54.364	63.252	68.568	0.000	68.568
Articles:	-	-	-	-	-

FY 2020 Plans:
Continue fabrication of Phase 1 vehicle and development of data products and analyses. Perform vehicle integration of subsystems, including propulsion, sensors, payload, communications, and control systems. Perform design validation testing concurrent to fabrication. Incorporate lessons learned (submarine certification efforts, risk reduction and battery integration) from Phase 1 to prepare Technical Data Package (TDP) for release of RFP to industry in 4QFY20.

FY 2021 Base Plans:
Complete Phase 1 vehicle fabrication and commence system level testing to characterize and assess Phase 1 submarine certification, risk reduction and battery integration. Incorporate hardware and software engineering changes for Phase 1 vehicle during testing. Continue submarine integration certification, risk reduction and

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
battery integration efforts. Complete source selection process and award LDUUV industry vehicle design and vehicle fabrication contract(s). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase in cost as program transitions from development of Phase 1 vehicles to contract for industry vehicle.					
Title: LDUUV Support	1.731	2.644	2.804	0.000	2.804
Articles:	-	-	-	-	-
FY 2020 Plans: Continue support of fabrication and material efforts. Manage submarine and platform integration products. Continue Fleet demonstration exercises with demo vehicles. Prepare for system certification. Provide support of the completion of delta design efforts to prepare TDP for release of RFP. ***FY 2021 Base Plans:*** Support of Phase 1 test readiness planning. Continue support of fabrication and test efforts. Continue to manage submarine and platform integration products. Continue Fleet demonstration exercises with demo vehicles. Complete source selection and award contract for industry vehicle. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight increase for source selection and contract award support.					
Title: LDUUV Test and Evaluation	0.000	0.000	4.092	0.000	4.092
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** Prepare for test readiness review (TRR). Conduct preliminary workups, fleet demonstrations, and data analysis to support in-water vehicle Quick Response Assessment (QRA) test event. ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase supports Test Readiness Review and initial testing and demonstration of Phase I vehicle.					
Title: LDUUV Management Services	1.847	2.414	2.658	0.000	2.658
Articles:	-	-	-	-	-
FY 2020 Plans: Provide program management support and travel for the LDUUV program. Manage concurrent Phase 1 vehicle fabrication and industry RFP development. Program management plans include overall technical guidance and leadership of the program. Oversight of financial and logistics efforts and coordination with Navy and other DoD organizations and contractors as required to ensure successful execution of the program. ***FY 2021 Base Plans:*** Provide program management support and travel for the LDUUV program. Manage concurrent Phase 1 vehicle testing and industry contract award. Program management plans include overall technical guidance and leadership of the program. Oversight of financial and logistics efforts and coordination with Navy and other DoD organizations and contractors as required to ensure successful execution of the program. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight increase for management of industry contract and Phase 1 test efforts.					
Accomplishments/Planned Programs Subtotals	57.942	68.310	78.122	0.000	78.122

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Utilizing Navy requirements to insert incremental capability, the LDUUV program will design, build, and test a risk-reduction UUV followed by competitive award of design and fabrication contracts to Industry. Phase 1 is a Government developed prototype with significant Industry involvement to develop Techniques, Tactics, and Procedures (TTP) and Concepts of Operation (CONOPS) and reduce risk for submarine integration. Phase 1 will fabricate a single UUV with sufficient test spares to focus on submarine integration (potential ship integration is deferred to the Industry variant). The Navy will develop the required Technical Data Package to support a

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

competitive Request for Proposal (RFP) release in FY20. A contract award to industry will occur in FY21, five years earlier than originally planned, for a single vendor design with options to fabricate up to four vehicles starting in FY23. Opportunity to pursue Industry Commercial Off-the-Shelf (COTS) vehicles for unique mission capabilities will be included in the acquisition strategy.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604031N / *Large Unmanned Undersea Vehicles*	Project (Number/Name) 2094 / *Unmanned Underwater Vehicle*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LDUUV Industry Vehicle Design	C/CPIF	TBD : TBD	0.000	0.000		0.000		32.565	Nov 2020	-		32.565	0.000	32.565	-
LDUUV Vehicles, Hardware, & Design	WR	NUWC Newport : Newport, RI	9.157	16.073	Dec 2018	20.650	Dec 2019	12.500	Nov 2020	-		12.500	Continuing	Continuing	Continuing
LDUUV Vehicles, Hardware, & Design	C/CPFF	Various : Various	0.000	17.565	Dec 2018	18.589	Dec 2019	1.900	Oct 2020	-		1.900	Continuing	Continuing	Continuing
LDUUV Vehicles, Hardware, & Design	WR	NSWC Carderock : West Bethesda, MD	2.920	6.235	Dec 2018	6.535	Dec 2019	4.086	Nov 2020	-		4.086	Continuing	Continuing	Continuing
LDUUV Vehicles, Hardware,& Design	WR	NSWC Panama City : Panama City, FL	0.166	0.000		0.000		0.000		-		0.000	0.000	0.166	-
LDUUV Vehicles, Hardware, & Design	SS/CPFF	ARL PSU : State College, PA	3.410	8.565	Jan 2019	10.802	Jan 2020	4.913	Dec 2020	-		4.913	Continuing	Continuing	Continuing
LDUUV Vehicles, Hardware, & Design	WR	SSC Pacific : San Diego, CA	0.423	0.306	Dec 2018	0.306	Dec 2019	0.954	Oct 2020	-		0.954	Continuing	Continuing	Continuing
LDUUV Vehicles, Hardware, & Design	WR	NUWC Keyport : Keyport, WA	0.856	5.520	Dec 2018	6.270	Dec 2019	4.060	Nov 2020	-		4.060	Continuing	Continuing	Continuing
LDUUV Experimentation and Risk Reduction - Battery Certification	WR	NSWC Crane : Crane, IN	0.213	0.100	Dec 2018	0.100	Dec 2019	1.940	Nov 2020	-		1.940	Continuing	Continuing	Continuing
LDUUV Platform Integration	Various	Various : Various	0.865	0.000		0.000		5.650	Feb 2021	-		5.650	Continuing	Continuing	Continuing
LDUUV Risk Reduction Sonar	SS/CPFF	ARL UT : Austin, TX	0.551	0.000		0.000		0.000		-		0.000	0.000	0.551	-
		Subtotal	18.561	54.364		63.252		68.568		-		68.568	Continuing	Continuing	N/A

Remarks

Th FY2021 funding request has been reduced by $3.973 million to account for the availability of prior year funds.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LDUUV Engineering Support	WR	NUWC Newport : Newport, RI	1.693	0.198	Dec 2018	0.345	Dec 2019	0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
LDUUV Launch and Recovery Engineering Support	WR	NSWC Panama City : Panama City, FL	0.306	0.000		0.000		0.000		-		0.000	0.000	0.306	-
LDUUV Hydrodynamics and Propulsion Engineering Support	C/CPFF	Various : Various	0.450	0.132	Dec 2018	0.132	Dec 2019	0.132	Nov 2020	-		0.132	Continuing	Continuing	Continuing
LDUUV Hull and Propultion Engineering Support	WR	NSWC Carderock : West Bethsda, MD	0.286	0.892	Dec 2018	0.971	Dec 2019	0.972	Nov 2020	-		0.972	Continuing	Continuing	Continuing
LDUUV Command and Control Engineering Support	WR	SSC Pacific : San Diego, CA	0.208	0.361	Dec 2018	0.361	Dec 2019	0.450	Dec 2020	-		0.450	Continuing	Continuing	Continuing
LDUUV Engineering Support	SS/CPFF	APL/JHU : Laurel, MD	0.335	0.100	Jan 2019	0.600	Jan 2020	0.600	Jan 2021	-		0.600	Continuing	Continuing	Continuing
LDUUV ILS and Engineering Support	WR	NUWC Keyport : Keyport, WA	0.125	0.048	Dec 2018	0.235	Dec 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
LDUUV ILS and Engineering Support	SS/CPFF	Various : Various	0.250	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	3.653	1.731		2.644		2.804		-		2.804	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FLEET Experimentation	Various	Various : Various	0.000	0.000		0.000		4.092	Dec 2020	-		4.092	0.000	4.092	-
		Subtotal	0.000	0.000		0.000		4.092		-		4.092	0.000	4.092	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
LDUUV Program Management	WR	NUWC Newport : Newport, RI	0.380	0.247	Dec 2018	0.579	Dec 2019	0.610	Nov 2020	-		0.610	Continuing	Continuing	Continuing
LDUUV Program Management	Various	Various : Various	1.130	1.500	Dec 2018	1.720	Dec 2019	1.928	Dec 2020	-		1.928	Continuing	Continuing	Continuing
LDUUV Travel	Various	NAVSEA : Washington, DC	0.162	0.100	Dec 2018	0.115	Dec 2019	0.120	Dec 2020	-		0.120	Continuing	Continuing	Continuing
		Subtotal	1.672	1.847		2.414		2.658		-		2.658	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	23.886	57.942		68.310		78.122		-		78.122	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604031N / *Large Unmanned Undersea Vehicles*	**Project (Number/Name)** 2094 / *Unmanned Underwater Vehicle*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
LDUUV				
LDUUV Development: Experimentation Risk Reduction:	3	2019	4	2023
Design Reviews: Phase 1 CDR	3	2019	3	2019
Design Reviews: Phase 1 Test Readiness Review	3	2021	3	2021
Design Reviews: TDP Review	2	2020	2	2020
Design Reviews: Industry Design PDR	2	2022	2	2022
Design Reviews: Industry Design CDR	4	2022	4	2022
Phase 1: Long Lead Material & Fabrication:	3	2019	4	2021
Phase 1: Government Testing Quick Reaction Assessment (QRA) Testing:	4	2021	3	2022
Phase 1: Correction of Deficiencies (CoD) and Submarine Integration:	3	2022	1	2024
Industry Phase: Technical Data Package Development:	4	2019	2	2020
Industry Phase: RFP Development:	1	2020	4	2020
Industry Phase: RFP Release:	4	2020	4	2020
Industry Phase: Source Selection:	1	2021	2	2021
Industry Phase: Award Design Phase:	3	2021	3	2021
Industry Phase: Industry Design:	3	2021	4	2022
Industry Phase: Fabrication Award:	1	2023	1	2023
Industry Phase: Industry Fabrication:	1	2023	3	2024
Industry Phase: Testing:	3	2024	1	2025
Industry Phase: Correction of Deficiencies (CoD) and Submarine Integration:	1	2025	3	2025
Industry Phase: Certifications and Submarine Integration:	3	2025	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	308.708	81.021	105.756	107.895	-	107.895	98.817	39.537	43.135	24.410	Continuing	Continuing
2208: *CVN 21*	223.164	24.826	88.276	103.702	-	103.702	98.817	39.537	43.135	24.410	Continuing	Continuing
4004: *EMALS*	85.544	32.076	17.480	4.193	-	4.193	0.000	0.000	0.000	0.000	0.000	139.293
9999: *Congressional Adds*	0.000	24.119	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.119

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 223

A. Mission Description and Budget Item Justification

The FY 2021 funding request was reduced by $1.450M to account for the availability of prior year execution balances.

This Navy program addresses unique technologies on Ford Class carriers. The program includes:

- (2208) - Development of ship hull, mechanical, propulsion, electrical, aviation, and combat support systems, subsystems and components to significantly improve aircraft carrier affordability, manpower requirements, survivability, and operational capabilities, and to meet the requirements of existing and pending regulations and statutes critical to the operation of existing and future aircraft carriers.

- (4004) - Development of an advanced technology aircraft launch system in support of the CVN 78 Class design and construction schedule. The Electro Magnetic Aircraft Launch System (EMALS) will replace the current steam catapult on CVN 78 Class ships. EMALS provides better control of applied forces, both peak and transient dynamic, improved
reliability and maintainability, increased operational availability and reduced operator and maintainer workload.

This Program Element (PE) and associated projects represent a continuation of efforts previously funded under PE 0603512N projects 2208 and 4004 in FY 2014 and earlier.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	83.121	121.310	99.418	-	99.418
Current President's Budget	81.021	105.756	107.895	-	107.895
Total Adjustments	-2.100	-15.554	8.477	-	8.477
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-15.554			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.100	0.000			
• Program Adjustments	0.000	0.000	8.250	-	8.250
• Rate/Misc Adjustments	0.000	0.000	0.227	-	0.227

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *CVN 78 Full Ship Shock Trial*	24.119	0.000
Congressional Add Subtotals for Project: 9999	24.119	0.000
Congressional Add Totals for all Projects	24.119	0.000

Change Summary Explanation

FY21 - PROJ 2208 CVN 21: Addition of Full Ship Shock Trials (FSST) (+23.3M)
FY21 - PROJ 2208 CVN 21: Program Adjustments (-13.6M)
FY21 - PROJ 2208 CVN 21: Reduction to Account for the Availability of Prior Year Execution Balances (-1.45M)

Schedule:
4004 EMALS
-Added CVN 78 events
-Added CVN 79 Events and Production Milestones
- CVN EMALS Production Complete in 2Q FY 2021
- CVN 79 EMALS Deadload Events from 4Q FY 2020 through 1Q FY 2022
-CVN 79 Preliminary Acceptance in 3Q FY 2022
-Added Aircraft Launch bulletin in 1Q FY 2020
-Training Development end date moved from FY 2020 to 3Q FY 2021 with Ready for Training (RFT) in 3Q FY 2020

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*

-Depot Planning/Logistics Development end date moved from 4Q FY 2021 to 1Q FY 2022
- IT&E
-Correction of Deficiencies end date moved from 2Q FY 2019 to 2Q 2021
-Reliability Deadloads moved from 3Q FY 2018 - 2Q FY 2019 to 2Q FY 2019 - 2Q FY 2021
-Power Conditioning Sub-System (PCS)/ Launch Control Sub-System (LCS) Environmental Qualification Test (EQT) moved from 1Q FY 2018-4Q FY 2019 to 2Q FY2019 - 2Q FY 2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*				Project (Number/Name) 2208 / *CVN 21*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2208: *CVN 21*	223.164	24.826	88.276	103.702	-	103.702	98.817	39.537	43.135	24.410	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 223												

A. Mission Description and Budget Item Justification

This project provides for the development of aircraft carrier specific technologies, the infusion of the ship technology base into existing and future aircraft carriers, and the potential realization of subsystem design capabilities not currently feasible. This project transitions the most promising technologies from the Navy technology base, other government laboratories, and the private sector into specific advanced development efforts. All systems developed in this project have the potential to support emerging requirements and other promising systems technologies for insertion into new aircraft carrier designs. The emphasis is directed toward developing ship hull, mechanical, propulsion, electrical, aviation, warfare systems, and combat support systems, sub-systems and components to significantly improve aircraft carrier affordability, manpower requirements, survivability, and operational capabilities and to meet the requirements of existing and pending regulations and statutes critical to the operation of future aircraft carriers. This project also encompasses those tasks required to support CVN 78 procurement, including, but not limited to engineering support, programmatic and program support, logistics support, modeling and simulation, test and evaluation, manpower and program related studies, and design support systems, such as the Integrated Digital Environment (IDE).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: CVN 78 Class Advanced Technology Design & Development	11.394	14.767	1.425	0.000	1.425
Articles:	-	-	-	-	-
Description: CVN 78 Class Advanced Technology Design & Development - Continue development and transition of technologies to support CVN 78 Class Key Performance Parameters (KPPs): maintain sortie generation rate, reductions in manpower, and further recovery of weight and stability service life margins. Continue design activities to integrate the new technologies, such as the new propulsion plant and Electromagnetic Aircraft Launch System into the ship. Complete shock qualification for components of all CVN 78 systems.					
FY 2020 Plans: Cyber-security: Continue developing CVN 78 cyber-security processes, requirements and solutions. Continue development efforts necessary to implement the Defense in Depth Functional Implementation Architecture standard, increasing CVN 78's survivability in a cyber-contested environment. Develop and maintain certification and accreditation packages for system support.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Cyber-security: Continue the development and maintenance of certification and accreditation packages for system support. Continue to update and maintain the CVN 78 Network Topology. Continue planning for Operational Cybersecurity testing. Continue developing physical and logical disconnect procedures for Contractor Furnished Equipment (CFE) and Government Furnished Equipment (GFE) systems under various operating conditions. Begin planning the NAVSEA Red Team cyber survivability assessment of cybersecurity attributes against mission areas. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to reprioritization of funds by the Department; reductions were spread between Advanced Technology Design & Development and Test & Evaluation.					
Title: CVN 21 - Test & Evaluation (T&E)	13.432	16.009	7.377	0.000	7.377
Articles:	-	-	-	-	-
FY 2020 Plans: Continue Post-Delivery Test & Trials (PDT&T), Consolidated Test Working Group (CTWG) and Carrier Integrated Test Team (CITT) efforts in support of DT/IT-5 testing. The test events scheduled for Developmental Test (DT)/Integrated Test (IT)-5 in FY 20 include continuing Dual Band Radar (DBR) shipboard engineering and developmental testing; platform-level combat systems interoperability testing; platform-level C4I interoperability testing; Combat Systems Ship Qualification Trial (CSSQT); structural test firings of Evolved Sea Sparrow Missile and Rolling Airframe Missile; Radar Cross Section and infrared measurements; degaussing and de-perming; cyber-security inspection; platform-level Hull, Mechanical and Electrical interoperability testing; platform-level aviation systems interoperability testing; and aircraft compatibility testing. Continue planning of Operational Testing (OT), to include Operational Test Phase C1 (OT-C1) and OT-C2 test events. Continue to collect reliability data on new and legacy systems. Continue to monitor corrective actions and track installation and performance on ship. Conduct system cyber vulnerability analysis; develop mitigations and solutions to address discovered vulnerabilities and known cyber-security risks. Conduct development and planning to support cyber-survivability testing during Initial Operational Test & Evaluation. ***FY 2021 Base Plans:*** Continue PDT&T, CTWG, and CITT efforts in support of the completion of DT/IT-5 testing. FY 21 activities will include: execution of the Combat Systems Operational Rehearsal Event (CSORE) Phase I, planning of CSORE Phase II, updating the CVN 78 ship characteristics for use in the Probability of Rain Annihilation					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(PRA) testbed, collect data on torpedo evasion runs conducted during Acoustic Trials, and begin platform-level Electronic Warfare assessments. Continue planning of Operational Testing, to include Operational Test Phase C1 (OT-C1) and OT-C2 test events. Continue to collect reliability data on new and legacy systems. Continue to monitor corrective actions and track installation and performance on ship. Begin planning for the Joint Mission Interoperability Test (JMIT). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to reprioritization of funds by the Department; reductions were spread between Advanced Technology Design & Development and Test & Evaluation.					
Title: Integrated Digital Shipbuilding (iDS)	0.000	40.000	54.000	0.000	54.000
Articles:	-	-	-	-	-
Description: Transformation to Integrated Digital Shipbuilding (iDS). ***FY 2020 Plans:*** Integrated Digital Shipbuilding (iDS): Begin iDS transformation, which is a critical affordability initiative to upgrade the shipbuilder's Ford Class Digital Data Environment to include development of applicable interfaces, business processes, supporting systems, and tools to support the construction of FORD Class Aircraft Carriers in a digital environment. The new process for CVN 80 and follow-on ships is to use the Digital Data Environment to develop three-dimensional work instructions which export out of the digital environment to be given to the craftsmen to build the ship. This process would render the overwhelming majority of paper drawings to be obsolete, and result in recurring savings for future FORD Class Aircraft Carriers. ***FY 2021 Base Plans:*** Continue CVN 80/81 FY21 Integrated Digital Shipbuilding implementation plan and execute $54M of the total contract by the Navy. This effort will continue each year through FY 2027 to enable HII-NNS to achieve 2-ship-buy savings. These efforts are directly tied to the construction trade products needed to support the build sequence in the shops and on the waterfront. Failure to fully fund installment clause would result in a change to the contract as funding requirements would not be met. Continue to apply upgrades to the shipbuilders Product Lifecycle Management (PLM) methodology, Product Data Management (PDM), and Software toolsets to support developing interfaces, new business processes, shipyard systems, and overall shipbuilding efficiency increase. Continue to support engineering efforts to define and add product manufacturing information into					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
the Product Model to allow design disclosure to the Navy and digital disclosure of work instructions and related technical references on tablet computers for the mechanics to use in the construction of CVN 80/81. Continue planning efforts to develop visual work instructions for manufacturing and constructions Trades. Continue to develop visual build management plans and Critical Chain Project Plans (CCPP) that will enable development of efficiently sequenced build plans. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The increase is due to the continued ramp of iDS construction products (Visual Build Management (VBM) and Visual Work Instruction (VWI)) in support of the CVN 80 schedule.					
Title: CVN 78 Full Ship Shock Trial (FSST)	0.000	17.500	40.900	0.000	40.900
Articles:	-	-	-	-	-
FY 2020 Plans: Finalize environmental, explosive operations, instrumentation, electrical power monitoring, and logistics planning in support of Full Ship Shock Trial (FSST) execution. Finalize all planning documents (e.g., Shock Trial Plan, Shock Trial Procedure). Complete all technical and environmental risk mitigation activities. Secure all necessary support vessels (e.g., fleet assets, environmental monitoring and explosive operations). Complete all pre-trial activities including, but not limited to: explosive charge dry run, installing instrumentation cabling, removal and storage of non-shock qualified items, and conducting ship equipment baseline assessments. ***FY 2021 Base Plans:*** Execute the FSST. Begin data reduction, analysis and report. Begin needed repairs. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is to conduct CVN 78 FSST.					
Accomplishments/Planned Programs Subtotals	24.826	88.276	103.702	0.000	103.702

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN / 0604567N: *Project Units 3108, 3179, 4007*	48.812	42.559	42.029	-	42.029	45.076	45.936	46.850	36.220	Continuing	Continuing
• SCN / 2001: *Carrier Replacement Program*	930.181	1,062.000	1,068.544	-	1,068.544	1,088.130	1,166.136	1,047.876	2,300.621	0.000	36,949.482
• OMN / 1B2B: *CVN 78 Ford Class Training and Sustainment (12BJ0)*	8.880	7.109	5.141	-	5.141	5.732	5.862	5.989	6.108	Continuing	Continuing
• OPN / 5664: *Surface Training Equipment*	7.942	1.412	4.457	-	4.457	2.532	2.418	2.428	2.511	Continuing	Continuing
• SCN / 5300: *Completion of PY Shipbldg Progr*	0.000	0.000	71.000	-	71.000	74.000	0.000	0.000	0.000	0.000	145.000
• SCN / 2004: *CVN 81*	643.000	1,214.500	1,645.606	-	1,645.606	1,306.988	759.980	666.968	590.969	5,622.684	12,450.695

Remarks

D. Acquisition Strategy

The CVN 78 is the first ship of the CVN 78 Class of aircraft carriers designed to replace USS ENTERPRISE and the ships of the NIMITZ Class. The CVN 78 will feature a new nuclear propulsion and electrical generation/distribution system, EMALS, advanced arresting gear (AAG) system, all electric auxiliaries, warfare system improvements, survivability
enhancements, improved weapons handling, and improved aircraft servicing. These design features will result in lower manpower and total ownership costs as compared to the NIMITZ Class. Additionally, the following war fighting benefits will be realized: increased sortie generation rate, improved ship self-defense capability, increased launch and recovery
capability/flexibility, increased operational availability, and increased flexibility to support future upgrades.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	Project (Number/Name) 2208 / *CVN 21*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced Design & Development	C/CPAF	HII : VA	30.347	0.000		1.919	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NSWC CARDEROCK : MD	4.451	0.500	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NAWC PATUXENT RIVER : MD	5.675	0.250	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NSWC DAHLGREN : VA	7.281	0.500	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	C/CPAF	RAYTHEON : VA	12.769	9.276	Oct 2018	7.064	Oct 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	C/CPFF	NAVSEA SEAPORT : VARIOUS	23.949	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	Various	MISCELLANEOUS : VARIOUS	2.627	0.250	Nov 2018	0.740	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NSWC PHILADELPHIA : PA	16.060	0.618	Oct 2018	5.044	Oct 2019	1.012	Nov 2020	-		1.012	Continuing	Continuing	Continuing
Advanced Design & Development	WR	SPAWAR : VARIOUS	6.640	0.000		0.000		0.413	Nov 2020	-		0.413	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NSWC CORONA : CA	1.602	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Advanced Design & Development	WR	NAWC LAKEHURST : NJ	1.338	0.000		0.000		0.000		-		0.000	0.000	1.338	-
Advanced Design & Development	WR	NSWC PORT HUENEME : CA	0.855	0.000		0.000		0.000		-		0.000	0.000	0.855	-
Advanced Design & Development	C/CPFF	BECHTEL : PA	6.400	0.000		0.000		0.000		-		0.000	0.000	6.400	-
Advanced Design & Development	C/CPFF	GRYPHON (SEI&T) : IN	0.352	0.000		0.000		0.000		-		0.000	0.000	0.352	-
Integrated Digital Shipbuilding	C/CPAF	HII : VA	6.965	0.000		40.000	Oct 2019	54.000	Nov 2020	-		54.000	0.000	100.965	-
		Subtotal	127.311	11.394		54.767		55.425		-		55.425	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract

Remarks

The increase to Integrated Digital Shipbuilding is due to the continued ramp of iDS construction products (Visual Build Management (VBM) and Visual Work Instruction (VWI)) in support of the CVN 80 schedule.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	C/CPAF	HII : VA	10.267	0.165	Nov 2018	0.625	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NAWC PATUXENT RIVER : MD	3.096	0.403	Nov 2018	0.633	Oct 2019	0.021	Nov 2020	-		0.021	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NSWC DAHLGREN : VA	10.254	1.648	Nov 2018	2.222	Oct 2019	0.943	Nov 2020	-		0.943	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NSWC CARDEROCK : MD	0.574	0.533	Nov 2018	0.969	Oct 2019	0.472	Nov 2020	-		0.472	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	SPAWAR : VARIOUS	8.381	0.040	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Development Test & Evaluation	C/CPAF	RAYTHEON : VARIOUS	5.643	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Development Test & Evaluation	Various	MISCELLANEOUS : VARIOUS	1.140	1.366	Oct 2018	3.004	Oct 2019	0.838	Nov 2020	-		0.838	Continuing	Continuing	Continuing
Development Test & Evaluation	C/CPFF	NAVSEA SEAPORT : VARIOUS	1.746	1.469	Nov 2018	0.851	Nov 2019	0.793	Nov 2020	-		0.793	Continuing	Continuing	Continuing
Development Test & Evaluation	C/BA	NSWC PORT HUENEME : CA	0.086	0.799	Oct 2018	1.773	Oct 2019	0.427	Nov 2020	-		0.427	Continuing	Continuing	Continuing
Development Test & Evaluation	C/BA	NSWC CORONA : CA	0.263	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	NAWC LAKEHURST : NJ	10.681	0.200	Nov 2018	0.922	Nov 2019	0.555	Nov 2020	-		0.555	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	NSWC PHILADELPHIA : PA	1.670	3.124	Nov 2018	2.753	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	COMOPTEVFOR : VA	8.371	2.904	Nov 2018	2.257	Nov 2019	3.328	Nov 2020	-		3.328	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	NAWC PATUXENT RIVER : MD	0.063	0.150	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Development Test & Evaluation	C/CPFF	GRYPHON (SEI&T) : IN	0.533	0.631	Dec 2018	0.000		0.000		-		0.000	0.000	1.164	-
Development Test & Evaluation	C/CPFF	GENERAL ATOMICS : CA	11.708	0.000		0.000		0.000		-		0.000	0.000	11.708	-
Full Ship Shock Trial	C/CPFF	BECHTEL : PA	6.500	0.000		1.132	Oct 2019	3.100	Nov 2020	-		3.100	0.000	10.732	-
Full Ship Shock Trial	WR	NAWC PATUXENT RIVER : MD	0.635	0.000		1.445	Oct 2019	2.300	Nov 2020	-		2.300	0.000	4.380	-
Full Ship Shock Trial	WR	NSWC DAHLGREN : VA	0.451	0.000		0.887	Oct 2019	2.780	Nov 2020	-		2.780	0.000	4.118	-
Full Ship Shock Trial	WR	NSWC CARDEROCK : MD	11.692	0.000		9.534	Oct 2019	15.700	Nov 2020	-		15.700	0.000	36.926	-
Full Ship Shock Trial	WR	NSWC PHILADELPHIA : PA	1.259	0.000		4.502	Oct 2019	5.000	Nov 2020	-		5.000	0.000	10.761	-
Full Ship Shock Trial	C/CPAF	HII : VA	0.600	0.000		0.000		12.020	Nov 2020	-		12.020	0.000	12.620	-
Full Ship Shock Trial	WR	SPAWAR : VARIOUS	0.240	0.000		0.000		0.000		-		0.000	0.000	0.240	-
		Subtotal	95.853	13.432		33.509		48.277		-		48.277	Continuing	Continuing	N/A

Remarks

Funding increased in FY21 to conduct FSST.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	223.164	24.826		88.276		103.702		-		103.702	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

Gerald R. Ford Class Carriers

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 2208 / *CVN 21*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2208				
CVN 21	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
4004: *EMALS*	85.544	32.076	17.480	4.193	-	4.193	0.000	0.000	0.000	0.000	0.000	139.293
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 223

A. Mission Description and Budget Item Justification

This project provides for the development of an advanced technology aircraft launch system in support of the CVN 78 design and construction schedule, as well as Engineering and Life Cycle System (E&LCS) design. The Electromagnetic Aircraft Launch System (EMALS) will be the aircraft catapult for CVN 78 Class ships. EMALS provides better control of applied forces, both peak and transient dynamic, improved reliability and maintainability, increased operational availability, and reduced operator and maintainer workload.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: EMALS	32.076	17.480	4.193	0.000	4.193
Articles:	-	-	-	-	-

Description: EMALS

FY 2020 Plans:
Continue EMALS Integrated Test & Evaluation (IT&E) land-based testing using deadloads for the correction of deficiencies. Provide interim training for crews until formal schoolhouse training is established. Continue development of the required processes and procedures to plan for Depot Level activities. Continue the planning and analysis necessary to standup EMALS Depot Level maintenance, overhaul and repair facility/facilities for EMALS components.

FY 2021 Base Plans:
Continue EMALS Integrated Test & Evaluation (IT&E) land-based testing using deadloads for the correction of deficiencies. Stand up training facility and achieve Ready For Training. Continue development of the required processes and procedures to plan for Depot Level activities. Continue the planning and analysis necessary to standup EMALS Depot Level maintenance, overhaul and repair facility/facilities for EMALS components.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
The decrease from FY 2020 to FY 2021 is due to the completion of the EMALS depot planning/logistics development.					
Accomplishments/Planned Programs Subtotals	32.076	17.480	4.193	0.000	4.193

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN / 0604567N: *Project Units 3108, 3179, 4007*	48.812	42.559	42.029	-	42.029	45.076	45.936	46.850	36.220	Continuing	Continuing
• SCN / 2001: *Carrier Replacement Program*	930.181	1,062.000	1,068.544	-	1,068.544	1,088.130	1,166.136	1,047.876	2,300.621	0.000	36,949.482
• OMN / 1B2B: *CVN 78 Ford Class Training and Sustainment (12BJ0)*	8.880	7.109	5.141	-	5.141	5.732	5.862	5.989	6.108	Continuing	Continuing
• OPN / 5664: *Surface Training Equipment*	7.942	1.412	4.457	-	4.457	2.532	2.418	2.428	2.511	Continuing	Continuing
• OPN / 4213: *Aircraft Support Equipment*	105.693	187.926	187.758	60.217	247.975	214.070	334.429	184.828	145.928	Continuing	Continuing
• SCN / 2004: *CVN 81*	643.000	1,214.500	1,645.606	-	1,645.606	1,306.988	759.980	666.968	590.969	5,622.684	12,450.695
• SCN: *Completion of PY Shipbldg Progr*	0.000	0.000	71.000	-	71.000	74.000	0.000	0.000	0.000	0.000	145.000

Remarks

OPN 4213 includes a portion of line item funding for EMALS.

D. Acquisition Strategy

The CVN 78 is the first ship of the CVN 78 Class of aircraft carriers designed to replace the ships of the NIMITZ Class. The CVN 78 will feature a new nuclear propulsion and electrical generation/distribution system, new electromagnetic aircraft launching system (EMALS), advanced arresting gear (AAG) system, all electric auxiliaries, warfare system improvements, survivability enhancements, improved weapons handling, and improved aircraft servicing. These design features will result in lower manpower and total ownership costs as compared to the NIMITZ Class. Additionally, the following war fighting benefits will be realized: increased sortie generation rate, improved ship self-defense capability, increased launch and recovery capability/flexibility, increased operational availability, and increased flexibility to support future upgrades.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary HW Development - SDD	C/CPFF	General Atomics : San Diego, CA	40.875	0.000		0.000		0.000		-		0.000	0.000	40.875	40.875
Training Development	C/FFP	Pro-Active Technologies, Inc : Oviedo, FL	5.569	0.000		0.000		0.000		-		0.000	0.000	5.569	5.569
Primary HW Development	WR	NAWCAD Lakehurst : Lakehurst, NJ	5.075	2.287	Dec 2018	0.000		0.000		-		0.000	0.000	7.362	-
Prior Year Cost No Longer Funded in FYDP	Various	Various : Various	19.020	0.000		0.000		0.000		-		0.000	0.000	19.020	-
		Subtotal	70.539	2.287		0.000		0.000		-		0.000	0.000	72.826	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	Various : Various	0.166	0.050	Jan 2019	0.000		0.000		-		0.000	0.000	0.216	-
Training Support	WR	NAWCAD TSD : Orlando, FL	0.668	0.306	Dec 2018	0.220	Jan 2020	0.202	Nov 2020	-		0.202	0.000	1.396	-
Training Support	WR	NAVFAC : Norfolk, VA	0.083	1.020	Dec 2018	0.000		0.000		-		0.000	0.000	1.103	-
Depot Logistics Development	C/CPFF	General Atomics : San Diego, CA	0.000	7.700	Jul 2019	10.369	Jan 2020	2.913	Jan 2021	-		2.913	0.000	20.982	20.982
Government Eng Support	WR	NAWCAD Lakehurst : Lakehurst, NJ	0.000	1.116	Dec 2018	1.111	Jan 2020	1.078	Nov 2020	-		1.078	0.000	3.305	-
		Subtotal	0.917	10.192		11.700		4.193		-		4.193	0.000	27.002	N/A

Remarks

The decrease from FY 2020 to FY 2021 is due to the completion of the EMALS depot planning/logistics development.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Test & Evaluation	WR	NAWC Lakehurst : Lakehurst, NJ	6.166	3.436	Dec 2018	0.833	Jan 2020	0.000		-		0.000	0.000	10.435	-
Integrated Test & Evaluation	C/CPFF	General Atomics : San Diego, CA	2.738	16.161	Jan 2019	4.947	Feb 2020	0.000		-		0.000	0.000	23.846	23.846
Prior Year Cost No Longer Funded in FYDP	Various	Various : Various	5.184	0.000		0.000		0.000		-		0.000	0.000	5.184	-
		Subtotal	14.088	19.597		5.780		0.000		-		0.000	0.000	39.465	N/A

Remarks

The decrease from FY2020 to FY2021 is due to the last year of EMALS funding for Integrated Test and Evaluation (IT&E).

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	85.544	32.076		17.480		4.193		-		4.193	0.000	139.293	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 4004 / *EMALS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4004				
Training: EMALS Training Development	1	2019	3	2021
Depot Development: EMALS Depot Level Planning	1	2019	1	2022
Test and Evaluation: EMALS Component Shock Test	1	2019	3	2019
Test and Evaluation: EMALS Integrated Test & Evaluation (IT&E)	1	2019	2	2021
Test and Evaluation: EMALS Reliability Deadloads	2	2019	2	2021
Test and Evaluation: EMALS Launch Control Subsystem (LCS) Environmental Qualification Testing (EQT)	2	2019	2	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	24.119	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.119
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project provides for planning for the Full Ship Shock Trial (FSST) for the USS Gerald Ford (CVN 78).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: CVN 78 Full Ship Shock Trial	24.119	0.000
FY 2019 Accomplishments: Full Ship Shock Trial (FSST) - Continued planning for a CVN 78 FSST to be conducted in FY 2021. Developed the DRAFT CVN 78 FSST Plan and provided to stakeholders for review and comment. Continued the Modeling & Simulation effort supporting the CVN 78 FSST pre-trial predictions. Continued planning to mitigate potential environmental impacts. Continued working with support activities to coordinate transport and storage of explosive charges. Continued modeling effort to characterize the charge behavior while being towed by the explosive ops vessel. Developed explosive operations procedures and conducted explosive operations rehearsal in July 2019. Began logistics planning to develop FSST spares strategy and storage of planned offloaded equipment. Continued developing list of post-shock check-out procedures for integration into a single timeline for system checks between shots. Developed risk mitigation strategies for all identified equipment / systems risks. Component Shock Qualification - Continued component shock qualification of CVN 78 Government-Furnished Equipment components / systems. Successful component shock qualification will support the required NAVSEA post-delivery shock certification of CVN 78 prior to deployment. Shock qualification testing was executed on Electromagnetic Aircraft Launch System and Advanced Arresting Gear components. Continued planning for shock testing of the Signal Data Processor, a Dual Band Radar component. This testing will help to mitigate risk during the FSST and may be used along with FSST results toward shock qualification. ***FY 2020 Plans:*** N/A		
Congressional Adds Subtotals	24.119	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• RDTEN / 0604567N: *Project Units 3108, 3179, 4007*	48.812	42.559	42.029	-	42.029	45.076	45.936	46.850	36.220	Continuing	Continuing
• SCN / 2001: *Carrier Replacement Program*	930.181	1,062.000	1,068.544	-	1,068.544	1,088.130	1,166.136	1,047.876	2,300.621	0.000	36,949.482
• OMN / 1B2B: *CVN 78 Ford Class Training and Sustainment (12BJ0)*	8.880	7.109	5.141	-	5.141	5.732	5.862	5.989	6.108	Continuing	Continuing
• OPN / 5664: *Surface Training Equipment*	7.942	1.412	4.457	-	4.457	2.532	2.418	2.428	2.511	Continuing	Continuing
• SCN / 5300: *Completion of PY Shipbldg Progr*	0.000	0.000	71.000	-	71.000	74.000	0.000	0.000	0.000	0.000	145.000
• SCN / 2004: *CVN 81*	643.000	1,214.500	1,645.606	-	1,645.606	1,306.988	759.980	666.968	590.969	5,622.684	12,450.695

Remarks

D. Acquisition Strategy

The CVN 78 is the first ship of the CVN 78 Class of aircraft carriers designed to replace USS ENTERPRISE and the ships of the NIMITZ Class. The CVN 78 will feature a new nuclear propulsion and electrical generation / distribution system, new electromagnetic aircraft launch system (EMALS), advanced arresting gear (AAG) system, all electric auxiliaries,
warfare system improvements, survivability enhancements, improved weapons handling, and improved aircraft servicing. These design features will result in lower manpower and total ownership costs as compared to the NIMITZ Class. Additionally, the following war fighting benefits will be realized: increased sortie generation rate, improved ship self-defense capability, increased launch and recovery capability / flexibility, increased operational availability, and increased flexibility to support future upgrades.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 9999 / *Congressional Adds*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Component Shock	WR	NSWC PHILADELPHIA : PA	0.000	0.890	Dec 2018	0.000		0.000		-		0.000	0.000	0.890	-
Component Shock	WR	NUWC NEWPORT : RI	0.000	0.859	Dec 2018	0.000		0.000		-		0.000	0.000	0.859	-
Component Shock	Various	SPAWAR SAN DIEGO : CA	0.000	1.372	Nov 2018	0.000		0.000		-		0.000	0.000	1.372	-
Component Shock	C/CPAF	RAYTHEON : MA	0.000	10.972	Mar 2019	0.000		0.000		-		0.000	0.000	10.972	-
Component Shock	Various	NAWC LAKEHURST : NJ	0.000	0.530	Dec 2018	0.000		0.000		-		0.000	0.000	0.530	-
Component Shock	WR	NSWC CARDEROCK : MD	0.000	0.260	Dec 2018	0.000		0.000		-		0.000	0.000	0.260	-
Full Ship Shock Trial	WR	NSWC CARDEROCK : MD	0.000	4.260	Jan 2019	0.000		0.000		-		0.000	0.000	4.260	-
Full Ship Shock Trial	WR	NSWC DAHLGREN : VA	0.000	0.270	Nov 2018	0.000		0.000		-		0.000	0.000	0.270	-
Full Ship Shock Trial	WR	NSWC PHILADELPHIA : PA	0.000	2.167	Dec 2018	0.000		0.000		-		0.000	0.000	2.167	-
Full Ship Shock Trial	WR	NAWC PATUXENT RIVER : MD	0.000	0.308	Jan 2019	0.000		0.000		-		0.000	0.000	0.308	-
Full Ship Shock Trial	C/CPAF	HII-NNS : VA	0.000	0.031	Jan 2019	0.000		0.000		-		0.000	0.000	0.031	-
Full Ship Shock Trial	C/BA	FLUOR MARINE PROPULSION : PA	0.000	2.200	Jan 2019	0.000		0.000		-		0.000	0.000	2.200	-
		Subtotal	0.000	24.119		0.000		0.000		-		0.000	0.000	24.119	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	24.119		0.000		0.000		-		0.000	0.000	24.119	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 9999 / *Congressional Adds*

Gerald R. Ford Class Carriers

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604112N / *GERALD R FORD CI NUC AIRCRAFT CARRIER CVN 78-80*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
CVN 21	1	2019	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	11.314	14.052	20.248	17.366	-	17.366	19.643	18.397	18.056	18.405	Continuing	Continuing
2131: *Assault Breaching System*	11.314	14.052	17.248	17.366	-	17.366	19.643	18.397	18.056	18.405	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.000

Note

The FY 2021 funding request was reduced by $1.700M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Assault Breaching System (ABS) program provides a combination of U.S. Navy systems to counter the threat to amphibious forces from obstacles and anti-landing/ sea mines in the Beach Zone and Surf Zone (0-10 ft water). The Assault Breaching Systems (ABS) consist of a system of systems approach that includes the following programs: Joint Direct Attack Munition (JDAM) Assault Breaching System (JABS); Coastal Battlefield Reconnaissance and Analysis (COBRA); Precision Navigation and Marking System (PNMS); Command, Control, Computers, Communications, and Intelligence (C4I). The Assault Breaching Systems enable the Navy-Marine Corps team to conduct Joint Forcible Entry Operations (JFEO), Ship-To-Objective Maneuver (STOM), and other combat operations to project power ashore.

JABS is a fielded system that neutralizes surface mines and obstacles in the Beach Zone (BZ) and Surf Zone (SZ). The ABS Tactical Decision Aid optimizes the Desired Points of Impact (DPI) for JDAM munitions to effectively neutralize mines and obstacles while minimizing the required number of munitions and friendly aircraft sorties. Continued testing is required to optimize the ABS Tactical Decision Aid database for the most common enemy mines and obstacles.

COBRA conducts Intelligence Surveillance Reconnaissance and Targeting (ISR/T). This system, which consists of two COBRA Airborne Payloads (CAPS) and one Post Mission Analysis (PMA) station, provides Coastal Mine Reconnaissance (CMR) capability. Block I is a multispectral sensor capable of daytime detection of surface-laid minefields and obstacles in the Beach Zone (BZ) and has on-board real-time processing. Block II capability adds an active illuminator sensor that enables nighttime detection of mines and obstacles in the BZ and the Surf Zone (SZ) (0-10 ft of water). COBRA consists of a modular payload architecture that is integrated onto the MQ-8 Fire Scout, other vessels of opportunity, and in it's expeditionary configuration, from the shore. COBRA will serve in the CMR mission module for the SZ and BZ in the Littoral Combat Ship (LCS) Mine Countermeasures (MCM) Mission Package.

PNMS provides navigational upgrades for the Landing Craft, Air Cushion (LCAC); Landing Craft, Utility (LCU); and Amphibious Assault Vehicle (AAV). A system of virtual lane marking improves the navigation ability of these three assault craft which enables them to navigate safely through the neutralized assault lanes provided by JABS. OPN funds the CRAFTALTS to upgrade the navigation systems. LCU Navigation Upgrade provides modernized navigation system to enable safe transit through the breach lane. LCAC autopilot upgrade provides an integrated improvement to the LCAC Service Life Extension Program (SLEP) navigation system for craft control to allow precise navigation and hovering within the breach lane. These software upgrades and backfits occur during scheduled LCAC SLEPs. AAV Navigation Upgrade provides modernized navigation system to enable precise transit through the breach lane.

C4I system will tie all of the above systems together under an integrated ABS architecture that is compatible with the existing Mine Warfare architecture.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	14.625	17.248	18.901	-	18.901
Current President's Budget	14.052	20.248	17.366	-	17.366
Total Adjustments	-0.573	3.000	-1.535	-	-1.535
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	3.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.573	0.000			
• Program Adjustments	0.000	0.000	-1.700	-	-1.700
• Rate/Misc Adjustments	0.000	0.000	0.165	-	0.165

Congressional Add Details ($ in Millions, and Includes General Reductions)

	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Coastal battlefield reconnaissance and analysis system*	0.000	3.000
Congressional Add Subtotals for Project: 9999	0.000	3.000
Congressional Add Totals for all Projects	0.000	3.000

Change Summary Explanation

FY 2019: -$573K SBIR
FY 2020: +$3.0M Program Increase - COBRA
FY 2021: -$1.7M underexecution reduction; +$165K rate adjustment

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2131: *Assault Breaching System*	11.314	14.052	17.248	17.366	-	17.366	19.643	18.397	18.056	18.405	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Assault Breaching System (ABS) program provides a combination of U.S. Navy systems to counter the threat to amphibious forces from obstacles and anti-landing/ sea mines in the Beach Zone and Surf Zone (0-10 ft water). The Assault Breaching Systems (ABS) consist of a system of systems approach that includes the following programs: Joint Direct Attack Munition (JDAM) Assault Breaching System (JABS); Coastal Battlefield Reconnaissance and Analysis (COBRA); Precision Navigation and Marking System (PNMS); Command, Control, Computers, Communications, and Intelligence (C4I). The Assault Breaching Systems enable the Navy-Marine Corps team to conduct Joint Forcible Entry Operations (JFEO), Ship-To-Objective Maneuver (STOM), and other combat operations to project power ashore.

JABS is a currently fielded system that neutralizes surface mines and obstacles in the Beach Zone (BZ) and Surf Zone (SZ). The ABS Tactical Decision Aid optimizes the Desired Points of Impact (DPI) for JDAM munitions to effectively neutralize mines and obstacles while minimizing the required number of munitions and friendly aircraft sorties. Continued testing is required to optimize the ABS Tactical Decision Aid database for the most common enemy mines and obstacles.

COBRA conducts Intelligence Surveillance Reconnaissance and Targeting (ISR/T). This system which consists of two COBRA Airborne Payloads (CAPS) and one Post Mission Analysis (PMA) station, provides Coastal Mine Reconnaissance (CMR) capability. Block I is a multispectral sensor capable of daytime detection of surface-laid minefields and obstacles in the Beach Zone and has on-board real-time processing. Block II capability adds an active illuminator sensor that enables nighttime detection of mines and obstacles in the BZ and the SZ (0-10 ft of water). COBRA consists of a modular payload architecture that is integrated onto the MQ-8 Fire Scout, other vessels of opportunity and in it's expeditionary configuration from the shore. COBRA will serve in the CMR mission module for the SZ and BZ in the Littoral Combat Ship (LCS) Mine Countermeasures (MCM) mission package.

PNMS provides navigational upgrades for the Landing Craft, Air Cushion (LCAC); Landing Craft, Utility (LCU); and Amphibious Assault Vehicle (AAV). A system of virtual lane marking improves the navigation ability of these three assault craft which enables them to navigate safely through the neutralized assault lanes provided by JABS. OPN funds the CRAFTALTS to upgrade the navigation systems. LCU Navigation Upgrade: Modernized the navigation system to enable safe transit through the breach lane. LCAC Autopilot Upgrade: An integrated improvement to the LCAC Service Life Extension Program (SLEP) navigation system for craft control that allows precise navigation and hovering within the breach lane. These software upgrades and backfits occur during scheduled LCAC SLEPs. AAV Navigation Upgrade : Modernize the navigation system to enable precise transit through the breach lane.

C4I system will tie all of the above systems together under an integrated ABS architecture that is compatible with the existing Mine Warfare architecture.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	9.095	10.463	11.085	0.000	11.085

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
FY 2020 Plans: COBRA - Continue design and development of COBRA hardware and continue integration test planning of additional SZ capabilities. JABS - Continue design and engineering of weapon effectiveness for BZ and SZ. ***FY 2021 Base Plans:*** COBRA - Design and development of -3A (algorithm optimization) and -4 (SMSI Camera integration) system enhancements. Perform -3A Developmental Test#1 integrated into the MQ-8B firescout. Conduct Block II Milestone B in Q3FY21. JABS - Continue design and engineering of weapon effectiveness for BZ and SZ. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increased funding in FY 2021 supports efforts leading to Block II Milestone B in Q3FY21 and additional JABS engineering efforts in support of characterization testing.					
Title: Technical Support	1.447	1.307	1.070	0.000	1.070
Articles:	-	-	-	-	-
FY 2020 Plans: COBRA - Support the transition to MSD. Continue to provide shipping, contract and test/studies management and C4I Data Fusion. Provide technical /acquisition support and documentation. ***FY 2021 Base Plans:*** COBRA - Continue to provide management and shipping, contract and test/studies, C4I Data Fusion. Provide technical /acquisition support and documentation (ILS, training, data, drawings). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
No significant change.					
Title: Test and Evaluation	2.382	4.336	4.101	0.000	4.101
Articles:	-	-	-	-	-
FY 2020 Plans: COBRA - Continue advance SZ component/capability design and test. Conduct Block I - 3A and 4 Flight Testing. JABS - SZ and BZ characterization testing. ***FY 2021 Base Plans:*** COBRA - Perform -3A Developmental Test#1 integrated into the MQ-8B firescout. JABS - Conduct SZ and BZ characterization testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight decrease in FY 2021 funding supports test and evaluation support necessary to meet COBRA Block I-3A flight testing requirements and JABS characterization testing.					
Title: Management	1.128	1.142	1.110	0.000	1.110
Articles:	-	-	-	-	-
FY 2020 Plans: COBRA - Continue contract and financial management support. JABS - Continue to manage Mine magazine inventory management and shipping, contract management and tests/studies, C4I/Data fusion. ***FY 2021 Base Plans:*** COBRA: Continue contract and financial management support. JABS: Continue to manage Mine magazine inventory management and shipping, contract management and tests/studies, C4I/Data fusion. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
No significant change.					
Accomplishments/Planned Programs Subtotals	14.052	17.248	17.366	0.000	17.366

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2624: *SHALLOW WATER Mine CM SHIP*	8.616	8.730	5.493	-	5.493	5.708	5.840	5.919	6.035	0.000	112.485

Remarks

D. Acquisition Strategy

Countermine/Counter Obstacle (CM/CO) JDAM Assault Breaching System (JABS) and ABS Tactical Decision Aid testing is ongoing. Intelligence/Surveillance/Reconnaissance/Targeting (ISR/T) - COBRA Block I achieved IOC in July 2017.

Precision Navigation & Marking System (PNMS) - The navigation upgrades for the Landing Craft, Air Cushion (LCAC) and Landing Craft, Utility (LCU) are complete. AAV enhancements will be achieved through an ECP (PMA AAV (Marine Corps)) in Q1FY19.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Dev, COBRA	C/CPAF	Arete : Tucson, AZ	5.038	6.813	Jan 2019	8.438	Dec 2019	7.900	Dec 2020	-		7.900	Continuing	Continuing	Continuing
Systems Engineering, COBRA	WR	NSWC, PC : PANAMA CITY, FL	0.781	1.090	Nov 2018	1.688	Nov 2019	1.775	Nov 2020	-		1.775	Continuing	Continuing	Continuing
JABS	WR	NSWC PC : NSWC IH	0.799	0.354	Jan 2019	0.000		1.312	Nov 2020	-		1.312	Continuing	Continuing	Continuing
Training Dev, COBRA	WR	NSWC, PC : PANAMA CITY, FL	0.559	0.659	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
ABS IPT/Test Assets/Proj Eng	WR	NSWC, PC : PANAMA CITY, FL	0.182	0.179	Dec 2018	0.337	Dec 2019	0.098	Dec 2020	-		0.098	Continuing	Continuing	Continuing
		Subtotal	7.359	9.095		10.463		11.085		-		11.085	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	NSWC, PC : PANAMA CITY, FL	0.613	0.942	Dec 2018	0.908	Dec 2019	0.674	Dec 2020	-		0.674	Continuing	Continuing	Continuing
Integrated Logistics Support	WR	NSWC PC : PANAMA CITY, FL	0.072	0.111	Nov 2018	0.060	Nov 2019	0.087	Nov 2020	-		0.087	Continuing	Continuing	Continuing
Configuration Management	WR	NSWC, PC : PANAMA CITY, FL	0.072	0.111	Nov 2018	0.061	Nov 2019	0.087	Nov 2020	-		0.087	Continuing	Continuing	Continuing
Studies & Analysis	WR	NSWC IH : INDIAN HEAD, MD	0.185	0.283	Dec 2018	0.278	Nov 2019	0.222	Nov 2020	-		0.222	Continuing	Continuing	Continuing
		Subtotal	0.942	1.447		1.307		1.070		-		1.070	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	NSWC, IH : INDIAN HEAD, MD	1.126	1.229	Nov 2018	3.201	Nov 2019	1.471	Nov 2020	-		1.471	Continuing	Continuing	Continuing
Operational Test & Evaluation	WR	NSWC/ IH, PC : INDIAN HEAD, PANAMA CITY	0.361	0.405	Dec 2018	1.135	Nov 2019	0.876	Nov 2020	-		0.876	Continuing	Continuing	Continuing
Development Test	WR	NSWC PC : Panama City, FL	0.722	0.748	Nov 2018	0.000		1.754	Nov 2020	-		1.754	Continuing	Continuing	Continuing
		Subtotal	2.209	2.382		4.336		4.101		-		4.101	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	C/CPFF	BAH, Northrop Grumman : DC, FL	0.090	0.131	Dec 2018	0.140	Dec 2019	0.137	Dec 2020	-		0.137	Continuing	Continuing	Continuing
Government Engineering Support	WR	NSWC, IH : INDIAN HEAD, MD	0.359	0.501	Nov 2018	0.505	Nov 2019	0.495	Nov 2020	-		0.495	Continuing	Continuing	Continuing
Program Management Support	WR	NSWC/ IH, PC : INDIAN HEAD, PANAMA CITY	0.318	0.438	Oct 2018	0.440	Oct 2019	0.422	Oct 2020	-		0.422	Continuing	Continuing	Continuing
Travel	WR	NAVSEA : WNY, DC	0.037	0.058	Dec 2018	0.057	Dec 2019	0.056	Dec 2020	-		0.056	Continuing	Continuing	Continuing
		Subtotal	0.804	1.128		1.142		1.110		-		1.110	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	11.314	14.052		17.248		17.366		-		17.366	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

2021PB - 0604126N - 2131

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 2131 / *Assault Breaching System*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
COBRA				
Acquisition Milestones: Block I Ready for Training	4	2019	4	2019
Acquisition Milestones: Block I Milestone Decision	1	2020	1	2020
Acquisition Milestones: Block II Milestone B	3	2021	3	2021
Acquisition Milestones: Block II Preliminary Design Review	1	2023	1	2023
Acquisition Milestones: Block II Critical Design Review	3	2023	3	2023
Acquisition Milestones: Block II Milestone C	3	2025	3	2025
System Development: Block I Algorithm Design & Implementation	1	2019	3	2021
System Development: Block I Hardware Development	1	2019	4	2023
System Development: Block II Engineering & Manufacturing Development	1	2022	2	2025
System Development: Block II / MQ 8C Integration	1	2024	4	2025
Test & Evaluation: Block I -3A and -4 Flight Test	1	2020	4	2025
Test & Evaluation: Block II Contractor Testing	1	2024	2	2025
Test & Evaluation: Block II Development Test	2	2025	4	2025
Test & Evaluation: Block II Operational Assessment	2	2025	3	2025
Deliveries: Block I Low Rate Production	1	2019	1	2021
Deliveries: Block I Production and Sustainment	1	2019	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

COBRA conducts Intelligence Surveillance Reconnaissance and Targeting (ISR/T). This system, which consists of two COBRA Airborne Payloads (CAPS) and one Post Mission Analysis (PMA) station, provides Coastal Mine Reconnaissance (CMR) capability. Block I is a multispectral sensor capable of daytime detection of surface-laid minefields and obstacles in the Beach Zone (BZ) and has on-board real-time processing. Block II capability adds an active illuminator sensor that enables nighttime detection of mines and obstacles in the BZ and the Surf Zone (SZ) (0-10 ft of water). COBRA consists of a modular payload architecture that is integrated onto the MQ-8 Fire Scout, other vessels of opportunity, and in it's expeditionary configuration, from the shore. COBRA will serve in the CMR mission module for the SZ and BZ in the Littoral Combat Ship (LCS) Mine Countermeasures (MCM) Mission Package.
Congressional increase of $3.0M to support acceleration of the COBRA program.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Coastal battlefield reconnaissance and analysis system ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Accelerate the planned integration of the simultaneous multi-spectral Imaging 9SMSI) camera into the redesigned COBRA Block I (-4) integrated gimbel (IG).	0.000	3.000
Congressional Adds Subtotals	0.000	3.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hardware Integration	C/CPAF	ARETE : Tucson, AZ	0.000	0.000		2.850	Mar 2020	0.000		-		0.000	0.000	2.850	-
Hardware Integration	WR	NSWC PCD : Panama City, FL	0.000	0.000		0.150	Feb 2020	0.000		-		0.000	0.000	0.150	-
		Subtotal	0.000	0.000		3.000		0.000		-		0.000	0.000	3.000	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		3.000		0.000		-		0.000	0.000	3.000	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604126N / *Airborne Mine Countermeasures*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
System Development: Block I Hardware Development	2	2020	4	2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	172.825	14.764	18.735	18.754	-	18.754	15.010	14.499	14.783	15.073	Continuing	Continuing
0530: *Mine Hunt Systems*	9.484	7.127	6.961	8.430	-	8.430	5.203	4.532	4.619	4.705	Continuing	Continuing
1233: *Surface MCM Mid-life Upgrade*	160.299	0.000	1.011	1.032	-	1.032	1.054	1.073	1.094	1.116	Continuing	Continuing
1235: *Mine Warfare Planning and Analysis*	3.042	7.637	10.763	9.292	-	9.292	8.753	8.894	9.070	9.252	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Surface Mine Countermeasures (SMCM) Program Element (PE) provides resources in support of development of mine countermeasures systems to provide minehunting and neutralization to counter known and projected mine threats. The mine countermeasures systems provide mobile, quick reaction forces capable of land or sea-based minehunting and neutralizing operations worldwide. Resources are for developing and deploying advanced minehunting and neutralization systems and the intelligence and oceanographic capabilities that will enable mine warfare superiority. Tactics and techniques used vary across a diversity of environments and a diversity of threats, including both asymmetric and emerging. Resources provide for systems and support of mine warfare systems, maritime systems, and expeditionary systems to allow for continuous operations of the Navy's warships and support vessels, other military vessels, and commercial vessels. Increased capability includes conducting minefield reconnaissance (mine density and location) at high area search rates, improving detection capability, decreasing sensor false alarm rates, reducing or eliminating post-mission analysis detect, classify, identify, decide time, improving neutralization time, improving network communications, automatic target recognition, and achieving in-stride detect-to-engage capability. The Surface Mine Countermeasures programs are in general platform independent and will provide detection, classification, localization, identification, neutralization, and influence clearance capabilities. Programs develop: (1) Unmanned minehunting capability for surface platforms; (2) the integration and improvement of new and existing systems (3) support for systems which detect, localize, classify, identify, and neutralize all mine types across MCM Avenger Class, Littoral Combat Ship (LCS) Class and other platforms.

1)The AN/AQS-20 is a minehunting and identification system with sensors housed in an underwater towed body. The sensors are designed for the detection, classification and localization of bottom, close-tethered, and volume targets, and also for the identification of bottom targets. The system will be deployed from the Littoral Combat Ship (LCS) as part of the MCM Mission Package or can be deployed from other Vessels of Opportunity (VOO). The MCM USV is the tow platform for the AN/AQS-20.

2) AN/SQQ-32(V)4 High-Frequency, Wide Band (HFWB) is a technology upgrade to the AN/SQQ-32 Towed Body which will incorporate HFWB technology into the detection sonar to address performance deficiencies against new mine threats in the littorals. This upgrade will be installed on MCM-1 Class ships with the AN/SQQ-32(V)3 and will develop new transducer modules, fiber optic cable and modify topside processing and display software.

3) AN/SLQ-60 Mine Neutralization System (MNS) Seafox on the MCM Class ships. MNS is the replacement to the existing AN/SLQ-48 Mine Neutralization System.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*

4) SSQ-94 MCM Trainer upgrade will incorporate the AN/SQQ-32 (V)4 sonar, SSN2(V)5 PINS and Mine Neutralization System Team Trainer.

5)Mine Warfare and Environmental Decision Aids Library (MEDAL) is the U.S. Navy's single Mine Warfare (MIW) tactical decision support system for integrated mission planning, evaluation, and situational awareness. MEDAL provides mine warfare planning and evaluation tools and databases to the MCM Commander and to the individual MCM units.

6) MIW Integrated Synthetic Trainer (MIST) will be a synthetic trainer which will provide integrated phase training for MIW staffs in end-to-end MCM scenarios. This tool will provide the capability to train the U.S. Navy's four MIW staffs against near peer threats. It will incorporate the laydown of simulated threat minefields expected to be used to blockade ports, defend against landing assaults, or deny access to sea lines of communication to control the training event. This effort begins in FY2020.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	15.527	18.735	18.700	-	18.700
Current President's Budget	14.764	18.735	18.754	-	18.754
Total Adjustments	-0.763	0.000	0.054	-	0.054
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.763	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.054	-	0.054

Change Summary Explanation

Program Changes:
FY19: -$763K SBIR reduction
FY20: No change.
FY21: $54K Miscellaneous increase

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*				**Project (Number/Name)** 0530 / *Mine Hunt Systems*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
0530: *Mine Hunt Systems*	9.484	7.127	6.961	8.430	-	8.430	5.203	4.532	4.619	4.705	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Mine Hunt Systems project contains resources for systems, subsystems, and sensors integrated for use with the Mine Countermeasures Unmanned Surface Vehicle (MCM USV) for mine detection, classification, localization, identification, neutralization, and influence sweep clearance capabilities. Research, development, test, and evaluation efforts are for increasing capability by decreasing time required to conduct Mine Countermeasures (MCM) operations, ensuring low risk to naval and commercial vessels, and removing the man from the minefield. Increased capability includes conducting minefield reconnaissance (mine density and location) at high area search rates, improving detection capability, decreasing sensor false alarm rates, and reducing post-mission analysis time for detection, classification, and identification.

The AN/AQS-20 is a minehunting and identification system with sensors housed in an underwater towed body. The sensors are designed for the detection, classification and localization of bottom, close-tethered, and volume targets, and also for the identification of bottom targets. The system will be deployed from the Littoral Combat Ship (LCS) as part of the MCM Mission Package (MP) or can be deployed from other Vessels of Opportunity (VOO). The MCM USV is the tow platform for the AN/AQS-20. The AN/AQS-20 Block 1 (the AQS-20A) underwent a Pre-Planned Product Improvement (P3I) program to upgrade the Forward Looking Sonar (FLS) and Side-Looking Sonars (SLS) to improve Probability of Classifying a Mine-like object as a Mine, reduce False Classification, and improve Depth Localization performance to meet Block 2 (the AQS-20C) performance. The Forward Looking Sonar is replaced with a new High Frequency Wideband Forward Looking Sonar (WBFLS) design. The SLS is replaced with a new Multifunction SLS with Synthetic Aperture Sonar (SAS) capability, as well as, improved signal processing and Signal to Noise Ratio. The Block 1 P3I program began in FY 2012 and completed in FY 2017. Award and management for Block 2 production units began in FY 2014 (the AQS-20C). Materiel Reliability, obsolescence, and performance Engineering Change Proposal (ECP) efforts continue beyond FY 2024.

In FY 2019, the AN/AQS-20 Block 2 program completed DT, initiated MCM USV integration efforts and supported Net-Centric Sensor Analysis for Mine Warfare (NSAM) system initial integration. The AN/AQS-20A Block 2 P3I program SAS acoustic mine recognition development will continue to support the potential for automated in-situ mine identification. Additional P3I efforts included Automated Target Recognition, will continue beyond FY 2024. Efforts will include defining and developing necessary improvements for AN/AQS-20 Block 2 integration with the MCM USV.

In FY 2020, the AN/AQS-20 Block 2 program will continue integration with the MCM USV, conduct DT with the MCM USV, and support workups for the LCS Mission Package (MP) testing. AN/AQS-20 will continue improving data consolidation and cyber requirements, as well as sensor performance for localization.

In FY 2021, the AN/AQS-20 Block 2 program will conduct DT and commence TechEval with the LCS MCM MP, complete the MCM USV User Operational Evaluation System (UOES) efforts, and commence Automated Target Recognition (ATR) efforts.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: AN/AQS-20 Product Development	2.999	2.100	3.251	0.000	3.251
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue algorithm development for AN/AQS-20 Block 2 PMA Improvements including NSAM integration. - Correct deficiencies identified during MCM USV integration. - Continue SAS Acoustic mine recognition development. - Continue improvement of localization and re-acquisition. ***FY 2021 Base Plans:*** - Continue AN/AQS-20 Block 2 PMA improvements and NSAM integration - Transition SBIR Sonar Data Fusion of AQS-20 multi-sensor data to improve single pass detection - Initiate Tech Refresh to improve iPMA performance, to include data fusion and contact management tool - Collect and Classify High Resolution Synthetic Aperture Sonar (SAS) images from test data to support machine learning of image processing - Initiate development of super classification of mines by leveraging machine learning - Improvement of Automated Target Recognition (ATR) by leveraging machine learning - Initiate development of a noise reduction algorithm to improve system performance by leveraging testing of the MCM USV - Initiate development of a Sound Velocity Profile (SVP) solution and integration of an active SVP profile update to improve system performance - Correct deficiencies identified during MCM USV developmental testing. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due to increased development efforts associated with Automated Target Recognition (ATR) and Sound Velocity Profile (SVP).					
Title: AN/AQS-20 Support	0.753	0.800	0.800	0.000	0.800
Articles:	-	-	-	-	-
FY 2020 Plans: - Provide ongoing technical and management support to AN/AQS-20. - Continue to conduct test minefield maintenance.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue AN/AQS-20 Block 2 Mission Planning and Post Mission Analysis MCM USV Concept of Employment development. ***FY 2021 Base Plans:*** - Provide ongoing technical and management support to AN/AQS-20 - Continue to conduct test minefield maintenance to support follow on system improvements - Continue AN/AQS-20 Block 2 Mission Planning and Post Mission Analysis MCM USV Concept of Employment development. ***FY 2021 OCO Plans:*** N/A					
Title: AN/AQS-20 Test and Evaluation	2.875	3.561	3.879	0.000	3.879
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue SAS Acoustic recognition Testing. - Conduct contractor integration testing with the MCM USV. - Commence DT with the MCM USV. - Refine tactics post MCM USV DT. ***FY 2021 Base Plans:*** - Support Block 2 DT/TechEval - Support MCM MP DT/TechEval - Complete DT with the MCM USV. - Initiate testing to characterize deep mining capability of AQS-20 - Initiate testing to characterize and model MCM USV Platform noise - Initiate testing and integration of Bi-Static EOID to transition the SBIR development program ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight increase due to MCM Mission Package DT/TechEval test events and system characterization testing.					
Title: AN/AQS-20 Management Services	0.500	0.500	0.500	0.000	0.500
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: - Provide planning and management for the AN/AQS-20 program. - Complete update of acquisition documentation in support of Full Rate Production (FRP) Decision Review. - Continue to provide Program Office travel support. ***FY 2021 Base Plans:*** - Provide planning and management for the AN/AQS-20 program. - Continue to provide Program Office travel support. - Continue support for sonar and iPMA technical refresh efforts. - Continue risk reduction efforts. - Conduct competitive procurement source selection efforts. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	7.127	6.961	8.430	0.000	8.430

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/1601: *LCS MCM Mission Modules*	98.901	64.789	218.822	-	218.822	222.754	234.330	243.187	247.949	1,111.812	2,666.795

Remarks

OPN/1601 - The above funding line accounts for several programs, of which the Mine Hunt Systems program is only a portion.

D. Acquisition Strategy

AN/AQS-20 Low-Rate Initial Production (LRIP) procurement continued following Block 2 (AQS-20C units) competitive contract award in FY 2014. Continue to meet MCM MP requirements to support production of Block 2 units. Conduct competitive procurement in FY 2021 and align resources with the MCM USV program.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/AQS-20 Block 2 Integration	C/CPFF	Lockheed Martin : Not Specified	0.300	0.000		0.000		0.000		-		0.000	0.000	0.300	-
AN/AQS-20 P3I	C/CPFF	Raytheon : Portsmouth, RI	0.509	1.099	Nov 2018	1.800	Nov 2019	1.551	Nov 2020	-		1.551	Continuing	Continuing	Continuing
AN/AQS-20 P3I	C/CPFF	ARL/UT : Austin, TX	0.000	0.250	Nov 2018	0.100	Dec 2019	1.000	Nov 2020	-		1.000	Continuing	Continuing	Continuing
AN/AQS-20 Block 2 PMA	WR	NSWC, PC : Panama City FL	1.100	0.800	Oct 2018	0.100	Oct 2019	0.100	Oct 2020	-		0.100	Continuing	Continuing	Continuing
AN/AQS-20 Block 2 PMA	C/CPFF	ARL/UT : Austin, TX	1.128	0.850	Nov 2018	0.100	Dec 2019	0.100	Dec 2020	-		0.100	Continuing	Continuing	Continuing
AN/AQS-20 Risk Reduction	C/FFP	TBD : TBD	0.000	0.000		0.000		0.500	Dec 2020	-		0.500	0.000	0.500	-
		Subtotal	3.037	2.999		2.100		3.251		-		3.251	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/AQS-20 Engineering Services	WR	NUWC/NPT : Newport, RI	0.365	0.000		0.000		0.000		-		0.000	0.000	0.365	-
AN/AQS-20 Engineering Services	WR	NSWC, PC : Panama City, FL	0.135	0.086	Oct 2018	0.140	Oct 2019	0.140	Oct 2020	-		0.140	Continuing	Continuing	Continuing
AN/AQS-20 Engineering Services	C/CPFF	Raytheon : Portsmouth, RI	0.200	0.151	Nov 2018	0.200	Nov 2019	0.200	Nov 2020	-		0.200	Continuing	Continuing	Continuing
AN/AQS-20 ILS Function	WR	NSWC, PC : Panama City FL	0.200	0.516	Nov 2018	0.460	Nov 2019	0.460	Nov 2020	-		0.460	Continuing	Continuing	Continuing
		Subtotal	0.900	0.753		0.800		0.800		-		0.800	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/AQS-20 T&E Functions	WR	COTF : Norfolk, VA	0.200	0.175	Nov 2018	0.200	Nov 2019	0.200	Nov 2020	-		0.200	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/AQS-20 T&E Functions	WR	NSWC, PC : Panama City FL	4.247	2.300	Oct 2018	2.851	Oct 2019	3.169	Oct 2020	-		3.169	Continuing	Continuing	Continuing
AN/AQS-20 T&E Functions	C/CPFF	Raytheon : Portsmouth, RI	0.600	0.400	Nov 2018	0.510	Nov 2019	0.510	Nov 2020	-		0.510	Continuing	Continuing	Continuing
		Subtotal	5.047	2.875		3.561		3.879		-		3.879	Continuing	Continuing	N/A

Remarks

COTF - Commander Operational Test and Evaluation Force

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AN/AQS-20 Management Services	TBD	Various : Various	0.470	0.470	Dec 2018	0.470	Dec 2019	0.470	Dec 2020	-		0.470	Continuing	Continuing	Continuing
AN/AQS-20 Travel	TBD	Various : Various	0.030	0.030	Mar 2019	0.030	Mar 2020	0.030	Mar 2021	-		0.030	Continuing	Continuing	Continuing
		Subtotal	0.500	0.500		0.500		0.500		-		0.500	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	9.484	7.127		6.961		8.430		-		8.430	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0530				
AN/AQS-20 Program Milestones: AN/AQS-20 Full Rate Production (FRP) Decision Block 2	3	2021	3	2021
AN/AQS-20 Program Milestones: Initial Operational Capability (IOC)	4	2021	4	2021
AN/AQS-20 Development Phase: AN/AQS-20 Block 2 P3I	1	2019	4	2025
AN/AQS-20 Development Phase: AN/AQS-20 Materiel Reliability, Obsolesence, and Performance ECP Development (Block 2)	1	2019	4	2025
iPMA Development: iPMA Development	1	2019	1	2019
iPMA Development: iPMA/NSAM Integration and Test	2	2019	1	2021
iPMA Development: iPMA Tech Refresh	2	2021	4	2025
Deploy and Retrieve (D&R) Development: Raytheon D&R Fabrication	1	2019	1	2019
Deploy and Retrieve (D&R) Development: D&R Integration	2	2019	2	2019
Deploy and Retrieve (D&R) Development: System Integration and Test	3	2019	4	2019
AN/AQS-20 Test and Evaluation: AN/AQS-20 Block 2 DT	1	2019	2	2019
AN/AQS-20 Test and Evaluation: AN/AQS-20/MCM USV DT	4	2020	2	2021
MCM Mission Package Testing: MCM MP Developmental Testing	2	2021	3	2021
MCM Mission Package Testing: MCM MP Tech Eval	4	2021	1	2022
MCM Mission Package Testing: MCM MP IOT&E	1	2022	2	2022
AN/AQS-20 Risk Reduction: Retrofit Upgrade	4	2020	4	2020
AN/AQS-20 Risk Reduction: Risk Reduction Sonar (Volume Search)	2	2020	2	2021
AN/AQS-20 Risk Reduction: Risk Reduction Tow Body	2	2020	2	2021
AN/AQS-20 Risk Reduction: Retrofit Upgrade Option 1	3	2021	3	2021
AN/AQS-20 Production: Production: AN/AQS-20 Block 2 Basic Award	2	2021	2	2021

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 0530 / *Mine Hunt Systems*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
AN/AQS-20 Production: Production: AN/AQS-20 Block 2 Option 1 Award	3	2022	3	2022
AN/AQS-20 Production: Production: AN/AQS-20 Block 2 Option 2 Award	3	2023	3	2023
AN/AQS-20 Production: Production: AN/AQS-20 Block 2 Option 3 Award	3	2024	3	2024
AN/AQS-20 Production: Production: AN/AQS-20 Block 2 Option 4 Award	3	2025	3	2025
AN/AQS-20 Production: Deliveries: AN/AQS-20 Block 2 Systems	1	2019	2	2019
AN/AQS-20 Production: Deliveries: AN/AQS-20 Block 2 Basic Award Systems	3	2023	3	2023
AN/AQS-20 Production: Deliveries: AN/AQS-20 Block 2 Option 1 Systems	3	2024	3	2024
AN/AQS-20 Production: Deliveries: AN/AQS-20 Block 2 Option 2 Systems	3	2025	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1233: *Surface MCM Mid-life Upgrade*	160.299	0.000	1.011	1.032	-	1.032	1.054	1.073	1.094	1.116	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Surface MCM Mid-life Upgrade project provides resources for development, improvement and integration of SSQ-94 MCM Trainer. Trainer upgrade will incorporate the AN/SQQ-32 (V)4 sonar, SSN2(V)5 PINS and Mine Neutralization System Team Trainer.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	0.000	1.011	1.032	0.000	1.032
Articles:	-	-	-	-	-
Description: SSQ-94 MCM Trainer Development ***FY 2020 Plans:*** Integration of MEDAL planning into the SSQ-94 MCM Trainer. ***FY 2021 Base Plans:*** Continue integration of MEDAL planning into the SSQ-94 MCM Trainer. Funding will be utilized to conduct analysis and feasibility testing of utilizing legacy combat systems on future platforms. This will include the potential reuse of the AN/SQQ-32(V)4 sonar on unmanned ships, the reuse of the AN/SLQ-37 and SLQ-38 on the unmanned surface vehicle, and the reuse of the AN/SLQ-60 onboard Vessels of Opportunity (VOO). ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding level remains consistent for SSQ-94 MCM Trainer development efforts.					
Accomplishments/Planned Programs Subtotals	0.000	1.011	1.032	0.000	1.032

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

D. Acquisition Strategy

SSQ-94 - Naval Surface Warfare Center, Panama City (NSWC, PC) and ARL UT designed and developed the SSQ-94 MCM Trainer.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MNS Development	Various	TBD : TBD	22.455	0.000		0.000		0.000		-		0.000	0.000	22.455	-
SSQ-94 Trainer	WR	NSWC, PC : NSWC, PC	16.344	0.000		1.011	Dec 2019	1.032	Dec 2020	-		1.032	0.000	18.387	-
BSP: Develop Bottom Sediment Classifier	WR	NRL : WASHINGTON, DC	0.258	0.000		0.000		0.000		-		0.000	0.000	0.258	-
Systems Engineering and Integration	WR	NSWC, PC : PANAMA CITY, FL	0.306	0.000		0.000		0.000		-		0.000	0.000	0.306	-
System Development 1	WR	NSWC, PC : SAN DIEGO, CA	0.373	0.000		0.000		0.000		-		0.000	0.000	0.373	-
Systems Engineering 2	WR	NSWC, PC : PANAMA CITY, FL	2.915	0.000		0.000		0.000		-		0.000	0.000	2.915	-
Systems Engineering 3 MCM CES	WR	NSWC, PC : PANAMA CITY, FL	1.633	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
HFWB: Primary Hardware Development 1	C/CPAF	ARL UT : TEXAS	15.511	0.000		0.000		0.000		-		0.000	0.000	15.511	-
Primary Hardware Development 2	WR	ARL-UT : AUSTIN, TX	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
HFWB: Tow Cable Development	C/CPAF	ARL UT : TEXAS	1.399	0.000		0.000		0.000		-		0.000	0.000	1.399	-
HFWB: Ship Integration	WR	NSWC, PC : PANAMA CITY, FL	1.697	0.000		0.000		0.000		-		0.000	0.000	1.697	-
HFWB: SYSTEM ENGINEER	C/CPAF	ARL UT : TEXAS	9.065	0.000		0.000		0.000		-		0.000	0.000	9.065	-
Software Development MEDAL EA	C/CPFF	SAIC : McLean, VA	41.180	0.000		0.000		0.000		-		0.000	0.000	41.180	-
		Subtotal	113.136	0.000		1.011		1.032		-		1.032	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Develop Logistics Products	WR	NSWC, PC : PANAMA CITY, FL	0.243	0.000		0.000		0.000		-		0.000	0.000	0.243	-
Software Development 1	C/CPFF	SAIC : McLean, VA	0.350	0.000		0.000		0.000		-		0.000	0.000	0.350	-
Software Development 2	C/CPFF	SAIC : McLean, Va	0.914	0.000		0.000		0.000		-		0.000	0.000	0.914	-
HFWB Software Development	C/CPAF	ARL-UT : TEXAS	8.450	0.000		0.000		0.000		-		0.000	0.000	8.450	-
HFWB Integrated Logistics Support	WR	NSWC, PC : PANAMA CITY, FL	2.765	0.000		0.000		0.000		-		0.000	0.000	2.765	-
Software Engineering 1 MCM CES	WR	NSWC, PC : PANAMA CITY, FL	1.517	0.000		0.000		0.000		-		0.000	0.000	1.517	-
Software Engineering 2 MEDAL	WR	NSWC, PC : PANAMA CITY, FL	2.458	0.000		0.000		0.000		-		0.000	0.000	2.458	-
		Subtotal	16.697	0.000		0.000		0.000		-		0.000	0.000	16.697	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL Test and Evaluation	C/FP	SAIC : McLean, VA	7.636	0.000		0.000		0.000		-		0.000	0.000	7.636	-
MCM CES Test and Evaluation 1	C/CPAF	VARIOUS : VARIOUS	1.782	0.000		0.000		0.000		-		0.000	0.000	1.782	-
HFWB: Developmental Test and Evaluation	C/CPAF	ARL-UT : TEXAS	5.925	0.000		0.000		0.000		-		0.000	0.000	5.925	-
Test and Evaluation 2	C/CPAF	VARIOUS : VARIOUS	5.204	0.000		0.000		0.000		-		0.000	0.000	5.204	-
		Subtotal	20.547	0.000		0.000		0.000		-		0.000	0.000	20.547	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support 1	C/CPFF	CACI : WASHINGTON, DC	0.263	0.000		0.000		0.000		-		0.000	0.000	0.263	-
Travel 1	WR	NAVSEA : WNY, DC	0.084	0.000		0.000		0.000		-		0.000	0.000	0.084	-
Government Engineering Support1	WR	NSWC, PC : PANAMA CITY, FL	0.325	0.000		0.000		0.000		-		0.000	0.000	0.325	-
MEDAL Program Management Support 2	Various	VARIOUS : VARIOUS	2.827	0.000		0.000		0.000		-		0.000	0.000	2.827	-
SBIR Assessment 2	Various	VARIOUS : VARIOUS	0.019	0.000		0.000		0.000		-		0.000	0.000	0.019	-
Program Management Support 3	C/CPFF	CACI : WASHINGTON, DC	1.341	0.000		0.000		0.000		-		0.000	0.000	1.341	-
Program Management Support 4	C/CPFF	CACI : WASHINGTON, DC	0.080	0.000		0.000		0.000		-		0.000	0.000	0.080	-
Government Engineering Support3	WR	NSWC, PC : PANAMA CITY, FL	0.090	0.000		0.000		0.000		-		0.000	0.000	0.090	-
Travel 3	C/CPAF	NAVSEA : WNY, DC	0.256	0.000		0.000		0.000		-		0.000	0.000	0.256	-
Program Management Support 5	C/CPFF	CACI : WASHINGTON, DC	0.167	0.000		0.000		0.000		-		0.000	0.000	0.167	-
Government Engineering Support4	WR	NSWC, PC : PANAMA CITY, FL	0.010	0.000		0.000		0.000		-		0.000	0.000	0.010	-
Travel4	C/CPAF	NSWC, PC : PANAMA CITY, FL	0.069	0.000		0.000		0.000		-		0.000	0.000	0.069	-
HFWB: Program Management Support 6	C/CPAF	VARIOUS : VARIOUS	1.442	0.000		0.000		0.000		-		0.000	0.000	1.442	-
HFWB: Government Engineering Support5	WR	NSWC, PC : PANAMA CITY, FL	0.750	0.000		0.000		0.000		-		0.000	0.000	0.750	-
HFWB: Travel 5	C/CPAF	NAVSEA : WNY, DC	0.080	0.000		0.000		0.000		-		0.000	0.000	0.080	-
Government Engineering Support6	WR	NSWC, PC : PANAMA CITY, FL	1.352	0.000		0.000		0.000		-		0.000	0.000	1.352	-
Travel 6	C/CPAF	NAVSEA : WNY, DC	0.238	0.000		0.000		0.000		-		0.000	0.000	0.238	-
SBIR Assessment 6	Various	VARIOUS : VARIOUS	0.054	0.000		0.000		0.000		-		0.000	0.000	0.054	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support 7	C/CPAF	VARIOUS : VARIOUS	0.350	0.000		0.000		0.000		-		0.000	0.000	0.350	-
Acquisition Workforce Fund	Various	VARIOUS : VARIOUS	0.122	0.000		0.000		0.000		-		0.000	0.000	0.122	-
		Subtotal	9.919	0.000		0.000		0.000		-		0.000	0.000	9.919	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	160.299	0.000		1.011		1.032		-		1.032	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

2020DON - 0604127N - 1233

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1233 / *Surface MCM Mid-life Upgrade*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
SSQ-94 Trainer				
System Development: SSQ-94 MCS Trainer: SSQ-94 MCS Trainer Development	1	2020	4	2022
System Development: SSQ-94 MCS Trainer: SSQ-94 MCS Integration and Testing	1	2023	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
1235: *Mine Warfare Planning and Analysis*	3.042	7.637	10.763	9.292	-	9.292	8.753	8.894	9.070	9.252	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Mine Warfare Planning and Analysis project consists of two separate projects, the Mine Warfare and Environmental Decision Aids Library (MEDAL) and the MIW Synthetic Trainer (MIST). MEDAL is a software-intensive software program and is U.S. Navy's single Mine Warfare (MIW) tactical decision support system for integrated mission planning, evaluation, and situational awareness. MEDAL provides mine warfare planning and evaluation tools and databases to mine countermeasures (MCM) Commanders and is employed at the unit level to perform MCM sortie planning and evaluation. The most recent MEDAL increment, known as MEDAL Enterprise Architecture (EA), is no longer dependent on Global Command and Control System - Maritime (GCCS-M) for fielding to MIW fleet users. MEDAL EA is a family of systems, comprised of the following three components: MINEnet Global, MINEnet Tactical, and Minefield Planning.

MINEnet Global is a shore-based website that provides MIW waterspace awareness functionality to support Navy non-MIW forces. MINEnet Global also supports dedicated MIW forces by providing downloadable reference databases, MIW reference publications and links to MIW information. The MINEnet Tactical component is a software application which provides MCM tactical planning, situational awareness and post mission evaluation capabilities. It has been developed to be fielded to standard Navy networks including, Consolidated Afloat Networks and Enterprise Services (CANES), Integrated Shipboard Network System (ISNS), and Navy Marine Corps Intranet (NMCI) servers and uses common web browser as the user interface. Minefield Planning is also a tactical software application which provides the capability to plan mining operations.

MIST will be a synthetic trainer which will provide integrated phase training for MIW staffs in end-to-end MCM scenarios. This tool will provide the capability to train the U.S. Navy's four MIW staffs against near peer threats. It will incorporate the laydown of simulated threat minefields expected to be used to blockade ports, defend against landing assaults, or deny access to sea lines of communication to control the training event. This effort begins in FY20.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	3.934	4.818	4.593	0.000	4.593
Articles:	-	-	-	-	-
FY 2020 Plans: In FY20, MINEnet Tactical v1.3.1 will complete and MINEnet Tactical (MNT) v1.4 development begins. MNT v1.3.1 addresses previously identified enhancements and fixed critical software bugs found in MNT v1.3.0. MNT v1.3.1 will be fielded in lieu of MNT v1.3.0. MNT v1.4 is a multi-year effort to replace commercial-off-the-shelf (COTS) components, which are either near end-of-life or no longer approved in Department of the Navy (DoN)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Application and Database Management System (DADMS), with new, approved components in order to maintain cybersecurity compliance. Additionally, FY20 effort includes incorporating initial performance values for UISS, Knifefish and AN/AQS-20C systems into the MEDAL Tactical Performance Database (TPDB), then analyzing the performance values, and validating effectiveness outputs. FY20 funding will initiate development of MIST. MIST will be a synthetic trainer which provides integrated phase training for MIW staffs in end-to-end MCM scenarios. FY20 work will initially focus on defining user requirements, software design, and software development processes. Initiation of MIST was delayed from FY19 to FY20 due to excess growth budget reduction. ***FY 2021 Base Plans:*** In FY21, MINEnet Tactical v1.4 development continues and final performance values for AN/AQS-24C will be incorporated into the Tactical Performance Database, tested, and validated for fleet release. The effort will include updates to the MINEnet Global application as required. Additionally, complete Minefield Planning v1.1 software development. In FY21, the MIST project will develop a prototype for testing and feedback. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding level decreased due to overall reduction in program funding.					
Title: Engineering Support	2.395	4.128	2.789	0.000	2.789
Articles:	-	-	-	-	-
FY 2020 Plans: Provide system engineering technical management and execute necessary integrated logistics support and training tasks across the MEDAL EA family of systems, to support the lifecycle of the project. FY20 systems engineering tasks include analysis of requirements and design for MNT v1.4 updates to replace end-of-life COTS products, allocation of requirements to baseline, preparation of engineering change proposals to initiate development of MINEnet Tactical v1.4 capability, and configuration management to document changes to the baseline. Additionally, finalize MEDAL EA software performance specification and prepare for software functional review in FY21. Continue maintenance of integrated logistics and training documents and processes (e.g. LCSP, NTSP, DEMIL, Maintenance. and Obsolescence plans) to support ILS certification and to ensure fielded systems are supported. Execute system upgrades to fielded systems to ensure cybersecurity compliance. Perform MIW Integrated Synthetic Trainer (MIST) requirements analysis, draft software function					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and software requirements specification with sufficient detail to inform System Functional Review/System Requirements Review (SFR/SRR) and begin agile software development. ***FY 2021 Base Plans:*** Continue systems engineering technical management for MEDAL EA MINEnet Tactical v1.4 development, assess critical issues and manage process to incorporate fixes. Conduct requirements analysis, prepare engineering change proposals and conduct configuration management for Minefield Planning v1.1 software update. Perform system functional review for MEDAL EA. Conduct requirements analysis of overall MEDAL backlog, allocate requirements to future builds. Provide technical integration of developed algorithms and models that have demonstrated the required level of maturity for transition. In FY21, MIW Integrated Synthetic Trainer (MIST) systems engineering will support development and assessment of prototype capabilities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding level decreased due to overall reduction in program funding.					
Title: Test and Evaluation	0.620	1.041	0.930	0.000	0.930
Articles:	-	-	-	-	-
FY 2020 Plans: Continue system release candidate testing activities for each MEDAL version, continue integration and certification with host networks with multiple platforms including LCS MCM MPAS, ISNS, CANES, ONENET, NMCI. Continue Cybersecurity patching and assessments. ***FY 2021 Base Plans:*** Continue annual integration testing activities multiple platforms including LCS MCM MPAS, ISNS, CANES, ONENET, NMCI integration tests. Continue Cybersecurity patching and assessments. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Funding level remains consistent for MEDAL test and evaluation efforts.					
Title: Management Services	0.688	0.776	0.980	0.000	0.980
Articles:	-	-	-	-	-

FY 2020 Plans:
Continue to provide program management support and travel oversight for MEDAL program. Program management shall include overall technical guidance and leadership for the program. Oversight of financial and logistics efforts. Coordination with Navy and other DoD organizations as required to ensure successful execution of the program. Communicate and coordinate with other program office tasking to include briefings, demonstrations, project planning, and project status as required.

MIST project manager will provide program management leadership for the MIST project. develop project planning Program management shall include overall technical guidance and leadership for the program. Oversight of financial and logistics efforts. Coordination with Navy and other DoD organizations as required to ensure successful execution of the program. Communicate and coordinate with other program office tasking to include briefings, demonstrations, project planning, and project status as required.

FY 2021 Base Plans:
Continue to provide program management support and travel oversight for MEDAL program. Program management shall include overall technical guidance and leadership for the program. Oversight of financial and logistics efforts. Coordination with Navy and other DoD organizations as required to ensure successful execution of the program. Communicate and coordinate with other program office tasking to include briefings, demonstrations, project planning, and project status as required.

MIST project manager will provide program management leadership for the MIST project. Program management shall include overall technical guidance and leadership for the program. Oversight of financial and logistics efforts. Coordination with Navy and other DoD organizations as required to ensure successful execution of the program. Communicate and coordinate with other program office tasking to include briefings, demonstrations, project planning, and project status as required.

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increased funding in FY21 will support required management support to successfully field MEDAL EA.					
Accomplishments/Planned Programs Subtotals	7.637	10.763	9.292	0.000	9.292

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 2622/LV075: *Mine Sweeping Replacement (MEDAL).*	1.021	0.000	0.000	-	0.000	0.362	0.611	0.623	0.000	0.000	14.383

Remarks

D. Acquisition Strategy

Mine Warfare and Environmental Decision Aids Library (MEDAL) is U.S. Navy's single Mine Warfare (MIW) tactical decision support system for integrated mission planning, evaluation, and situational awareness. FY19 was the last year of the prime contract and the systems engineering and software development efforts will transition to government teams at the Naval Surface Warfare Center, Panama City Division (NSWC PCD), Panama City, FL. MEDAL is currently a pre-acquisition category IV-monitor program and plans to enter the acquisition process at Milestone B. MEDAL will follow the DoD acquisition model for incrementally deployed software-intensive systems.

The sole source prime contract completed on 30 Sept 2019. Software development will be accomplished by the Naval Surface Warfare Center Panama City Division, Panama City, FL from this point forward.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL EA	C/CPAF	SAIC : McLean, VA	1.336	1.574	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
MEDAL EA & MIW Integrated Synthetic Training (MIST)	SS/IDIQ	Various : Various	0.000	0.000		0.700	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Medal EA & MIW Integrated Synthetic Training (MIST)	WR	NSWC PCD : Panama City FL	0.000	2.360	Oct 2018	4.118	Oct 2019	4.593	Oct 2020	-		4.593	Continuing	Continuing	Continuing
		Subtotal	1.336	3.934		4.818		4.593		-		4.593	Continuing	Continuing	N/A

Remarks

FY 2017 and prior funding in Program Element (PE) 0603502N.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL EA & MIW Integrated Synthetic Training (MIST)	WR	NSWC PC : Panama City FL	0.423	2.395	Oct 2018	3.278	Oct 2019	2.789	Oct 2020	-		2.789	Continuing	Continuing	Continuing
MEDAL EA & MIW Integrated Synthetic Training (MIST)	C/IDDQ	TBD : TBD	0.000	0.000		0.850	Jun 2020	0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	0.423	2.395		4.128		2.789		-		2.789	Continuing	Continuing	N/A

Remarks

FY 2017 and prior funding in Program Element (PE) 0603502N.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL EA	C/CPAF	SAIC : McLean, VA	0.675	0.124	Oct 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL EA & MIW Integrated Synthetic Training (MIST)	WR	NSWC PCD : Panama City, FL	0.000	0.496	Oct 2018	1.041	Oct 2019	0.930	Oct 2020	-		0.930	Continuing	Continuing	Continuing
		Subtotal	0.675	0.620		1.041		0.930		-		0.930	Continuing	Continuing	N/A

Remarks

FY 2017 and prior funding in Program Element (PE) 0603502N.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MEDAL	WR	NSWC PC : Panama City Fl	0.608	0.688	Oct 2018	0.776	Oct 2019	0.980	Oct 2020	-		0.980	Continuing	Continuing	Continuing
		Subtotal	0.608	0.688		0.776		0.980		-		0.980	Continuing	Continuing	N/A

Remarks

FY 2017 and prior funding in Program Element (PE) 0603502N.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	3.042	7.637		10.763		9.292		-		9.292	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MEDAL				
Acquisition Milestones: Milestone B	2	2021	2	2021
System Development: MEDAL EA Development: MEDAL EA Minefield Planning (MP) Development	1	2019	2	2019
System Development: MEDAL EA Development: MEDAL EA Development MINENet Tactical V1.3	1	2019	1	2020
System Development: MEDAL EA Development: MEDAL EA Development MINENet Tactical V1.4	2	2020	4	2022
System Development: MEDAL EA Development: MEDAL EA Development MINENet Tactical V1.5	1	2023	4	2023
System Development: MEDAL EA Development: MEDAL EA Development MINENet Tactical V1.6	2	2024	2	2025
System Development: MEDAL EA Development: MEDAL EA Minefield Planning v1.1 (MFP) Development	1	2021	4	2021
System Development: MEDAL EA Development: MEDAL EA Minefield Planning v1.2 (MFP) Development	1	2024	2	2024
System Development: MEDAL EA Development: MEDAL EA MINENet Tactical v1.2 Training Development	2	2019	2	2020
System Development: MEDAL EA Development: MEDAL EA MINENet Tactical v1.3 Training Development	3	2020	2	2021
System Development: MEDAL EA Development: MEDAL EA MINENet Tactical v1.5 Training Development	2	2024	2	2025
System Development: MEDAL EA Development: MEDAL Tactical Performance Database update 1	3	2020	3	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
System Development: MEDAL EA Development: MEDAL Tactical Performance Database update 2	1	2021	1	2021
System Development: MEDAL EA Development: MEDAL Tactical Performance Database update 3	1	2022	1	2022
System Development: MEDAL EA Development: MEDAL Tactical Performance Database update 4	3	2022	3	2022
System Development: MEDAL EA Development: MEDAL Tactical Performance Database update 5	2	2023	2	2023
System Development: MEDAL EA Development: MEDAL EA Logistics: ILS Cert for ships 1	4	2019	4	2019
System Development: MEDAL EA Development: MEDAL EA Logistics: ILS Cert for ships 2	4	2020	4	2020
System Development: MIW Integrated Synthetic Training (MIST) Development: MIW Integrated Synthetic Training (MIST) Development V1.0	2	2020	1	2022
System Development: MIW Integrated Synthetic Training (MIST) Development: MIW Integrated Synthetic Training (MIST) Development V1.1	4	2022	1	2024
Test and Evaluation: MEDAL EA T&E: MEDAL EA MFP Test & Evaluation	3	2019	4	2019
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.3.0	3	2019	3	2019
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.3.1	2	2020	2	2020
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.4	1	2023	1	2023
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.5	1	2024	1	2024
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.6	2	2025	2	2025
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.7	2	2024	2	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Test and Evaluation: MEDAL EA T&E: MEDAL EA Test & Evaluation MINENet Tactical V1.8	2	2025	2	2025
Test and Evaluation: MEDAL EA T&E: MEDAL EA MFP v1.1 Test & Evaluation	1	2022	1	2022
Test and Evaluation: MEDAL EA T&E: MEDAL EA MFP v1.2 Test & Evaluation	2	2024	2	2024
Test and Evaluation: MEDAL EA T&E: MINEnet Tactical and CANES Integration Testing 1	3	2019	3	2019
Test and Evaluation: MEDAL EA T&E: MINEnet Tactical and NETC2 Integration Testing	4	2019	1	2020
Test and Evaluation: MEDAL EA T&E: MINEnet Tactical and ISNS Integration Testing	1	2020	2	2020
Test and Evaluation: MEDAL EA T&E: MINEnet Tactical and CANES Integration Testing 2	3	2020	3	2020
Test and Evaluation: MIW Integrated Synthetic Training (MIST) T&E: MIST Fleet Prototype Assessment Test and Evaluation	3	2021	3	2021
Test and Evaluation: MIW Integrated Synthetic Training (MIST) T&E: MIST Shore-Based Test Event 1	4	2022	4	2022
Test and Evaluation: MIW Integrated Synthetic Training (MIST) T&E: MIST Shore-based Test Event 2	3	2024	3	2024
Delivery Milestones: MEDAL EA Fielding: MEDAL EA MINENet Tactical V1.2.x Fielding	1	2019	2	2020
Delivery Milestones: MEDAL EA Fielding: MEDAL EA MFP V1.0 Fielding	4	2020	4	2020
Delivery Milestones: MEDAL EA Fielding: MEDAL EA Fielding MINENet Tactical V1.3	3	2020	2	2021
Delivery Milestones: MEDAL EA Fielding: MEDAL EA Fielding MINENet Tactical V1.4	2	2023	2	2024
Delivery Milestones: MEDAL EA Fielding: MEDAL EA Fielding MINENet Tactical V1.5	2	2024	2	2025
Delivery Milestones: MEDAL EA Fielding: MEDAL EA Fielding MINENet Tactical V1.6	4	2025	4	2025
Delivery Milestones: MEDAL EA Fielding: MEDAL EA MFP V1.1 Fielding	2	2022	2	2022
Delivery Milestones: MEDAL EA Fielding: MEDAL EA MFP V1.2.x Fielding	3	2024	3	2024

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604127N / *Surface Mine Countermeasures*	**Project (Number/Name)** 1235 / *Mine Warfare Planning and Analysis*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Delivery Milestones: MIW Integrated Synthetic Training (MIST) Fielding: MIST V1.0 Fielding	1	2023	3	2023
Delivery Milestones: MIW Integrated Synthetic Training (MIST) Fielding: MIST V1.1 Fielding	4	2024	1	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	48.243	45.853	58.449	59.776	-	59.776	49.056	37.339	36.970	37.711	Continuing	Continuing
3348: *DAIRCM Development*	48.243	45.853	58.449	59.776	-	59.776	49.056	37.339	36.970	37.711	Continuing	Continuing

A. Mission Description and Budget Item Justification

This element includes development of electronic warfare systems for the United States Navy (USN) and United States Marine Corps (USMC) assault aircraft. This includes the development and testing of advanced infrared countermeasures systems for emerging threats and emergency contingencies for Aircraft Survivability Equipment (ASE) suite integration. This program develops integrated hardware/software solutions that link on-board integrated Aircraft Survivability Equipment (iASE) with platform mission planning/information systems. IASE includes Infrared (IR), Hostile Fire Indication, and Laser Warning Sensors as well as Countermeasures Dispensing Systems (CMDS) and expendables. This program also adopts future multi-band, networking capabilities to facilitate real-time transfer of threat information, and off-board queuing and control of onboard sensors. DAIRCM studies and evaluates current and future aircraft threats, makes modeling and simulation for improved countermeasure capabilities, develops, tests and provides test equipment to address new and emerging threats. DAIRCM develops improved aircraft survivability of Department of Navy (DoN) assault aircraft in complex terrain for worldwide deployment.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	47.278	68.346	60.448	-	60.448
Current President's Budget	45.853	58.449	59.776	-	59.776
Total Adjustments	-1.425	-9.897	-0.672	-	-0.672
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-9.897			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.425	0.000			
• Program Adjustments	0.000	0.000	-0.652	-	-0.652
• Rate/Misc Adjustments	0.000	0.000	-0.020	-	-0.020

Change Summary Explanation

FY 2019 RDT&E funding completed JUONS testing and begin risk reduction efforts to incorporate lessons learned from the JUONs.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*

FY 2020 RDT&E to correct Joint Urgent Operational Need Statement (JUONS) testing deficiencies and award DAIRCM primary HW Development.

FY 2020 RDT&E Risk Reduction continues until Engineering & Manufacturing Development contract award (Changed 1QFY20 to 3QFY20). UH-1Y is the focus platform for initial development through Critical Design Review, leveraging risk reduction efforts to support integrating the system under glass. Concurrently developing interface controls and integration plans for platforms AH-1Z, MH-60S, and MH-60R to speed platform integration and test.

Summary of changes:
-DAIRCM Capability Development Document (CDD) extended to Q1 FY24 to align with entrance at acquisition post Milestone B (MS B); CDD finalized prior to MS C (1Q2024)
-DAIRCM MSC Decision updated from 2Q2023 to 3Q2024 due to delay in completion of JUONS and align with DAIRCM Engineering Manufacturing and Development (EMD) Contract Award (3Q2020)

The below schedule updates due to delay in completion of JUONS and align with DAIRCM EMD Contract Award:
-DAIRCM SRR 2 changed from 2Q2020-3Q2020 to 1Q2021-1Q2021
-DAIRCM SFR changed from 3Q2020-3Q2020 to 2Q2021-2Q2021
-DAIRCM PDR changed from 4Q2020-4Q2020 to 3Q2021-3Q2021
-DAIRCM CDR changed from 3Q2021-3Q2021 to 2Q2022-2Q2022
-DAIRCM H1 Integration Testing changed from 1Q2022-4Q2022 to 3Q2023-4Q2023
-Added DAIRCM Development Test 1Q2023-3Q2024
-DAIRCM TRR changed from 1Q2023-1Q2023 to 3Q2023-3Q2023
-DAIRCM Integrated Test & Evaluation changed from 1Q2023-4Q2024 to 3Q2023-1Q2025
-DAIRCM Operation Assessment changed from 4Q2024-4Q2024 to 2Q2025-2Q2025
-DAIRCM LRIP 1 Contract Award changed from 2Q2023-2Q2023 to 3Q2024-3Q2024
-Changed DAIRCM Risk Reduction Delivery Orders from Production Milestones to Systems Development and updates End to reflect second delivery order awarded in December 2019: changed 1Q2019-1Q2020 to 1Q2019-1Q2021.
-Changed DAIRCM Engineering Manufacturing and Development (EMD) Contract Award from Production Milestones to Systems Development and updated award date from 1Q2020-1Q2020 to 3Q2020-3Q2020.
-Added Engineering Development Model (EDM) and Production Representative Model (PRM) deliveries to schedule details.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3348: *DAIRCM Development*	48.243	45.853	58.449	59.776	-	59.776	49.056	37.339	36.970	37.711	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The AN/AAQ-45 Distributed Aperture Infrared Countermeasures (DAIRCM) system consists of three major components: Missile Warning Sensors, processor, and inexhaustible countermeasures. DAIRCM interfaces with the platform aircraft and provides signals to onboard Aircraft Survival Equipment (ASE). DAIRCM includes the development and testing of advanced infrared countermeasures systems for emerging threats and emergency contingencies for ASE suite integration. This program also adopts future multi-band, networking capabilities to facilitate real-time transfer of threat information, and off-board queuing and control of onboard sensors as well as studies and evaluations of current and future aircraft threats, modeling and simulation for improved countermeasure capabilities, and development and testing and test equipment to address new and emerging threats. The projects in this element improve the aircraft survivability of Department of Navy (DoN) assault aircraft in complex terrain for worldwide deployment.

FY 2019 RDT&E funding required to complete JUONS testing and began developing design considerations for the future DAIRCM solution. The Risk reduction efforts evaluated technical opportunities to reduce weight, increase effectiveness, determine suitability lessons learned from the JUONs approach options to improve situational awareness.

FY 2020 RDT&E funding required for resolution of JUONS test deficiencies, complete Quick Reaction Assessment and for continuation of the risk reduction to prepare for the contract award, development of the Government tracking software, development of (under glass) integrated hardware/software solutions that link on-board integrated Aircraft Survivability Equipment (iASE). DAIRCM Engineering and Manufacturing Development (EMD) Contract award in 3Q20 will start the preparation for System Requirements Review 2 and System Functional Review with the prime contractor. Continue studies and evaluations of current and future aircraft threats, modeling and simulation for improved countermeasure capabilities, and development and testing and test equipment to address new and emerging threats, which include sharing of testing opportunities within DoD.

FY21: Complete Preliminary Design Review. Development to support Critical Design Review(CDR) in 2Q2022. Initiate modeling and simulations to support CDR. Complete size, weight, and power analysis to support integration with platforms. Examine long lead Engineering Development Models (EDM) and Production Representative Models (PRM) supply sources to reduce supply risk for platform integration test and evaluation. Complete B-Kit preliminary development to support contractor developmental testing.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: DAIRCM Development	45.853	58.449	59.776	0.000	59.776
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Continue Risk Reduction efforts to support DAIRCM design reviews. Award EMD contract. Evolve functional specs into product documentation for H-1 A-Kits (Fiber Optic Cable Assembly) and DAIRCM B-Kits. Conduct H-1 size, weight, power cooling analysis to support integrated DAIRCM system. Demonstrate prototype DAIRCM under glass solution. ***FY 2021 Base Plans:*** Conduct H-1 size, weight, power cooling analysis to support integrated DAIRCM system. Demonstrate prototype DAIRCM under glass solution. Complete PDR. Update government software algorithm to support development and test. Evaluate DAIRCM supply chain and other logistics requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 - FY21 H-1 Operational Flight Program Development decreased to align with H-1 platform focus for DAIRCM development. FY20 - FY21 Increased Primary HW Dev DAIRCM.					
Accomplishments/Planned Programs Subtotals	45.853	58.449	59.776	0.000	59.776

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• APN/0576: *Assault DIRCM*	9.820	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	708.400	790.916

Remarks

D. Acquisition Strategy

The Distributed Aperture Infrared Countermeasures (DAIRCM) acquisition approach is a single step acquisition to full capability. It replaces existing AN/AAR-47 UV Threat Warning System - providing an inexhaustible countermeasure with improved 2-color IR Threat Warning system and growth capability to meet future design

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

improvements and combat advanced threats. It leverages JUONs capability, cooperation between Government laboratories and industry partners to grow into an integrated capability that meets the key performance parameters. DAIRCM contract strategy is to award a development cost contract in FY20; a separate LRIP contract Milestone C award planned 3QFY24.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary HW Dev JUONS	C/CPFF	DRS : Dallas, TX	19.445	30.069	Jan 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Primary HW Dev JUONS	C/CPFF	Daylight Solutions : San Diego, CA	7.417	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
H-60 Operational Flight Program Dev	C/CPFF	Lockheed Martin : Owego, NY	5.000	0.000		5.000	Mar 2020	0.000	Mar 2021	-		0.000	Continuing	Continuing	Continuing
H-1 Operational Flight Program Dev	C/CPFF	Northrop Grumman : Woodland Hills, CA	0.000	0.000		5.000	Mar 2020	2.000	Mar 2021	-		2.000	Continuing	Continuing	Continuing
Govt Eng Support	WR	NAWCAD : Patuxent River, MD	3.338	0.000		5.500	Oct 2019	5.500	Oct 2020	-		5.500	Continuing	Continuing	Continuing
Govt Eng Support	WR	FRC : Jacksonville, FL	0.549	0.000		0.123	Nov 2019	0.150	Nov 2020	-		0.150	Continuing	Continuing	Continuing
Govt Software Eng Support	WR	NAWCWD : PT Mugu	2.000	0.000		3.170	Nov 2019	3.201	Nov 2020	-		3.201	Continuing	Continuing	Continuing
Aircraft Integration	WR	FRC East : Cherry Point, NC	0.400	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Govt Software Eng Support	WR	NRL : Washington, DC	0.260	5.713	Jan 2019	1.385	Nov 2019	3.500	Nov 2020	-		3.500	Continuing	Continuing	Continuing
Govt Integrated Logistic Support	C/CPFF	ENGILITY : Chantilly, VA	0.000	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Primary HW Dev DAIRCM	C/CPFF	DRS Sysco : Melbourne, FL	0.000	0.000		31.003	Jun 2020	37.980	Sep 2021	-		37.980	Continuing	Continuing	Continuing
		Subtotal	38.409	35.782		51.181		52.331		-		52.331	Continuing	Continuing	N/A

Remarks

(1) FY20 Primary HW Dev JUONS (DRS: Dallas TX and Daylight Solutions: San Diego, CA) form a single business entity under DRS Sysco, Melbourne, FL for DAIRCM Primary HW Development; FY20 Risk Reduction Award of $3.798 in Dec 19; DAIRCM EMD Contract Award 3Q2020.
(2) FY20 Govt Software Eng Support (NAWCWD) increase to support under glass software requirements, design, and demonstration.
(3) FY21 Govt Software Eng Support (NRL) increased to support algorithm software support development test and platform integration.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Govt Integrated Logistic Support	WR	Fleet Readiness Depot : Jacksonville, FL	0.000	0.000		0.123	Oct 2019	0.150	Oct 2020	-		0.150	Continuing	Continuing	Continuing
Logistic Deliverables	SS/CPFF	RIAC : Ft Belvoir, VA	0.322	0.000		0.125	Nov 2019	0.150	Nov 2020	-		0.150	Continuing	Continuing	Continuing
ESOH support	WR	NAWC WD : China lake	0.123	0.000		0.000		0.000		-		0.000	0.000	0.123	-
Integrated Logistic Support	C/CPAF	Wyle Laboratories : Lexington Park, MD	0.300	0.000		0.000		0.000		-		0.000	0.000	0.300	0.300
Comercial Shipping TAC code	TBD	Various : Various	0.017	0.000		0.130	Nov 2019	0.150	Nov 2020	-		0.150	Continuing	Continuing	Continuing
ESOH Support	SS/CPFF	RIAC : Ft. Belvoir, VA	0.000	0.000		0.065	Nov 2019	0.070	Nov 2020	-		0.070	Continuing	Continuing	Continuing
Govt Integrated Logistics Support	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.555	Oct 2019	0.600	Oct 2020	-		0.600	Continuing	Continuing	Continuing
		Subtotal	0.762	0.000		0.998		1.120		-		1.120	Continuing	Continuing	N/A

Remarks

(1) FY20 - FY21 Support lines increase to support design reviews, test, and integration for EDM design.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Govt T&E Support	WR	NAWCAD : Patuxent River, MD	0.865	7.558	Dec 2018	1.999	Oct 2019	1.900	Oct 2020	-		1.900	Continuing	Continuing	Continuing
Govt T&E Support	WR	NAWCWD : China Lake, CA	0.000	0.019	Nov 2018	0.216	Nov 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
Flight Test/Live Fire	WR	USA DPG : Various	0.000	0.798	Mar 2019	0.405	Mar 2020	0.200	Mar 2021	-		0.200	Continuing	Continuing	Continuing
T& E Support	C/CPFF	GWEF : Eglin AFB, FL	0.826	0.359	Feb 2019	0.100	Feb 2020	0.200	Feb 2021	-		0.200	Continuing	Continuing	Continuing
Govt T&E Support	WR	COTF : Norfolk, VA	0.100	0.893	Jun 2019	0.208	Nov 2019	0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
Govt T&E Support	WR	CRANE : CRANE	0.350	0.350	Jun 2019	0.500	Jan 2020	0.350	Jan 2021	-		0.350	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
OCO Flight & Live Fire Test	WR	Various : Various	2.877	0.000		0.000		0.000		-		0.000	0.000	2.877	Continuing
OCO Govt T&E Support	WR	Vasrious : Various	2.370	0.000		0.000		0.000		-		0.000	0.000	2.370	0.450
		Subtotal	7.388	9.977		3.428		3.150		-		3.150	Continuing	Continuing	N/A

Remarks

(1) FY20 - Govt T&E Support (NAWCAD, Patuxent River, MD) increase to correspond to development schedule reviews, test and integration.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Mgmt Support	C/CPFF	Amelex : California, MD	0.000	0.000		0.500	Oct 2019	0.550	Oct 2020	-		0.550	Continuing	Continuing	Continuing
Contractor Eng Support	C/CPFF	Engility : Lexington Park, MD	0.864	0.000		0.711	Oct 2019	0.750	Oct 2020	-		0.750	Continuing	Continuing	Continuing
Travel	WR	NAVAIR Various : Patuxent River, MD	0.119	0.094	Oct 2018	0.308	Oct 2019	0.350	Oct 2020	-		0.350	Continuing	Continuing	Continuing
Govt PM support	WR	NAWCAD : Patuxent River, MD	0.499	0.000		1.090	Oct 2019	1.250	Oct 2020	-		1.250	Continuing	Continuing	Continuing
Govt Eng Support	WR	NSWC : Dahlgren, VA	0.014	0.000		0.020	Nov 2019	0.025	Nov 2020	-		0.025	Continuing	Continuing	Continuing
Eng Support	C/CPFF	DCS : Bethesda, MD	0.188	0.000		0.213	Feb 2020	0.250	Feb 2021	-		0.250	Continuing	Continuing	Continuing
		Subtotal	1.684	0.094		2.842		3.175		-		3.175	Continuing	Continuing	N/A

Remarks

FY20 - FY21 Govt PM support (NAWCAD) increase to correspond to management to design reviews, test and integration and to support Earned Value Management.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	48.243	45.853		58.449		59.776		-		59.776	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604272N / *Tact Air Dir Infrared CM (TADIRCM)*	**Project (Number/Name)** 3348 / *DAIRCM Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
DAIRCM				
Acquisition Milestones: DAIRCM Capability Development Document (CDD): Schedule Detail	4	2020	4	2020
Acquisition Milestones: DAIRCM MSC Decision: Schedule Detail	3	2024	3	2024
Systems Development: DAIRCM SRR 2: Schedule Detail	1	2021	1	2021
Systems Development: DAIRCM SFR: Schedule Detail	2	2021	2	2021
Systems Development: DAIRCM PDR: Schedule Detail	3	2021	3	2021
Systems Development: DAIRCM CDR: Schedule Detail	2	2022	2	2022
Systems Development: DAIRCM Risk Reduction BOA: Schedule Detail	1	2019	4	2020
Systems Development: DAIRCM Engineering Manufacturing and Development (EMD) Contract Award: Schedule Detail	3	2020	3	2020
Test and Evaluation: DAIRCM Development Test: Schedule Detail	1	2023	3	2024
Test and Evaluation: DAIRCM Integrated Test & Evaluation: Schedule Detail	3	2023	1	2025
Test and Evaluation: DAIRCM Operation Assessment: Schedule Detail	2	2025	2	2025
Production Milestones: DAIRCM LRIP 1 Contract Award: Schedule Detail	3	2024	3	2024
Deliveries: EMD Hardware Deliveries: Schedule Detail	1	2023	3	2023
Deliveries: Production Representatives Models (PRMS): Schedule Detail	1	2024	1	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	5.890	19.420	0.000	-	0.000	1.257	8.224	7.455	8.726	Continuing	Continuing
2741: *Additive Manufacturing*	0.000	5.890	1.971	0.000	-	0.000	1.257	3.268	2.399	3.569	Continuing	Continuing
2743: *Next Generation Logistics (NexLog)*	0.000	0.000	2.449	0.000	-	0.000	0.000	4.956	5.056	5.157	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000

Note

In FY 2019 efforts in this PE transferred from PE 0604286M.

A. Mission Description and Budget Item Justification

This program element supports cost associated with the research and development of Marine Corps Systems Command policy, acquisition process modifications, and prototyping to support the USMC Additive Manufacturing (AM) Initiative.

The USMC Additive Manufacturing Initiative is an initiative intended to give Marine units access to additive manufacturing techniques to allow them the opportunity to exercise innovation in the resolution of issues affecting unit combat readiness. This PE will support of the development of procedures to enable the approval and manufacturing of items requested from Marines. This involves the development of Marine Corps Policy, an approval process, engineering analysis and testing, establishment of facilities to produce prototype additive manufactured parts and development of training to support the Marine Corps use of additive manufacturing. This initiative incorporates development of strategic partnerships with other DoN Systems Commands and field activities to develop DoN standards, processes and other associated acquisition activities to support future use of additive manufacturing in DoN acquisition and readiness areas.

The Next Generation Logistics (NexLog) project supports cost associated with the research and development, experimentation and limited, rapid fielding of emerging logistics capabilities necessary to enable the Fleet Marine Forces to execute the Marine Corps Operating Concept and inform logistics policies. These emerging logistics capabilities include development of autonomous ground, surface and sub-surface materiel distribution systems; development of operational and tactical, in-field digital fabrication capabilities; and, the development of sensor-driven logistics information technology. This element also supports development of strategic partnerships with DoN Systems Commands and field activities in order to leverage their capabilities and align DoN standards and processes, while furthering the use of additive manufacturing, and other emerging logistics technologies, to increase warfighter readiness, capability, survivability and effectiveness.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	6.073	4.420	9.972	-	9.972
Current President's Budget	5.890	19.420	0.000	-	0.000
Total Adjustments	-0.183	15.000	-9.972	-	-9.972
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.067	0.000			
• SBIR/STTR Transfer	-0.116	0.000			
• Program Adjustments	0.000	0.000	-1.000	-	-1.000
• Rate/Misc Adjustments	0.000	0.000	-8.972	-	-8.972

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Construction robotics*	0.000	5.000
Congressional Add: *Large-scale 3D printing robotic system*	0.000	10.000
Congressional Add Subtotals for Project: 9999	0.000	15.000
Congressional Add Totals for all Projects	0.000	15.000

Change Summary Explanation

The FY 2021 funding request was reduced by $2.096M to account for the availability of prior year execution balances.

The decrease of $19.420M from FY 2020 to FY 2021 is primarily due to FY20 congressional adds for Construction robotics and Large-scale 3D printing robotic system efforts. Decrease also reflects the completion of Unmanned Logistics System (ULS) development projects and Data Driven Logistics Sensor Driven Logistic efforts.

Funding in this line item has been reprioritized while ensuring the Marine Corps continues to evolve toward a Force that is aligned with the National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2741: *Additive Manufacturing*	0.000	5.890	1.971	0.000	-	0.000	1.257	3.268	2.399	3.569	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports costs associated with the research and development of Marine Corps Systems Command policy, acquisition process modifications, prototyping, and future logistics innovations to support the USMC Additive Manufacturing (AM) Initiative under the direction of Deputy Commandant Installations & Logistics. This PE is the DoD's sole investment in the 3D printing of buildings, bridges and metal landing crafts and other large scale constructs. The USMC Additive Manufacturing Initiative is an initiative intended to give Marine units access to additive manufacturing techniques to allow them the opportunity to exercise innovation in the resolution of issues affecting unit combat readiness.

This effort supports the development of procedures to enable the approval and manufacturing of items requested from Marines. This involves the development of Marine Corps Policy, an approval process, engineering analysis and testing, establishment of facilities to produce prototype additive manufactured parts and development of training to support the Marine Corps use of additive manufacturing. This initiative incorporates development of strategic partnerships with other DoN Systems Commands and field activities to develop DoN standards, processes and other associated acquisition activities to support future use of additive manufacturing in DoN acquisition and readiness areas.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Additive Manufacturing	5.890	1.971	0.000	0.000	0.000
Articles:	-	-	-	-	-

FY 2020 Plans:
- Complete efforts to identify and develop Additive Manufacturing (AM) requirements, verification methods, and technical data needed to acquire AM manufactured components.
- Complete fabrication of prototype hardware, fixtures, and jigs that facilitate design processes and procedures for test and performance verification.
- Complete system engineering efforts to identify and develop AM fabrication requirements, field repair procedures, and technical data needed to effectively repair AM manufactured components.
- Complete prototype testing to verify component design and reliability attributes.
- Complete certification studies to assess potential performance/integration issues with expeditionary repaired AM parts.

FY 2021 Base Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $1.971M from FY20 to FY21 reflects the completion of the system engineering efforts to identify and develop AM fabrication requirements. Funding in this line item has been reprioritized while ensuring the Marine Corps continues to evolve toward a Force that is aligned with the National Defense Strategy.					
Accomplishments/Planned Programs Subtotals	5.890	1.971	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The AM program utilizes a non-traditional acquisition strategy, due to AM being a set of enabling technologies vice a conventional platform for milestone-driven acquisition. It will incorporate strategic partnerships with other DoN activities, as well as the Joint Staff and services. For that reason, these AM investments are designed to explore future capabilities where AM may resolve gaps in logistical readiness, provide a warfighting solutions, and to mitigate AM-related risk within existing programs of record.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AM Guidebook development	MIPR	NSWC : Dahlgren, VA	0.000	0.200	Feb 2019	0.100	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
AM Guidebook development	MIPR	NAVSEA/PSU-ARL : State College, PA	0.000	0.350	Feb 2019	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
AM Guidebook development	MIPR	NSWC : Carderock, MD	0.000	0.250	Mar 2019	0.000		0.000		-		0.000	0.000	0.250	-
AM Training Material	MIPR	JHU-APL : Carderock, MD	0.000	0.250	Mar 2019	0.200	Feb 2020	0.000		-		0.000	0.000	0.450	-
AM Technical Data Package Development	MIPR	NAVAIR : Pax River, MD	0.000	0.100	Feb 2019	0.100	Mar 2020	0.000		-		0.000	0.000	0.200	-
AM Process Qualification and Certification	MIPR	Army/ERDC : Vicksburg, MS	0.000	0.400	Feb 2019	0.000		0.000		-		0.000	0.000	0.400	-
AM Prototype Parts and Redesign	MIPR	Army/ERDC : Vicksburg, MS	0.000	0.400	Mar 2019	0.200	Feb 2020	0.000		-		0.000	0.000	0.600	-
AM Develop USMC Fleet Wide Repository	MIPR	NIWC-Pacific : San Diego, CA	0.000	0.250	Feb 2019	0.100	Mar 2020	0.000		-		0.000	0.000	0.350	-
AM Expeditionary Laboratory and Training Facility	Various	NAWC : Orlando, FL	0.000	0.638	Feb 2019	0.200	Mar 2020	0.000		-		0.000	0.000	0.838	-
AM Structure Design	MIPR	Army/ERDC : Vicksburg, MS	0.000	0.500	Feb 2019	0.190	Mar 2020	0.000		-		0.000	0.000	0.690	-
AM 3D printing of littoral ship to shore	RO	NIWC-Pacific : San Diego, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
AM Development of Aluminum Group 4 UAS	RO	NIWC-Pacific : San Diego, CA	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
		Subtotal	0.000	3.338		1.090		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

The AM program utilizes a non-traditional acquisition strategy, due to AM being a set of enabling technologies vice a conventional platform for milestone-driven acquisition. The funding distribution above reflects research and development efforts for additive manufacturing enabling technologies.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AM Identification of Legacy Part	C/FFP	GE : Columbus, OH	0.000	0.250	Mar 2019	0.000		0.000		-		0.000	0.000	0.250	-
AM Identification of New Part	MIPR	JHU-APL : Columbia, MD	0.000	0.400	Feb 2019	0.200	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing
AM Identify Cases for Prototypes	MIPR	NSWC : Dahlgren, VA	0.000	0.300	Mar 2019	0.200	Apr 2020	0.000		-		0.000	0.000	0.500	-
AM Program Acquisition Strategy and Sustainment	MIPR	NAVSEA : Navy Yard, Washington DC	0.000	0.702	Feb 2019	0.200	Feb 2020	0.000		-		0.000	0.000	0.902	-
AM Research Advances 3D Printer Technology	MIPR	NSWC-CD : Carderock, MD	0.000	0.250	Feb 2019	0.150	Jan 2020	0.000		-		0.000	0.000	0.400	-
AM Identification Advanced Prototyping Lab/ Workspace	MIPR	NAVSEA : Navy Yard, Washington DC	0.000	0.600	Feb 2019	0.100	Jan 2020	0.000		-		0.000	0.000	0.700	-
Travel	Various	Various : Various	0.000	0.050	Jan 2019	0.031	Jan 2020	0.000		-		0.000	0.000	0.081	-
		Subtotal	0.000	2.552		0.881		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

The AM program utilizes a non-traditional acquisition strategy, due to AM being a set of enabling technologies vice a conventional platform for milestone-driven acquisition. The funding distribution above reflects research and development efforts for additive manufacturing enabling technologies.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	5.890		1.971		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*

Proj 2741

2021PB - 0604289M - 2741

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2741 / *Additive Manufacturing*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2741				
Laboratory and Training Facility	2	2019	2	2021
Guidebook development	2	2019	2	2021
Training Material	3	2019	2	2021
Technical Data Package Development	2	2019	2	2021
Develop USMC Fleet Wide Repository	2	2019	2	2021
Structure Design	2	2019	2	2021
Research Advances 3D Printer Technology	2	2019	2	2021
Advanced Prototyping Lab/Workspace	2	2019	2	2021
AM Prototype Parts and Redesign	2	2019	2	2021
Identify Cases for Prototypes	2	2019	3	2021
Program Acquisition Strategy	2	2019	2	2021
Process Qualification and Certification	2	2019	2	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*				**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2743: *Next Generation Logistics (NexLog)*	0.000	0.000	2.449	0.000	-	0.000	0.000	4.956	5.056	5.157	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This is a new Project in FY 2020.

A. Mission Description and Budget Item Justification

The Next Generation Logistics (NexLog) project supports costs associated with the research and development, experimentation and limited, rapid fielding of emerging logistics capabilities necessary to enable the Fleet Marine Forces to execute the Marine Corps Operating Concept and inform logistics policies. These emerging logistics capabilities include, but are not limited to, the development of intelligent distribution systems such autonomous Unmanned Logistics System (ULS) operating in the ground, air, surface and sub-surface domains. The development of enabling technologies that will increase the speed needed to detect an impending support requirement as well as the speed of response to satisfy that requirement. This involves the deployment of sensor technologies, collection of clean, properly tagged data, and the ability to electronically mine and monitor that sensor data for anomalies and micro-patterns that will provide logistics intelligence augmentation, thereby increasing Marine Air-Ground Task Force (MAGTF) lethality.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Unmanned Logistics Systems	0.000	1.199	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This Unmanned Logistics System (ULS) thrust area directly supports DoD and USMC directed innovation efforts that enable critical and emerging operational efforts to include Expeditionary Advance Basing Operations (EABO) and Littoral Operations in a Constrained Environment (LOCE). The current and emerging projects in this thrust area also better enable speed and Operating Force lethality while reducing MAGTF risk and acting as a force multiplier. ULS capabilities also lightens the MAGTF loads, and allows commanders to control the timing of delivery of mission critical, time sensitive supplies and equipment. Specifically, this project thrust area explores a number of promising Joint and OSD coordinated projects to include, but not limited to Unmanned Logistics Systems in the Surface, Ground, Air and Sub-Surface domains. ***FY 2020 Plans:*** - Initiate and complete ULS-Ground development projects that include development of unmanned electric vehicles that have an ever increasing range, high payload capacity and are ruggedized for use in support of combat scenarios. Also, in the ULS-Ground domain are projects that explore emerging capabilities that can be applied to current inventory assets through autonomous applique kits.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Initiate and complete ULS-Surface include Pipefish, which fills the bulk fuel supply, mobility, and distribution gaps between large tankers and requirements at the points of need both at sea and ashore at a low operating cost and risk level. - Initiate and complete ULS-Surface projects including the Autonomous Littoral Connector, which provides a low cost autonomous resupply platform utilizing legacy LCM-8 landing craft integrated with autonomous technology being utilized on the Sea Hunter program, delivering critical supplies to the Operating Forces at a significantly reduced risk while increasing the force's reach. - Initiate and complete exploration of numerous ULS-Air domain projects to included ULS-Air Small, Medium and Large Platforms that help explore autonomous technologies emerging from industry and the DoD Lab environment to provide an organic, highly autonomous, aerial distribution capability within sustainment and maneuver units. ULS-Air provides rapid, responsive, and flexible sustainment options in support of dispersed and semi-independent operations critical to the most likely future operating environment. - Initiate and complete exploration into other autonomous enabling capabilities to include artificial intelligence, sensing capability, autonomic response and integrated fast turn, emerging commercial technologies. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 funding decreased by $1.199M. Funding in this project has been reprioritized while ensuring the Marine Corps continues to evolve toward a Force that is aligned with the National Defense Strategy.					
Title: Data Driven Logistics Autonomous Learning and Innovation	0.000	1.250	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This Data Driven Logistics (D2L) thrust area directly supports DoD and USMC directed innovation efforts that enable critical and emerging operational efforts to include Expeditionary Advance Basing Operations (EABO) and Littoral Operations in a Constrained Environment (LOCE). The current and emerging projects in this thrust area also better enable speed and Operating Force lethality while reducing MAGTF risk and ensuring					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
increased artificial intelligence, augmented reality integration, improved command and control, focused analytics, greater data accuracy and more responsive processes. ***FY 2020 Plans:*** - Initiate and complete the Support Data Driven Logistic Sensor Driven Logistic Projects such as Joint Operational Energy Command and Control (JOEC2), shot round counter and the Personal Combat Assistant and Reporting Device (PCARD) system, whose development may ultimately provide sensored technologies at the tactical edge. Additionally, JOEC2 and shot round counter enables supply monitoring of battlefield consumption rates for ammunition and bulk fuel accountability, visibility, and energy command and control from the tactical edge to the enterprise, providing logistical information in real-time from the individual Marine through the highest echelon, enabling logistics units to be proactive vice reactive in the provision of needed sustainment. These emerging capabilities help to create a central hub for data that permits the application of analytical and data-driven algorithms that can have operational and strategic affects with future efforts that may be leveraged by fires, medical, and drones. - Initiate and complete other D2L efforts include sensor driven logistics, augmented reality, logistics artificial intelligence pilots and condition based maintenance efforts meant to increase predictive maintenance, focus resources and provide assets at the critical points to avoid backlogs and Operating Force burdens. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 funding decreased by $1.250M. Funding in this project has been reprioritized while ensuring the Marine Corps continues to evolve toward a Force that is aligned with the National Defense Strategy.					
Accomplishments/Planned Programs Subtotals	0.000	2.449	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

D. Acquisition Strategy

NexLog will incorporate strategic partnerships with other DoN activities, as well as the Joint Staff and services. For that reason, these investments are designed to explore future capabilities that may resolve gaps in logistical readiness, provide warfighting solutions, and mitigate Log-related risk within existing programs of record. Ensure the USMC can meet the logistics challenges of future operating environments.

-Accelerate measurable transition outcomes
-Grow logistics innovation network and partnerships
-Promote warfighter-driven logistics innovation
-Mature the innovation skillset

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ULS-Ground	MIPR	TBD : TBD	0.000	0.000		0.349	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Data Driven Logistic Sensor Driven Logistic Projects	MIPR	TBD : TBD	0.000	0.000		0.600	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Data Driven Logistics Asset Management/ Inventory Security Projects	MIPR	TBD : TBD	0.000	0.000		0.300	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Data Driven Logistics Artificial Intelligence, and Capabilities Based Mainenance	MIPR	TBD : TBD	0.000	0.000		0.350	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Travel	Various	TBD : TBD	0.000	0.000		0.050	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
ULS - Air	MIPR	TBD : TBD	0.000	0.000		0.800	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		2.449		0.000		-		0.000	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		2.449		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 2743 / *Next Generation Logistics (NexLog)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2743				
NEXTLOG: Data Driven Logistics	2	2020	2	2021
NEXTLOG: Unmanned Logistics Systems Ground	2	2020	2	2021
NEXTLOG: Unmanned Logistics Systems Air	2	2020	2	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*				**Project (Number/Name)** 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports the costs associated with the research and development of expeditionary logistics capabilities such as the Expeditionary Fabrication (XFAB) Facility and Tactical Fabrication (TACFAB) suite in support of Expeditionary Advanced Base Operations and Distributed Operations. The project supports the investment to develop the digital infrastructure required to support the implementation of 3D printing; the 3D printing of expeditionary capabilities such as buildings, bridges, ship-to-shore landing crafts and other large scale constructs; the characterization of material that can be used for repair parts and potential feedstock to include the use of discarded materials on the battlefield; engineering analysis and testing; and innovation/problem solving training to enable Marines to leverage advanced manufacturing technologies. The Expeditionary Logistics Initiative will give Marine units access to additive manufacturing techniques to allow them the opportunity to exercise innovation to resolve issues affecting unit combat readiness in austere environments. This effort supports the development of procedures to enable the approval and manufacturing of items requested from Marines and incorporates the development of strategic partnerships with other DoN Systems Commands and field activities to exploit additive manufacturing technologies in support of our Naval Forces.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2019**	**FY 2020**
Congressional Add: Construction robotics ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** -Initiate efforts to develop a prototype large-scale expendable landing crafts, perform construction structure design, and conduct construction material development research.	0.000	5.000
Congressional Add: Large-scale 3D printing robotic system ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** -Initiate efforts to develop a large-scale robotic mobile manufacturing system prototype capable of 3D printing large objects and structures in expeditionary/austere environments, develop the digital infrastructure required to share the technical data needed to exploit AM technologies in garrison and deployed environments, and provide support to Marine units employing 3D technologies in varying battlefield environments.	0.000	10.000
Congressional Adds Subtotals	0.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

The AM program utilizes a non-traditional acquisition strategy, due to AM being a set of enabling technologies vice a conventional platform for milestone-driven acquisition. It incorporates strategic partnerships with other DoN activities, as well as the Joint Staff, other Services, and government laboratories. For that reason, these AM investments are designed to explore future capabilities where AM may resolve gaps in logistical readiness, provide warfighting solutions, establish the digital infrastructure required to share the technical data required to exploit AM across the DoD, and to mitigate AM-related risk within existing programs of record.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AM Large-Scale Expendable landing craft - CR	C/FFP	NIWC PAC : San Diego, CA	0.000	0.000		1.540	Mar 2020	0.000		-		0.000	0.000	1.540	-
AM Construction Structure Design - CR	WR	Army / ERDC : Vicksburg, MS	0.000	0.000		0.500	Mar 2020	0.000		-		0.000	0.000	0.500	-
AM Construction Materiel Development Research - CR	C/FFP	DIU / WHS : Washington, DC	0.000	0.000		1.500	Mar 2020	0.000		-		0.000	0.000	1.500	-
AM Ship-to-shore landing craft (refueler variant) - CR	C/FFP	NIWC PAC : San Diego, CA	0.000	0.000		0.535	Sep 2020	0.000		-		0.000	0.000	0.535	-
AM Mobile Recycling Facility - RS	WR	ARL : Aberdeen, MD	0.000	0.000		0.200	May 2020	0.000		-		0.000	0.000	0.200	-
Mobile Large-Scale Additive Manufacturing System - RS	C/FFP	NIWC PAC : San Diego, CA	0.000	0.000		5.000	Jun 2020	0.000		-		0.000	0.000	5.000	-
Develop USMC Digital Repository - RS	WR	NIWC PAC : San Diego, CA	0.000	0.000		2.000	Jun 2020	0.000		-		0.000	0.000	2.000	-
AM Expeditionary Battlefield Decoys - RS	TBD	TBD : TBD	0.000	0.000		0.200	Aug 2020	0.000		-		0.000	0.000	0.200	-
Digital Repository - MBE Environment - RS	C/FFP	NAWC-TSD : Orlando, FL	0.000	0.000		0.500	Sep 2020	0.000		-		0.000	0.000	0.500	-
		Subtotal	0.000	0.000		11.975		0.000		-		0.000	0.000	11.975	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Ship-to-Shore landing craft modeling and simulation - CR	MIPR	DTIC : TBD	0.000	0.000		0.500	Jul 2020	0.000		-		0.000	0.000	0.500	-
Digital Repository - DLA JAMMEX - RS	Reqn	DTIC : Omaha, NB	0.000	0.000		0.250	Sep 2020	0.000		-		0.000	0.000	0.250	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 9999 / *Congressional Adds*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Interim Digital Repository - RS	Reqn	NIWC Lant : Charleston, SC	0.000	0.000		0.300	Sep 2020	0.000		-		0.000	0.000	0.300	-
AM Fleet Support - 3D printing, construction, and Ship-to-Shore connectors - RS	WR	NIWC PAC : San Diego, CA	0.000	0.000		0.250	Sep 2020	0.000		-		0.000	0.000	0.250	-
AM Fleet Support - 3D printing training and integration - RS	WR	NSWC CD : Carderock, MD	0.000	0.000		0.400	Sep 2020	0.000		-		0.000	0.000	0.400	-
AM Fleet Support - Materiel characterization and prototype eval - RS	Reqn	NAVSEA : Washington, DC	0.000	0.000		0.250	Sep 2020	0.000		-		0.000	0.000	0.250	-
AM Identification Advanced Prototyping Lab/ Workspace - RS	MIPR	DTIC : TBD	0.000	0.000		0.150	Sep 2020	0.000		-		0.000	0.000	0.150	-
		Subtotal	0.000	0.000		2.100		0.000		-		0.000	0.000	2.100	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AM Large-Scale Expendable landing craft - CR	C/FFP	NIWC PAC : San Diego, CA	0.000	0.000		0.425	Sep 2020	0.000		-		0.000	0.000	0.425	-
Mobile Large-Scale Additive Manufacturing System - RS	WR	Army / ERDC : Vicksburg, MS	0.000	0.000		0.500	Jun 2020	0.000		-		0.000	0.000	0.500	-
		Subtotal	0.000	0.000		0.925		0.000		-		0.000	0.000	0.925	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		15.000		0.000		-		0.000	0.000	15.000	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604289M / *(U)Expeditionary Logistics*	Project (Number/Name) 9999 / *Congressional Adds*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604289M / *(U)Expeditionary Logistics*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
Construction Robotic: Large-Scale Expendable	2	2020	2	2021
Construction Robotic: AM Construction	2	2020	2	2021
Construction Robotic: AM Ship-to-shore	4	2020	3	2021
Large-scale 3D printing robotic system: AM Mobile System	3	2020	3	2021
Large-scale 3D printing robotic system: USMC Digital Repository	3	2020	3	2021
Large-scale 3D printing robotic system: AM Fleet Support	4	2020	4	2021
Large-scale 3D printing robotic system: AM Expeditionary Battlefield Decoys	4	2020	4	2021
Large-scale 3D printing robotic system: AM Identification Advanced Prototyping	4	2020	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	0.000	5.097	-	5.097	10.197	0.000	0.000	0.000	0.000	15.294
2940: *Future Vertical Lift (Maritime Strike)*	0.000	0.000	0.000	5.097	-	5.097	10.197	0.000	0.000	0.000	0.000	15.294

Note

This is a new Program Element (PE) in FY 2021.

A. Mission Description and Budget Item Justification

Future Vertical Lift (Maritime Strike) (FVL (MS)) directs a Naval Aviation initiative to close key warfighting gaps and recapitalize capabilities lost when legacy rotary wing platforms (MQ-8C, MH-60S, and MH-60R) reach service-life limits beginning in the late 2020s. The FVL (MS) program will develop and field more capable, maintainable and reliable manned and unmanned rotorcraft systems to meet the needs of the Navy. FVL (MS) will be a key component of Distributed Maritime Operations (DMO) which will add warfighting capabilities in long-range Intelligence, Surveillance, Reconnaissance, and Targeting (ISR&T), Surface Warfare, Undersea Warfare (Anti-Submarine Warfare and Mine Warfare), Air Warfare, Electronic Warfare, Naval Special Warfare, Personnel Recovery, Patient Movement, Humanitarian Assistance/ Disaster Relief and Combat Logistics.

The activities conducted under this program will contribute to the acquisition documentation required to support a Milestone A (MS-A) decision and enable Technology Maturation and Risk Reduction (TMRR) key activities. These efforts will enable timely development of a system that provides best value and capability to the warfighter while maintaining effective and efficient war fighting capability in support of the Navy's 30-year Aviation Plan.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	5.097	-	5.097
Total Adjustments	0.000	0.000	5.097	-	5.097
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	5.097	-	5.097

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*

Change Summary Explanation

Technical: Not applicable.

Schedule: Added FVL (MS) Analysis of Alternatives (AoA) Study to assess the technical feasibility with the intent to develop the next generation of Naval rotary wing aircraft family of systems.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*	**Project (Number/Name)** 2940 / *Future Vertical Lift (Maritime Strike)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2940: *Future Vertical Lift (Maritime Strike)*	0.000	0.000	0.000	5.097	-	5.097	10.197	0.000	0.000	0.000	0.000	15.294
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This is a new Project Unit (PU) in FY 2021.

A. Mission Description and Budget Item Justification

The Future Vertical Lift (Maritime Strike)(FVL (MS)) project directs developmental activities in support of the replacement of the current inventory of Navy helicopters in the 2030+ timeframe. Specific development activities required for FVL (MS) include: capability requirements definition, documentation, and validation; Analysis of Alternatives (AoA) planning and execution including AoA Study Guidance and Study Plan preparation); completion of affordability studies; establishment of the appropriate security environment (e.g. computers, facilities, and administration); production of an Acquisition Strategy (AS), Life Cycle Cost Estimate (LCCE), Life Cycle Support Plan (LCSP), Systems Engineering Plan (SEP), and Draft Capability Development Document (CDD); Request for Proposal (RFP) development: acquisition documentation; risk reduction initiatives; design trade studies; and support to joint FVL, including open hardware and software reference and objective architectures definition, mission system interoperability, and shipboard compatibility. These activities will result in completion of all acquisition documentation required for Milestone-A in FY 2024. Follow-on activities support preparation and execution of efforts to develop common systems reference and objective open architectures, and eventual prototype aircraft flight demonstrations in support of the FVL Technology Maturation and Risk Reduction acquisition phase. Activities and technologies developed also have the potential to be leveraged for sustainment of legacy Navy helicopters. These efforts will enable timely development of a system that provides best value and capability to the Joint Warfighter while maintaining effective and efficient war fighting capability in support of the Navy's 30 year Aviation Plan.

FY 2021 budget request funds the initial support for FVL (MS) AoA to assess the technical feasibility, technical risk, and affordability of potential strategic solutions with the intent to develop the next generation of Naval rotary wing aircraft systems. Tasks to be performed include but are not limited to: AoA support, acquisition program management functions, establishment of the security environment, engineering modeling and analysis, TEMP development, system specification and Draft CDD development and design trade studies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: FVL (MS) Requirements Definition and Acquistion Documentation	0.000	0.000	5.097	0.000	5.097
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*	**Project (Number/Name)** 2940 / *Future Vertical Lift (Maritime Strike)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Provide initial support for FVL (MS) AoA to assess the technical feasibility, technical risk, and affordability of potential strategic solutions with the intent to develop the next generation of Naval rotary wing aircraft systems. Tasks to be informed include: AoA support, acquisition program management functions, establishment of the security environment, engineering modeling and analysis, TEMP development, system specification and Draft CDD development, and design trade studies. Support for these efforts will come from government, industry, and academia. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increase of $5.097M for FVL (MS) AoA that was not previously funded.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	5.097	0.000	5.097

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Provide research and development support for pre-milestone A activities to enable replacement of the Navy H-60 and MQ-8 series helicopters, multi-mission helicopter capability, in the 2030+ timeframe.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*	**Project (Number/Name)** 2940 / *Future Vertical Lift (Maritime Strike)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NAWC AD : Patuxent River, MD	0.000	0.000		0.000		3.300	Oct 2020	-		3.300	3.795	7.095	-
Trade Studies/ Requirements Analysis	Various	Various : Various	0.000	0.000		0.000		1.502	Dec 2020	-		1.502	5.100	6.602	-
		Subtotal	0.000	0.000		0.000		4.802		-		4.802	8.895	13.697	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	WR	NAWC AD : Patuxent River, MD	0.000	0.000		0.000		0.255	Oct 2020	-		0.255	1.262	1.517	-
Travel	Various	Various : Various	0.000	0.000		0.000		0.040	Oct 2020	-		0.040	0.040	0.080	-
		Subtotal	0.000	0.000		0.000		0.295		-		0.295	1.302	1.597	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		5.097		-		5.097	10.197	15.294	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*	**Project (Number/Name)** 2940 / *Future Vertical Lift (Maritime Strike)*

Snapshot Date: 1/9/2020

BFM Budget Request Flag 3

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604292N / *Future Vertical Lift (Maritime Strike)*	**Project (Number/Name)** 2940 / *Future Vertical Lift (Maritime Strike)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2940				
Analysis of Alternatives	1	2021	3	2024
Program Planning and Documentation	1	2022	3	2024
MS-A	3	2024	3	2024

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	6.786	6.986	4.558	3.664	-	3.664	9.203	6.190	6.425	8.045	Continuing	Continuing
0386: *Rapid Prototype Development, Marine Corps*	6.786	6.986	4.558	3.664	-	3.664	9.203	6.190	6.425	8.045	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Commandant of the Marine Corps (CMC) directed the formation of the Marine Corps Rapid Capabilities Office (MCRCO) to accelerate the identification, development, and assessment of emergent and disruptive technology. The MCRCO seeks emergent and disruptive technology to rapidly develop and assess operational prototypes that increase Marine Air Ground Task Force survivability and lethality by providing operational assessments to accelerate requirement development and investment planning. MCRCO conducts data collection at intervals throughout this period of time to capture Tactics, Techniques, and Procedures (TTPs), military utility, and system performance. Prototypes will be assessed at a Technology Readiness Level 7 (TRL 7) or higher, being either non-developmental government or commercial off-the-shelf or developmental items. MCRCO utilizes collected data to generate a Capability Assessment Report (CAR), requirement, and acquisition recommendation for decision by the General Officer Board of Directors (GOBOD).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.107	4.558	9.049	-	9.049
Current President's Budget	6.986	4.558	3.664	-	3.664
Total Adjustments	-0.121	0.000	-5.385	-	-5.385
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.121	0.000			
• Program Adjustments	0.000	0.000	-2.490	-	-2.490
• Rate/Misc Adjustments	0.000	0.000	-2.895	-	-2.895

Change Summary Explanation

The FY 2021 funding request was reduced by $2.490M to account for the availability of prior year execution balances.

Funding in this line item has been reprioritized while ensuring the Marine Corps continues to evolve toward a Force that is aligned with the National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0386: *Rapid Prototype Development, Marine Corps*	6.786	6.986	4.558	3.664	-	3.664	9.203	6.190	6.425	8.045	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Commandant of the Marine Corps (CMC) directed the formation of the Marine Corps Rapid Capabilities Office (MCRCO) to accelerate the identification, development and assessment of capabilities that appear to offer significant military utility. The MCRCO will seek emergent and disruptive technology to rapidly develop and deliver operational prototypes that increase Operating Forces' survivability and lethality, and that will inform requirement development and investment planning. Prototypes to be assessed will be at a Technology Readiness Level 7 or higher and can be either non developmental government off the shelf, non-developmental commercial off the shelf, or developmental items.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Product Development	5.757	3.250	2.310	0.000	2.310
Articles:	-	-	-	-	-

FY 2020 Plans:

FY20 efforts include Fight the Naval Force Forward, Human Performance Augmentation, and Organic Resource Generation. These efforts are linked to USMC specific warfighting strategies, the National Defense Strategy, the Marine Operating Concept, and the Marine Corps Warfighting Lab Campaign Plan. These policy and strategy linkages insure these efforts will be focused on the proper priorities.

- The Fight the Naval Force Forward effort will identify, prototype, and assess systems that provide critical capabilities for small task organized units operating as the forward edge of an inside force. Efforts includes active and passive systems that operate with resilience in a Network-Contested Environment (NCE) and smaller, dispersed, and resilient systems which operate from diverse platforms.

- The Human Performance Augmentation effort will identify, prototype, and assess various wearables that enhance physical and or cognitive capabilities of the individual Marine that will increase their combat effectiveness. System efforts include exoskeletons, man-machine, and artificial intelligence interfaces to enhance performance including close combat lethality in complex terrain.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- The Organic Resource Generation effort will identify, prototype and assess personal and small unit systems in optionally mounted configurations that enable creation of various classes of supply to extend operational endurance and reduce logistical reliance. Organic Resource Generation efforts include decentralized energy generation, water recycling and desalination, energy storage, increase deployed energy efficiency, bio-fuels, and non-commercially dependent distributed logistics. ***FY 2021 Base Plans:*** - Continue Naval Force Forward (NFF) efforts to prototype and assess systems that provide critical capabilities for small task organized units operating as the forward edge of an inside force. - Continue support of Human Performance Augmentation efforts to prototype and assess various wearables that enhance physical and or cognitive capabilities of the individual Marine that will increase their combat effectiveness. - Continue Organic Resource Generation efforts to prototype and assess personal and small unit systems in optionally mounted configurations that enable creation of various classes of supply to extend operational endurance and reduce logistical reliance. - Initiate prototype development and operational force assessment of Non-Satellite Terrestrial Communications capabilities. - Initiate prototype development and operational force assessment of Localized Micro-Aerial Superiority capability. - Initiate prototype development and operational assessment of Multi-Spectral Deception capability. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $.940M from FY20 to FY21 is due to the completion of Naval Force Forward (NFF), Human Performance Augmentation, and Organic Resource Generation identification efforts.					
Title: Support	0.566	0.602	0.620	0.000	0.620
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: - Continue support efforts to include development of a innovation portal, modeling and simulation, and other data collection efforts. ***FY 2021 Base Plans:*** - Continue support efforts to include development of a innovation portal, modeling and simulation, and other data collection efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change from FY20 to FY21.					
Title: Test & Evaluation	0.663	0.706	0.734	0.000	0.734
Articles:	-	-	-	-	-
FY 2020 Plans: FY20 efforts include testing and evaluation of the Fight the Naval Force Forward, Human Performance Augmentation, and Organic Resource Generation efforts which are linked to USMC specific warfighting strategies, the National Defense Strategy, the Marine Operating Concept, and the Marine Corps Warfighting Lab Campaign Plan. These policy and strategy linkages insure these testing and evaluation efforts will be focused on the proper priorities. - The Fight the Naval Force Forward effort will assess systems that provide critical capabilities for small task organized units operating as the forward edge of an inside force. Testing efforts include active and passive systems that operate with resilience in a Network-Contested Environment (NCE) and smaller, dispersed, and resilient systems which operate from diverse platforms. - The Human Performance Augmentation effort will assess various wearables that enhance physical and or cognitive capabilities of the individual Marine that will increase their combat effectiveness. Testing efforts include exoskeletons, man-machine, and artificial intelligence interfaces to enhance performance including close combat lethality in complex terrain.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- The Organic Resource Generation effort will assess personal and small unit systems in optionally mounted configurations that enable creation of various classes of supply to extend operational endurance and reduce logistical reliance. Organic Resource Generation testing efforts include decentralized energy generation, water recycling and desalination, energy storage, increase deployed energy efficiency, bio-fuels, and non-commercially dependent distributed logistics. ***FY 2021 Base Plans:*** - Continue testing efforts to include active and passive systems that operate with resilience in a Network-Contested Environment (NCE) and smaller, dispersed, and resilient systems which operate from diverse platforms. - Continue testing efforts to include exoskeletons, man-machine, and artificial intelligence interfaces to enhance performance including close combat lethality in complex terrain. - Continue decentralized energy generation, water recycling and desalination, energy storage, increase deployed energy efficiency, bio-fuels, and non-commercially dependent distributed logistics. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant change from FY20 to FY21.					
Accomplishments/Planned Programs Subtotals	6.986	4.558	3.664	0.000	3.664

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The MCRCO Process consists of three phases, Identify, Assess, and Inform, each have unique functions in support of the mission. All MCRCO projects will align to this phased approach. In the Identify Phase the MCRCO undertakes a continuous process of investigation and compiling of technologies, concepts, and prototypes for various capability areas. In the Assess Phase, MCRCO will assess performance of prototypes based on military utility, enabling competition, and lifecycle affordability. The Inform Phase provides the results of the assessment event and includes transition to a program office if applicable.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomous Vehicles Development	WR	NSWC : Panama City, FL	0.000	0.250	Aug 2019	0.000		0.000		-		0.000	0.000	0.250	-
Information Warfare Development	WR	NSWC : Crane, IN	0.000	0.250	Jul 2019	0.000		0.000		-		0.000	0.000	0.250	-
Urban Engagement Systems Development	WR	NSWC : Corona, CA	0.000	0.130	May 2019	0.000		0.000		-		0.000	0.000	0.130	-
Autonomous Vehicle Contract Award	C/CPIF	MCSC : Quantico, VA	0.000	2.127	Mar 2019	0.000		0.000		-		0.000	0.000	2.127	-
Information Warfare Contract Award	C/CPIF	MCSC : Quantico, VA	0.000	2.000	Mar 2019	0.000		0.000		-		0.000	0.000	2.000	-
Urban Engagement Systems Contract Award	C/CPIF	MCSC : Quantico, VA	0.000	1.000	Jul 2019	0.000		0.000		-		0.000	0.000	1.000	-
Naval Force Forward	Various	TBD : TBD	0.000	0.000		1.000	May 2020	0.005	Sep 2021	-		0.005	0.000	1.005	-
Human Performance Augmentation	Various	TBD : TBD	0.000	0.000		0.750	May 2020	0.005	Sep 2021	-		0.005	0.000	0.755	-
Organic Resource Generation	Various	TBD : TBD	0.000	0.000		1.500	May 2020	0.005	Sep 2021	-		0.005	0.000	1.505	-
Non-Satellite Terrestrial	Various	TBD : TBD	0.000	0.000		0.000		0.745	Mar 2021	-		0.745	0.000	0.745	-
Micro-Aerial Superiority	Various	MCSC : Quantico, VA	0.000	0.000		0.000		0.825	May 2021	-		0.825	0.000	0.825	-
Multi-Spectral Deception	Various	TBD : TBD	0.000	0.000		0.000		0.725	Apr 2021	-		0.725	0.000	0.725	-
Prior Years Cumulative Funding	Various	Various : Various	1.738	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	1.738	5.757		3.250		2.310		-		2.310	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Analysis and program office support	C/FFP	MCSC : Quantico, VA	0.000	0.566	Sep 2019	0.602	Mar 2020	0.620	Mar 2021	-		0.620	0.000	1.788	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	0.566		0.602		0.620		-		0.620	0.000	1.788	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Autonomous Vehicles OPFOR Assessment	MIPR	Yuma Proving Grounds : Yuma, AZ	0.000	0.250	Sep 2019	0.000		0.000		-		0.000	0.000	0.250	-
Information Warfare OPFOR Assessment	MIPR	Electronic Proving Ground (EPG) : Ft Huachuca, AZ	0.000	0.263	Sep 2019	0.000		0.000		-		0.000	0.000	0.263	-
Urban Engagement Systems OPFOR Assessment	MIPR	Muscatatuck : Bulerville, IN	0.000	0.150	Sep 2019	0.000		0.000		-		0.000	0.000	0.150	-
Naval Force Forward	MIPR	Yuma Proving Grounds : Yuma, AZ	0.000	0.000		0.290	Jan 2020	0.300	Mar 2021	-		0.300	0.000	0.590	-
Human Performance Augmentation	MIPR	Human Performance Augmentation : Bulerville, IN	0.000	0.000		0.102	Jan 2020	0.110	Mar 2021	-		0.110	0.000	0.212	-
Organic Resource Generation	C/BA	Electronic Proving Ground (EPG) : Ft Huachuca, AZ	0.000	0.000		0.314	Jan 2020	0.324	May 2021	-		0.324	0.000	0.638	-
Prior Years Cumulative Funding	Various	Various : Various	0.726	0.000		0.000		0.000		-		0.000	0.000	0.726	-
		Subtotal	0.726	0.663		0.706		0.734		-		0.734	0.000	2.829	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Years Cumulative Funding	Various	Various : Various	4.322	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	4.322	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	6.786	6.986		4.558		3.664		-		3.664	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604320M / *(U)Rapid Technology Capability Prototype*	**Project (Number/Name)** 0386 / *Rapid Prototype Development, Marine Corps*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0386				
FY20 Operations Assessments (OA) (HPA) Bio Sensors	1	2020	2	2020
FY20 OA (HPA) Color At Night	1	2020	3	2020
FY20 OA (ORG) SUPM	2	2020	4	2020
FY20 Capability Assessment Review (CAR) (HPA) Bio Sensors	4	2020	4	2020
FY20 CAR (HPA) Color At Night	4	2020	4	2020
FY20 CAR (ORG) SUPM	4	2020	4	2020
FY20 Contract Award (HPA)	4	2020	4	2020
FY20 Contract Award (ORG)	4	2020	4	2020
FY20 Contract Award (FNFF)	4	2020	4	2020
FY21 OA (MSD)	1	2021	2	2021
FY21 OA (NTSC)	1	2021	3	2021
FY21 OA (LMAS)	1	2021	3	2021
FY21 CAR (LMAS)	3	2021	3	2021
FY21 CAR (MSD)	4	2021	4	2021
FY21 CAR (NTSC)	4	2021	4	2021
FY21 Contract Award (LMAS)	4	2021	4	2021
FY21 Contract Award (NSTC)	4	2021	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	93.699	5.463	12.500	10.203	-	10.203	5.268	3.077	3.129	3.181	Continuing	Continuing
2474: *LPD Flight II Design & Total Integration*	93.699	5.463	12.500	10.203	-	10.203	5.268	3.077	3.129	3.181	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 542

A. Mission Description and Budget Item Justification

LPD 17 Flight II will replace LSD-41 Class ships and LSD-49 Class ships for embark, transport, control, insert, sustainment, and extract of Marine Air-Ground Task Force elements and supporting forces by helicopters, landing craft, and amphibious vehicles. Efforts are required to continue pursuing affordability initiatives. Efforts also include Gate and Milestone (MS) reviews/documentation, Capability Development Document (CDD), Indicative/Preliminary/Contract Design (ID/PD/CD) and development of logistics and Test & Evaluation documentation. In addition, this program element includes the Live Fire Test & Evaluation (LFT&E) and Operational Evaluation (OPEVAL) tests required for the lead ship. LPD 28 and LPD 29 will be used to conduct these test events as they incorporate some LPD Flight II changes prior to the lead Flight II Ship. LPD 28, LPD 29 and LPD 30 each incorporate LX(R) changes across three ships. Program is on track to support FY 2027 retirement of LSDs.

The FY 2018 Defense Appropriations Act authorized the procurement of LPD 30. Per signed Acquisition Decision Memorandum, LPD 17 Flight II will meet the Capabilities Development Document for LX(R) and shall subsume all previous LX(R) efforts. LPD 30 will be the first ship of LPD 17 Flight II.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	5.549	12.500	12.289	-	12.289
Current President's Budget	5.463	12.500	10.203	-	10.203
Total Adjustments	-0.086	0.000	-2.086	-	-2.086
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.086	0.000			
• Program Adjustments	0.000	0.000	-2.236	-	-2.236
• Rate/Misc Adjustments	0.000	0.000	0.150	-	0.150

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*

Change Summary Explanation

The FY 2021 funding request was reduced by $2.086 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*				**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
2474: *LPD Flight II Design & Total Integration*	93.699	5.463	12.500	10.203	-	10.203	5.268	3.077	3.129	3.181	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 542

A. Mission Description and Budget Item Justification

LPD 17 Flight II will replace LSD-41 Class ships and LSD-49 Class ships for embark, transport, control, insert, sustainment, and extract of Marine Air-Ground Task Force elements and supporting forces by helicopters, landing craft, and amphibious vehicles. Efforts are required to continue pursuing affordability initiatives. Efforts also include Gate and Milestone (MS) reviews/documentation, Capability Development Document (CDD), Indicative/Preliminary/Contract Design (ID/PD/CD) and development of logistics and Test & Evaluation documentation. In addition, this program element includes the Live Fire Test & Evaluation (LFT&E) and Operational Evaluation (OPEVAL) tests required for the lead ship. LPD 28 and LPD 29 will be used to conduct these test events as they incorporate some LPD Flight II changes prior to the lead Flight II Ship. LPD 28, LPD 29 and LPD 30 each incorporate LX(R) changes across three ships. Program is on track to support FY 2027 retirement of LSDs.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: LPD Flight II DESIGN/TOTAL SHIP INTEGRATION	5.463	12.500	10.203	0.000	10.203
Articles:	-	-	-	-	-

FY 2020 Plans:
Begin Live Fire Test & Evaluation Efforts and update TEMP. Procure High Temperature Superconducting (HTS) degaussing cable to support prototyping development for installation on LPD 28 for a full ship demonstration to support LPD 17 Flight II design changes. Continue affordability initiatives and development of Cost Reduction Initiatives (CRIs) for follow on ships. Continue to attend and contribute to T&E Working-level Integrated Product Team (WIPT) meetings with stakeholders. Continue to work with Naval Warfare Centers on Integrated Topside Integration activities to mitigate (E3) risks and EASR integration analysis.

FY 2021 Base Plans:
Continue to attend and contribute to T&E Working-level Integrated Product Team (WIPT) meetings with stakeholders. Produce a Detail Design Survivability Assessment Report (DDSAR) for the Flight II ship. The DDSAR will update the LPD 17 Class assessment of the vulnerability, susceptibility, and recoverability focused on the Flight II design. Work with stakeholders to plan for the Dynamic Interface Test (DIT) expected to occur in FY22 on LPD 28. Continue to work with Naval Warfare Centers on Integrated Topside integration activities to mitigate (E3) risks and EASR integration analysis. Continue HTS Degaussing efforts with the development

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*	**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and integration of Integrated Product Teams (IPTs) and development of Government use Integrated Logistics Support (ILS) products based on OEM vendor support documentation. HTS Full Ship Demonstration and Initial installation activities begin on the ship as the fully integrated system is initially installed and evaluated. Cybersecurity requirements to perform Risk Management Framework (RMF) Steps 1-5 will be developed, performed, and updated for new fielding of systems such as, Engineering Control System (ECS), Ship Control Systems (SCS), HTS, and other Contractor Furnished Equipment(CFE)/Government Furnished Equipment (GFE) systems. Define the appropriate controls, documenting the system configuration certifications, and system tests required to operate these IT systems in accordance with current cybersecurity guidance, regulation and policy. Flight II Network updates will be developed and tested in the lab. These efforts will be conducted to ensure that the new construction fielding of Interior Communications Data Network (ICDN) and Navigation Critical Distribution System (NCDS) will be operable with other connected systems being fielded in new construction ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $2.297M from FY20 to FY21 due to procurement of (HTS) degaussing cable in FY20.					
Accomplishments/Planned Programs Subtotals	5.463	12.500	10.203	0.000	10.203

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• SCN/3010: *LPD Flight II*	247.100	524.100	1,155.801	-	1,155.801	0.000	1,847.629	0.000	1,870.303	0.000	7,458.933
• SCN CTC/5300: *LPD FLIGHT II*	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	5.600	0.000	5.600

Remarks

D. Acquisition Strategy

Sole Source to Huntington Ingalls Industries.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*	**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Design/Systems Integration	C/CPIF	CSC, Alion, ICI : Washington, DC	27.567	1.761	Nov 2018	3.800	Jan 2020	0.000		-		0.000	0.000	33.128	-
Design/Systems Integration	WR	NSWC Carderock/ SSES Philadelphia : NSWC Beth, MD/ SSES Philadelphia, PA	20.600	1.809	Oct 2018	6.560	Dec 2019	4.460	Oct 2020	-		4.460	Continuing	Continuing	Continuing
Design/Systems Integration	WR	NSWC Dahlgren : Dahlgren, VA	2.437	0.415	Oct 2018	0.985	Jan 2020	0.090	Oct 2020	-		0.090	Continuing	Continuing	Continuing
Design/Systems Integration	WR	PEO C4I, PEO IWS : Washington, DC	5.864	0.982	Oct 2018	0.555	Jan 2020	0.150	Dec 2020	-		0.150	Continuing	Continuing	Continuing
Design/Systems Integration	WR	NAWC Lakehurst : Lakehurst, NJ	1.601	0.193	Oct 2018	0.350	Jan 2020	0.000		-		0.000	0.000	2.144	-
Design/Systems Integration	WR	NSWC, Panama City : Panama City, FL	1.125	0.000		0.000		0.340	Oct 2020	-		0.340	Continuing	Continuing	Continuing
Design/Systems Integration	WR	NSWC, Port Hueneme : Port Hueneme, CA	1.148	0.122	Oct 2018	0.000		0.000		-		0.000	0.000	1.270	-
Design/Systems Integration	C/CPFF	HII, General Dynamics : Various	32.891	0.000		0.000		0.000		-		0.000	0.000	32.891	-
Design/Systems Integration	WR	NAVSEALOGCEN : Mechanicsburg, PA	0.466	0.181	Oct 2018	0.000		0.000		-		0.000	0.000	0.647	-
Systems Engineering and Integration	C/CPFF	Huntington : Pascagoula, MS	0.000	0.000		0.000		1.175	Oct 2020	-		1.175	0.000	1.175	-
		Subtotal	93.699	5.463		12.250		6.215		-		6.215	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test and Evaluation	C/BA	COTF : Norfolk, VA	0.000	0.000		0.250	Jan 2020	0.235	Oct 2020	-		0.235	0.000	0.485	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*	**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test and Evaluation	WR	NSWCCD : Bethesda, MD	0.000	0.000		0.000		1.325	Oct 2020	-		1.325	0.000	1.325	-
Test and Evaluation	WR	NSWC PC : Panama City, FL	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	0.000	0.200	-
Test and Evaluation	WR	NSWCPD : Philadelphia, PA	0.000	0.000		0.000		0.075	Oct 2020	-		0.075	0.000	0.075	-
T&E Contractor Support	C/CPIF	TBD/Various : Various	0.000	0.000		0.000		1.350	Oct 2020	-		1.350	0.000	1.350	-
Test and Evaluation	WR	NAVAIR : Various	0.000	0.000		0.000		0.788	Oct 2020	-		0.788	0.000	0.788	-
Test and Evaluation	WR	JITC : Fort Huachuca, AZ	0.000	0.000		0.000		0.015	Dec 2020	-		0.015	0.000	0.015	-
		Subtotal	0.000	0.000		0.250		3.988		-		3.988	0.000	4.238	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	93.699	5.463		12.500		10.203		-		10.203	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*	**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*

*Note: LPD 28 and LPD 29 will be used to conduct test events as they incorporate some LPD Flight II changes prior to the lead Flight II Ship. LPD 28, LPD 29 and LPD 30 each incorporate LX(R) changes across three ships.

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604454N / *LX (R)*	**Project (Number/Name)** 2474 / *LPD Flight II Design & Total Integration*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2474				
LPD 30 Detail Design & Construction Award	2	2019	2	2019
Production Readiness Review	2	2020	2	2020
LPD 30 Start of Construction	3	2020	3	2020
Live Fire Test and Evaluation Phase	2	2020	2	2025
LPD 31 Detail Design & Construction Award	2	2020	2	2020
LPD 31 Start of Construction	3	2022	3	2022
Operational Test & Evaluation Begins	1	2022	1	2022
LPD 32 Ship Detail Design & Construction Award	4	2023	4	2023
LPD 32 Start of Construction	3	2024	3	2024
LPD 30 Delivery	2	2025	2	2025
LPD 33 Detail Design & Construction Award	4	2025	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	95.768	108.482	187.187	115.858	-	115.858	42.995	78.539	76.965	7.708	Continuing	Continuing
3394: *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*	95.768	84.363	172.187	115.858	-	115.858	42.995	78.539	76.965	7.708	Continuing	Continuing
9999: *Congressional Adds*	0.000	24.119	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.119

Note

The FY 2021 funding request was reduced by $10.300M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Orca Extra Large Unmanned Undersea Vehicle (XLUUV) is the Navy's Extra Large UUV effort as part of the Family of UUVs. The Orca XLUUV effort is established to address a Joint Emergent Operational Need (JEON). Orca XLUUV is a multi-phased accelerated acquisition effort to rapidly deliver capability to the Fleet. Phase 1 was a competitively sourced design effort. Phase 2 down selected to one of the Phase 1 vendors in FY 2019 for fabrication and testing of the vehicle and support elements. Fabrication award of additional Orca XLUUV systems is planned for FY23 and FY24. XLUUV will have a modular payload bay, with defined interfaces that current and future payloads must adhere to for employment from the vehicle. The Orca XLUUV effort will integrate the currently required payload, and additional potential future payloads will be developed, evaluated, and preliminarily integrated leveraging the Core Technologies Program Element 0604029N. Additional XLUUV technologies/capabilities risk reduction will occur in parallel, leveraging the competitive Industrial base.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	112.669	181.967	126.106	-	126.106
Current President's Budget	108.482	187.187	115.858	-	115.858
Total Adjustments	-4.187	5.220	-10.248	-	-10.248
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-9.780			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.187	0.000			
• Program Adjustments	0.000	0.000	-10.300	-	-10.300
• Rate/Misc Adjustments	0.000	0.000	0.052	-	0.052

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Updated Acquisition Strategy*	24.119	0.000
Congressional Add: *XLUUV competitive risk reduction*	0.000	15.000
Congressional Add Subtotals for Project: 9999	24.119	15.000
Congressional Add Totals for all Projects	24.119	15.000

Change Summary Explanation

Program Changes:
FY19: -$4,187K Small Business Innovation Research (SBIR)
FY20: -$7,530K dual vendor acquisition strategy; -$2,250K testing early to need; +$15,000K competitive risk reduction
FY21: -$10,300K Underexecution reduction; +$52K miscellaneous reduction

Technical: Not applicable.
Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3394: *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*	95.768	84.363	172.187	115.858	-	115.858	42.995	78.539	76.965	7.708	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

The FY 2021 funding request was reduced by $10.300M to account for the availability of prior year execution balances.

A. Mission Description and Budget Item Justification

The Orca Extra Large Unmanned Undersea Vehicle (XLUUV) is the Navy's Extra Large UUV effort as part of the UUV Family of Systems (FoS). The Orca XLUUV effort has been established to address a Joint Emergent Operational Need (JEON). Orca XLUUV will have a modular payload bay, with defined interfaces that current and future payloads must adhere to for employment from the vehicle. The Orca XLUUV effort will integrate the currently required payload, and additional potential future payloads will be developed, evaluated, and preliminarily integrated under the Core Technologies Program Element 0604029N. Additional XLUUV technologies/ capabilities risk reduction will occur in parallel, leveraging the competitive Industrial base.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: XLUUV Product Development	74.271	160.095	64.522	0.000	64.522
Articles:	-	-	-	-	-
Description: Orca XLUUV Phase 1 design was completed via a full and open competition with two industry teams. Phase 2 fabrication was down selected to one vendor for the fabrication and delivery of 5 Orca vehicles.					
FY 2020 Plans: Continue Phase 2 material procurement and fabrication of 5 Orca vehicles. Vehicle integration of subsystems includes propulsion, sensors, payload, communications, and control systems. First vehicle(s) to begin contractor in-water testing by the end of FY 2020.					
FY 2021 Base Plans: Continue Phase 2 fabrication of initial vehicles. Accept delivery of vehicles 1 and 2. Vehicle integration of subsystems includes propulsion, sensors, payload, communications, and control systems. Conduct contractor testing to validate and verify system requirements and prepare system for Government testing.					
FY 2021 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease in funding due to completion of initial vehicle fabrication efforts and delivery of initial vehicles in FY 2021.					
Title: XLUUV Support	6.110	7.982	11.664	0.000	11.664
Articles:	-	-	-	-	-
FY 2020 Plans: Support engineering and technical oversight of single vendor fabrication efforts and engineering services including engineering change proposals. Review and approve CDRLs, design products, and manufacturing processes. Provide expert oversight and support of subsystem and system testing. ***FY 2021 Base Plans:*** Support engineering and technical oversight of fabrication efforts and engineering services including engineering change proposals. Review and approve CDRLs, design products, and manufacturing processes. Provide expert oversight and support of subsystem and system testing, including support for the testing. Engage UUVRON to develop and document tactics, techniques, and procedures (TTPs) to create and validate Integrated Logistics Support products. Initiate preparation of payload integration efforts. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY 2021 increased funding supports initial vehicle delivery and initial contractor testing.					
Title: XLUUV Test and Evaluation	0.000	0.000	35.626	0.000	35.626
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** Commence XLUUV contractor testing of first Orca XLUUV vehicle. Fabrication contractor to provide support for test events including technical representatives and hardware to conduct events. Government test support					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
to include planning for and participating at multiple test events at various Navy test range locations. Plan for XLUUV testing. Initiate subsystem testing for payload integration. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due to commencement of multiple test and evaluation events associated with delivery of vehicles, and preparations for payload integration testing.					
Title: XLUUV Management Services	3.982	4.110	4.046	0.000	4.046
Articles:	-	-	-	-	-
FY 2020 Plans: Provide technical guidance, project planning, program management and travel for Orca prototyping. Provide financial and contracting support, and coordinated work with Fleet, test support, engineering support, and contractors. ***FY 2021 Base Plans:*** Provide technical guidance, project planning, program management and travel for Orca fabrication. Provide financial and contracting support, and coordinate work with the Fleet, test support, engineering support, and contractors. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Slight decrease due to transition from supporting fabrication to test and evaluation efforts.					
Accomplishments/Planned Programs Subtotals	84.363	172.187	115.858	0.000	115.858

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/1613: *Extra Large UUV*	0.000	0.000	0.000	-	0.000	0.000	158.500	161.600	232.779	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

D. Acquisition Strategy

Orca XLUUV is a multi-phased accelerated acquisition effort to rapidly deliver capability to the Fleet. Phase 1 was a competitively sourced design effort. Two design contracts were awarded to Industry in FY 2017. Phase 2 commenced with a down select in FY 2019 to one of the Phase 1 vendors for fabrication and testing of the vehicle and support elements. Five (5) Orca XLUUV systems (vehicles, mobile C2 equipment, and support equipment) are being fabricated for demonstration and use by the Fleet. Additional XLUUV technologies/capabilities risk reduction will occur in parallel, leveraging the competitive Industrial base. Phase 3 provides the option to fabricate up to four (4) additional systems from the vendor who fabricated vehicles in Phase 2. Fabrication award of these additional Orca XLUUV systems is planned for FY23 and FY24. Transition to a program of record and production may occur in FY23 should the Navy issue follow on requirements for the XLUUV with new payload capabilities.

XLUUV will have a modular payload bay, with defined interfaces that current and future payloads must adhere to for employment from the vehicle. Potential future payloads, advanced energy solutions, and enhanced autonomy and command and control will be developed and evaluated under the Core Technologies PE 0604029N and integrated into Orca XLUUV when ready.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Payload Design documentation	C/CPIF	Various : Various	3.735	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Design & Long Lead Material, including sub-systems	C/CPIF	Boeing : Huntington Beach, CA	39.654	9.904	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Design & Long Lead Material, including sub-systems	C/CPIF	Lockheed Martin : Riviera Baech, FL	39.654	3.695	Dec 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Fabrication of 5 XLUUVs, including sub-systems	C/FPIF	Boeing : Huntington Beach, CA	0.000	60.672	Feb 2019	160.095	Dec 2019	64.522	Dec 2020	-		64.522	Continuing	Continuing	Continuing
		Subtotal	83.043	74.271		160.095		64.522		-		64.522	Continuing	Continuing	N/A

Remarks

The FY2021 funding request has been reduced by $10.300 million to account for the availability of prior year funds.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
RFP/PSPED Dev	SS/CPFF	APL/JHU : Laurel, MD	0.300	0.000		0.000		0.000		-		0.000	0.000	0.300	-
Source Selection	WR	NSWC CD : West Bethesda, MD	1.090	0.428	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Source Selection	WR	SSC PAC : San Diego, CA	0.205	0.312	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Engineering Support	WR	NSWC CD : West Bethesda, MD	0.000	1.200	Nov 2018	1.620	Nov 2019	2.606	Nov 2020	-		2.606	0.000	5.426	-
Engineering Support	WR	NSWC IH : Indian Head, MD	0.000	0.900	Nov 2018	1.050	Nov 2019	2.613	Nov 2020	-		2.613	0.000	4.563	-
Engineering and Logistic Support	WR	NUWC KPT : Keyport, WA	0.000	1.500	Nov 2018	2.560	Nov 2019	2.541	Nov 2020	-		2.541	0.000	6.601	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Technical Warrant Holder Support	Various	NAVSEA Activities : Washington, DC	0.000	0.500	Nov 2018	0.420	Nov 2019	0.782	Nov 2020	-		0.782	0.000	1.702	-
Program Support	Various	Various : Various	6.372	1.270	Nov 2018	2.332	Nov 2019	3.122	Nov 2020	-		3.122	Continuing	Continuing	Continuing
		Subtotal	7.967	6.110		7.982		11.664		-		11.664	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test support	WR	Naval Base Ventura County : Point Mugu, CA	0.000	0.000		0.000		9.840	Dec 2020	-		9.840	0.000	9.840	-
Test support	WR	NSWC, CD : West Bethesda, MD	0.000	0.000		0.000		8.750	Dec 2020	-		8.750	0.000	8.750	-
Test safety support	WR	NSWC, IH : Indian Head, MD	0.000	0.000		0.000		0.560	Dec 2020	-		0.560	0.000	0.560	-
Test Ranges and support equipment	WR	Various : Various	0.000	0.000		0.000		9.580	Dec 2020	-		9.580	0.000	9.580	-
Test hardware and support equipment	C/CPFF	Boeing : Hunting Beach, CA	0.000	0.000		0.000		6.896	Dec 2020	-		6.896	0.000	6.896	-
		Subtotal	0.000	0.000		0.000		35.626		-		35.626	0.000	35.626	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mgmt & Techncal Efforts	WR	NAVSEA Activities : WASHINGTON, D.C.	4.758	3.982	Nov 2018	4.110	Nov 2019	4.046	Nov 2020	-		4.046	Continuing	Continuing	Continuing
		Subtotal	4.758	3.982		4.110		4.046		-		4.046	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*	

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	95.768	84.363		172.187		115.858		-		115.858	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 3394 / *Adv Undersea Prototyping-Vehicles, Propulsion & Navigation*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3394				
XLUUV Phase 1 Design: XLUUV Design: Design	1	2019	1	2019
XLUUV Phase 1 Design: Design reviews: CDR	1	2019	1	2019
XLUUV Contracts: Fabrication Contract (Phase 2): Proposal Evaluation	1	2019	2	2019
XLUUV Contracts: Fabrication Contract (Phase 2): Contract Award	2	2019	2	2019
XLUUV Contracts: Fabrication Contract (Phase 3): Award 1 (Phase 3)	1	2023	1	2023
XLUUV Contracts: Fabrication Contract (Phase 3): Award 2 (Phase 3)	1	2024	1	2024
XLUUV Contracts: Production Contract: Award (Production)	2	2025	4	2025
XLUUV Phase 2 Fabrication: Fabrication Contract: Fabrication Contract	2	2019	4	2022
XLUUV Phase 2 Fabrication: XLUUV Deliveries: Delivery System 1	3	2021	3	2021
XLUUV Phase 2 Fabrication: XLUUV Deliveries: Delivery System 2	4	2021	4	2021
XLUUV Phase 2 Fabrication: XLUUV Deliveries: Delivery System 3	1	2022	1	2022
XLUUV Phase 2 Fabrication: XLUUV Deliveries: Delivery System 4	3	2022	3	2022
XLUUV Phase 2 Fabrication: XLUUV Deliveries: Delivery System 5	1	2023	1	2023
XLUUV Phase 2 Fabrication: XLUUV Testing: Test	3	2021	4	2024
XLUUV Phase 2 Fabrication: Payload Integration: Integration	1	2022	4	2023
XLUUV Phase 2 Fabrication: XLUUV Employment:	2	2023	4	2025
XLUUV Phase 3 Fabrication: Fabrication Contract: Fabrication Contract	2	2023	4	2025
XLUUV Phase 3 Fabrication: XLUUV Delivieries: Delivery System 6	4	2024	4	2024
XLUUV Phase 3 Fabrication: XLUUV Delivieries: Delivery System 7	2	2025	2	2025
XLUUV Phase 3 Fabrication: XLUUV Delivieries: Delivery System 8	4	2025	4	2025
XLUUV Phase 3 Fabrication: XLUUV Testing: Test	1	2025	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	24.119	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.119
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Orca Extra Large Unmanned Undersea Vehicle (XLUUV) is the Navy's Extra Large UUV effort as part of the Family of UUVs. The Orca XLUUV effort has been established to address a Joint Emergent Operational Need (JEON). Orca XLUUV will have a modular payload bay, with defined interfaces that current and future payloads must adhere to for employment from the vehicle. The Orca XLUUV effort will integrate the currently required payload, and additional potential future payloads will be developed, evaluated, and preliminarily integrated under the Core Technologies Program Element 0604029N.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Updated Acquisition Strategy ***FY 2019 Accomplishments:*** Conducted down select to one industry partner and awarded contract for fabrication of five (5) Orca XLUUVs. Commenced vehicle fabrication, including purchase of remaining vehicle materials (long lead materials previously authorized in FY18), initial assembly, bench and subsystem testing, and integration of the first vehicles. ***FY 2020 Plans:*** N/A	24.119	0.000
Congressional Add: XLUUV competitive risk reduction ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** Orca XLUUV Battery risk reduction- design and integration with Navy certification testing. XLUUV demonstration asset for technology development (open autonomy, obstacle avoidance). Development of Innovative Launch and recovery efforts; maintenance/logistics risk reduction. Competitively award XLUUV technology/capability risk reduction efforts to Industry partners.	0.000	15.000
Congressional Adds Subtotals	24.119	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 9999 / *Congressional Adds*

D. Acquisition Strategy

Orca XLUUV is a multi-phased accelerated acquisition effort to rapidly deliver capability to the Fleet. Phase 1 was a competitively sourced design effort. Two design contracts were awarded to Industry in FY 2017. Phase 2 commenced with a down select in FY 2019 to one of the Phase 1 vendors for fabrication and testing of the vehicle and support elements. Up to five (5) Orca XLUUV systems (vehicles, mobile C2 equipment, and support equipment) are to be fabricated for demonstration and use by the Fleet.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Fabrication Contract	C/FPIF	Boeing : Huntington Beach, CA	0.000	24.119	Mar 2019	0.000		0.000		-		0.000	0.000	24.119	-
Secondary Battery development	Various	Various : Various	0.000	0.000		6.820	Jan 2020	0.000		-		0.000	0.000	6.820	-
XLUUV demonstration/test asset	C/CPFF	Not Specified : West Palm Beach, FL	0.000	0.000		4.670	Feb 2020	0.000		-		0.000	0.000	4.670	-
Innovative L&R efforts	Various	Various : Various	0.000	0.000		3.510	Apr 2020	0.000		-		0.000	0.000	3.510	-
		Subtotal	0.000	24.119		15.000		0.000		-		0.000	0.000	39.119	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	24.119		15.000		0.000		-		0.000	0.000	39.119	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 9999 / *Congressional Adds*

2021PB - 0604536N - 9999

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604536N / *Advanced Undersea Prototyping*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
XLUUV Congressional Add				
XLUUV Phase 2 Fabrication: Fabrication Contract(s) Award: Schedule Detail	2	2019	2	2019
XLUUV Phase 2 Fabrication: Fabrication Contract(s):	2	2019	4	2020
XLUUV Risk Reduction: Secondary Battery Development:	2	2020	3	2021
XLUUV Risk Reduction: XLUUV Demonstration/Test Asset:	3	2019	3	2020
XLUUV Risk Reduction: Innovative Launch & Recovery:	4	2020	1	2021
XLUUV Risk Reduction: Innovative Launch & Recovery: Testing	2	2020	3	2021
XLUUV Risk Reduction: Innovative Launch & Recovery: Maintenance	3	2020	4	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	3.100	14.259	-	14.259	5.610	6.064	5.957	6.076	Continuing	Continuing
3241: *Counter Unmanned Aircraft Systems (C-UAS)*	0.000	0.000	3.100	14.259	-	14.259	5.610	6.064	5.957	6.076	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Counter Unmanned Aircraft System (C-UAS) program was initiated in response to Joint Urgent Operational Need Statement CC-0558 and Joint Emergent Operational Need Statement ST-0008. The program originated as a Rapid Deployment Capability (RDC) to employ integrated C-UAS solution sets designed to protect high value or critical Naval assets, and support public safety against threats posed by the inadvertent or unlawful misuse of unmanned aircraft systems (UAS). The C-UAS program provides an integrated Family of Systems (FoS) employing advanced target discrimination and defeat capabilities to meet fleet requirements. More details available at a higher classification level.

A deployed C-UAS capability improves defenses against the rapidly evolving capabilities of remote and autonomously controlled devices. With UAS becoming more readily available, affordable and capable, the threat of inadvertent or unlawful flight over restricted spaces multiplies exponentially, raising concern that these UAS may be used as tools for surveillance, espionage or hostile actions at critical Navy Installations.

FY21 funding is requested to manage, evaluate, verify and implement system assessments, strategies, improvements, program management, and systems engineering support. Funding provides for refinement of material and non-material solutions, threat assessments, identification and development of advanced target discrimination, and defeat capabilities for integration into the C-UAS FoS. Funding also provides for continued development of common Command and Control (C2) and data fusion architecture for C-UAS FoS.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	5.500	5.610	-	5.610
Current President's Budget	0.000	3.100	14.259	-	14.259
Total Adjustments	0.000	-2.400	8.649	-	8.649
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-2.400			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	8.638	-	8.638
• Rate/Misc Adjustments	0.000	0.000	0.011	-	0.011

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*

Change Summary Explanation

FY20 Congressional adjustment for system development duplication. FY21funding increase by $8.649 in support of universal C2 Joint Capability Technology Demonstration(JCTD).

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3241: *Counter Unmanned Aircraft Systems (C-UAS)*	0.000	0.000	3.100	14.259	-	14.259	5.610	6.064	5.957	6.076	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Counter Unmanned Aircraft System (C-UAS) program was initiated in response to Joint Urgent Operational Need Statement CC-0558 and Joint Emergent Operational Need Statement ST-0008. The program originated as a Rapid Deployment Capability (RDC) to employ integrated C-UAS solution sets designed to protect high value or critical Naval assets, and support public safety against threats posed by the inadvertent or unlawful misuse of unmanned aircraft systems (UAS). The C-UAS program provides an integrated Family of Systems (FoS) employing advanced target discrimination and defeat capabilities to meet fleet requirements. More details available at a higher classification level.

FY21 funding is requested to manage, evaluate, verify and implement system assessments, strategies, improvements, program management, and systems engineering support. Funding provides for refinement of material and non-material solutions, threat assessments, and identification or development of advanced target discrimination and defeat capabilities for integration into the C-UAS FoS. Funding provides for continued development of common Command and Control (C2) and data fusion architecture for C-UAS FoS.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: C-UAS System Development and Integration	0.000	3.100	14.259	0.000	14.259
Articles:	-	-	-	-	-
FY 2020 Plans: Initiate to manage, evaluate, verify and implement system assessments, strategies, improvements, program management, and systems engineering support. Initiate initial design and system interface design. Begin capabilities development efforts through threat assessment analysis.					
FY 2021 Base Plans: Continue management, evaluation, verification and implementation of system assessments, strategies, improvements, program management, and systems engineering support. Continue management and technical support for C-UAS Systems Integration Lab (SIL). Funding initiates assessment of material and non-material solutions, and continues threat assessments and development of advanced target discrimination and defeat					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
capabilities for integration into the C-UAS FoS. Funding provides for continued development of common Command and Control (C2) and data fusion architecture for C-UAS FoS. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase associated with C2 Joint Capability Technology Demonstration (JCTD) as part of the USD (R&E) development roadmap for Fully-Networked Command, Control, and Communication.					
Accomplishments/Planned Programs Subtotals	0.000	3.100	14.259	0.000	14.259

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Navy's acquisition strategy capitalizes on prior Rapid Development Capability efforts while leveraging existing DoD investments with the Government acting as Lead Systems Integrator. This acquisition strategy maintains commonality of current C-UAS solutions while continuing to evaluate, improve, and implement layered defense capabilities into the integrated FoS to defeat evolving threats. More details available at a higher classification level.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Development	Various	Not Specified : Various	0.000	0.000		0.000	Jan 2020	11.661	Jan 2021	-		11.661	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		11.661		-		11.661	Continuing	Continuing	N/A

Remarks

FY20 Product Development reduction of $2.400 due to Congressional Directed Reduction. FY21 funding increase by $8.761 to $11.661 in support of universal C2 Joint Capability Technology Demonstration (JCTD).

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Material solutions and threat assessments	Various	Not Specified : Various	0.000	0.000		1.750	Dec 2019	1.209	Dec 2020	-		1.209	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		1.750		1.209		-		1.209	Continuing	Continuing	N/A

Remarks

Support cost reduction in FY21 reflects delta between initial Threat Assessment funded in FY20 and annual Follow-on Threat Assessments executed through the FYDP.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	Various	Not Specified : Various	0.000	0.000		0.550	Oct 2019	0.567	Oct 2020	-		0.567	Continuing	Continuing	Continuing
Government Engineering Support	WR	Not Specified : NAWC AD PAX	0.000	0.000		0.750	Oct 2019	0.773	Oct 2020	-		0.773	Continuing	Continuing	Continuing
Travel	WR	Not Specified : Various	0.000	0.000		0.050	Oct 2019	0.049	Oct 2020	-		0.049	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		1.350		1.389		-		1.389	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		3.100		14.259		-		14.259	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604636N / *Counter Unmanned Aircraft System (C-UAS)*	**Project (Number/Name)** 3241 / *Counter Unmanned Aircraft Systems (C-UAS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3241				
System Development: Initial Design Review	2	2021	3	2021
System Development: System Interface Design	3	2021	4	2021
System Development: C2 Architecture Development	4	2021	2	2022
System Development: Capability Upgrade Development 1	2	2023	1	2024
System Development: Capability Upgrade Development 2	3	2024	2	2025
System Development: System Integration Assessment 1	2	2022	4	2022
System Development: System Integration Assessment 2	4	2023	2	2024
System Development: System Integration Assessment 3	1	2025	3	2025
System Development: SIL Standup	2	2021	4	2021
Technology Maturation: Initial Threat Assessment	1	2020	4	2020
Technology Maturation: Follow-on Threat Assessment 1	1	2021	4	2021
Technology Maturation: Follow-on Threat Assessment 2	1	2022	4	2022
Technology Maturation: Follow-on Threat Assessment 3	1	2023	4	2023
Technology Maturation: Follow-on Threat Assessment 4	1	2024	4	2024
Technology Maturation: Follow-on Threat Assessment 5	1	2025	4	2025
Technology Maturation: Trade Studies	2	2023	3	2023
Test and Evaluation: System Test 1	3	2022	1	2023
Test and Evaluation: System Test 2	1	2024	3	2024
Test and Evaluation: System Test 3	2	2025	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	32.774	89.477	637.254	1,102.387	-	1,102.387	1,419.425	1,286.990	987.606	1,008.475	Continuing	Continuing
3334: *Conventional Prompt Strike (CPS)*	0.000	10.809	512.226	1,008.375	-	1,008.375	1,305.701	1,197.914	891.424	910.573	Continuing	Continuing
3378: *Next Generation Land Attack Weapon (NGLAW)*	14.139	3.936	19.722	7.493	-	7.493	56.665	69.097	88.740	90.520	Continuing	Continuing
3407: *Air Launched Decoy Development*	18.635	74.732	105.306	79.724	-	79.724	49.265	12.285	6.743	6.883	Continuing	Continuing
3409: *Advanced Aerial Refueling System*	0.000	0.000	0.000	5.995	-	5.995	6.994	6.994	0.000	0.000	0.000	19.983
3411: *CAD/PAD Digital Twin Modeling*	0.000	0.000	0.000	0.800	-	0.800	0.800	0.700	0.699	0.499	Continuing	Continuing

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): 570

Note

Project 3409, Advanced Aerial Refueling System and Project 3411, CAD/PAD Digital Twin Modeling, are new starts in FY 2021.

A. Mission Description and Budget Item Justification

Initial and continuing development of strike weapons consisting of armament, munitions, and weapon subsystems to allow for horizontal integration among current and future weapon system capabilities to provide enhanced anti-surface and land strike capabilities in a demanding Anti-Access Area-Dental environment. This program provides for the development of weapon and weapon system technologies to address future requirements for enhanced and alternative weapon system capability requirements that include selectable output weapons, low collateral damage weapons, precision lethality weapons, area weapons, alternative warhead technology, Insensitive Munitions (IM), scaled munitions, Department of Defense (DoD) fuzing systems, sensors, extended range weapons, precision guided training rounds, aerial refueling, fuel containment, and technologies associated with cartridge actuated devices/propellant actuated devices.

PROJ 3334: The Precision Strike Weapons Development Program Element supports Conventional Prompt Strike (CPS) warfighting capability that enables precise and timely strike capabilities in contested environments across multiple platforms. In coordination with the Army, the Navy CPS Program will design a missile comprised of a common hypersonic glide body (C-HGB) and a 34.5" two-stage booster. Development efforts under this program element leads to a weapon system capability that:(1) is non-ballistic over the majority of the flight path; (2) controls stage drop; (3) provides positive control and precision accuracy from launch to impact; (4) provides adequate cross-range/maneuverability to avoid over-flight issues; (5) provides prompt lethal effects on targets; and (6) is man-safe and deployable for surface and submerged platforms.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*

PROJ 3378: The Precision Strike Weapons Development Program Element (PE) supports the Next Generation Strike Weapon (NGSW) Family of Systems (FoS) based on the NGLAW Analysis of Alternatives (AoA) completed with results briefed out to OSD. NGSW FoS more accurately reflects the surface/submarine capabilities for land-attack and maritime strike that the AoA results identified for the most capable and economic solutions fielding incrementally between 2020 and 2032. NGSW FoS Increments I and II will leverage mature as well as emerging technologies vice developing a single weapon. NGSW funding will maintain the security environment (enclave), facility, and study team to enable continuing analysis efforts across the FoS. The NGSW enclave ensures the Navy is able to maintain the most up to date modeled threats and validate the effectiveness of current US weapons, offensive and defensive, as well as future systems and concepts developed by industry and other DoD organizations. Maintaining this capability allows expedited analysis of systems and fully informed investment decisions.

PROJ 3407: The Precision Strike Weapons Development Program Element (PE) supports the air-launched electronic warfare (EW) systems capability; through the integration of a Navy variant of the Miniature Air Launched Decoy (MALD). EW is an integral war-fighting effect supporting combatant commander integrated priorities, as well as Joint or Coalition operations. EW systems influence, deceive, disrupt, degrade, deny and destroy threats throughout the electromagnetic spectrum to airborne and air-launched systems and their operations. EW includes air-launched electronic attack (EA) as well as elements of electronic support (ES) and electronic protection (EP). EA provides self-protection capabilities to other weapon systems through active and passive measures that deceive threats to airborne and air-launched systems and their operations by using kinetic and non-kinetic means to defeat threats that rely on the electromagnetic spectrum (Radio Frequency (RF), Electro-Optical (EO), Infrared (IR). The ES capabilities support the collection, analysis, and dissemination of information related to the detection, geo-location, characterization, and identification of threats to airborne and air-launched systems and their operations. An air-launched EW system with stand-in capability increases the range and duration of EW systems while providing flexibility to commanders for employment.

MALD is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. The development and acquisition of MALD has been structured to be fielded at a pace relevant to maintain overmatch against long-term strategic competition. Specifically MALD directly contributes to building a more lethal force and is a critical enabler for joint lethality in contested environments; deterring adversaries from aggression and evolves innovative operational concepts.

PROJ 3409: The Precision Strike Weapons Development Program Element (PE) supports the Advanced Aerial Refueling Store (AARS) which incorporates new technologies to be the next generation of Aerial Refueling. This variant will increase safety of flight, facilitate unmanned tanker to refuel receiver aircraft, incorporate better health and diagnostics information and improved fail-safe technology. The AARS will increase reliability and decrease serial refueling mishaps.

PROJ 3411: The Precision Strike Weapons Development Program Element (PE) supports the Cartridge Actuated Device / Propellant Actuated Device (CAD/PAD) Digital Twin Modeling to develop and validate models and algorithms for the Department of the Navy (DoN). The development effort is specific to Navy Air Crew Common Ejection Seats (NACES). These models will also be used to support initial service life decisions, service life extension decisions, and address obsolescence.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	91.833	718.148	1,169.920	-	1,169.920
Current President's Budget	89.477	637.254	1,102.387	-	1,102.387
Total Adjustments	-2.356	-80.894	-67.533	-	-67.533
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-80.894			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.356	0.000			
• Program Adjustments	0.000	0.000	-71.961	-	-71.961
• Rate/Misc Adjustments	0.000	0.000	4.428	-	4.428

Change Summary Explanation

FY 2020: Funding reduced (-$80.9M) based on Congressional adjustment to Conventional Prompt Strike for 'unexecutable growth.'

FY 2021: Funding reduced (-$67.5M) due to program adjustments to reflect two new start efforts (+$6.0M for Proj 3409 and +$0.8M for Proj 3411); the re-phasing of CPS test schedule (Proj 3334, -$57.6M); redirection of funds from NGLAW to new production of Tomahawk Land Attack Missile (Proj 3378,-$7.0M); reduction of funds to Air Launched Decoy Development based on prior year execution balance (Proj 3407, -$14.2M); and Rate Adjustments for Navy Working Capital Fund (+$4.4M).

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*				**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3334: *Conventional Prompt Strike (CPS)*	0.000	10.809	512.226	1,008.375	-	1,008.375	1,305.701	1,197.914	891.424	910.573	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Conventional Prompt Strike (CPS) Weapon System delivers a hypersonic conventional offensive strike capability through a depressed boost-glide trajectory to prosecute deep-inland, time-critical, soft and medium-hardened targets in contested environments. The Navy CPS weapon system or major elements of the weapon system will be deployed onboard multiple launch platforms. The CPS program is a joint effort between services with design and data sharing. The Navy and Army are collaborating to design and produce the common hypersonic glide body (C-HGB). To enable weapon system integration to Navy mission requirements, near-term design, development, and experimentation will be required for boosters, thermal protection systems, navigation, guidance and control systems, enhancements, payload modules, weapon control systems and interface to existing fire control systems, support equipment, and launcher systems. Component & subsystem technology maturity and risk reduction will be demonstrated through ground-based testing, in-air and underwater launch testing, and flight tests. Furthermore, with each platform deployment, risk continues to be reduced for weapon subsystems and components until prototyping efforts culminate in an initial operational Virginia-Class submarine weapon system capability. The program will capitalize on commonality between platform implementations, enabling other Service operational capabilities.

CPS supports the National Defense Strategy by supporting modernization initiatives for hypersonic technologies and enabling a more lethal force by: (1) Providing rapid delivery of capability through multiple acquisition increments and configurations; and (2) Providing flexibility to allow for additional capability phases as the weapon system and warfighter requirements evolve.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Conventional Prompt Strike (CPS)	10.809	512.226	1,008.375	0.000	1,008.375
Articles:	-	-	-	-	-
FY 2020 Plans: U) ($512.226M) (U) CPS Weapons System ($165.130M): -Building off the success of the flight experiment (FE-1) in FY 2018, FE-2 will be conducted in FY 2020. Full scale flight test will demonstrate system performance and validate modeling efforts and ground testing; FE-2 will advance the C-HGB design and aid in technology transition to industry through the demonstration of contested environment capability and an expanded flight envelope.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
-Leveraging defense-wide research and development funds provided in FY 2019 (PE 0604165D8Z), weapon system development and integration activities include the design, development, and experimentation of hypersonic subsystems including: boosters, thermal protection systems, navigation, guidance and control systems, enhancements, payload modules, weapon control systems (including three agnostic software modules for on-platform mission planning, weapons control, and weapons interface) and interface to existing fire control systems, support equipment, and launcher systems. -Following FE-2, transition from C-HGB Block 0 to C-HGB Block 1 design, build, integrate & test activities. -Design, development, and construction of Underwater Launch Test Facility (ULTF) located at Naval Surface Warfare Center (NSWC) Crane. Testing will be conducted using all-up-round (AUR) analog test vehicles to investigate launch phenomena and to mitigate risks/potential impacts to underwater launch due to advanced payload module (APM), ejector designs, design changes, or ship characteristics. The program will leverage Naval Air Warfare Center Weapons Division (NAWCWD) China Lake as the subject matter expert to facilitate the design and construction of the ULTF. (U) Flight Subsystem ($282.336M): -Continued missile systems engineering to include missile architecture development through trade studies and model-based analysis; subsystem, component, and test requirements development; systems integration; and verification and test. Includes ongoing design and development of prototype missile body for C-HGB Block 1 and the initiation of prototype missile body for C-HGB Block 2. -Continued efforts for 1st and 2nd stage solid rocket motors including engineering design, development & test, hardware manufacturing, and quality assurance. -Ongoing prototype design & development efforts for Box-Launch capability (including prototype canister), design efforts for Virginia Payload Module (VPM) modification, and design efforts for future deployment platforms. -Identify and acquire initial materials and parts for missile test assets required for Navy FE-3 & Dynamic Booster Test (DBT). This joint flight campaign (JFC-1) will be conducted in FY22 and will demonstrate AUR capability with a new prototype missile body and Block 1 C-HGB. -Initiate In-Air Launcher Testing to refine the technology for cold gas ejection of the missile; initial testing will determine system maturity and readiness for canister launched weapon system level testing.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(U) Platform Integration ($34.700M): -Continue to establish a comprehensive Integration and Test Program that addresses all CPS test activities for component- level, subsystem-level, system-level, interface, integration, environmental, safety, security/cyber, logistics, and flight tests. -Develop an acquisition strategy for integration of the Conventional Prompt Strike Mission Planning capability into the Theater Mission Planning Center. Off-Hull Mission Planning will be developed and tested in coordination with PMA-281, Strike Planning and Execution Systems. For each weapon system capability iteration, at least one flight test will be an end- to-end test including off-hull mission planning. (U) Advanced Research and Development ($30.060M): - The program will continue to develop, model, and refine CPS architecture designs, including hardware, software, computer software and computer software documentation and operator requirement allocations and support of external system interfaces. Advanced R&D efforts support future spiral capabilities such as enhanced warhead, advanced communication, alternative navigation, and terminal sensor technology. ***FY 2021 Base Plans:*** (U) ($1,008.375M) (U) CPS Weapon System ($322.075M): - Continue C-HGB Block 1 efforts in preparation for JFC-1 to be conducted in Q1 FY 2022 and initiate C-HGB Block 2 design and build. -Continue development of an underwater launch test capability to support launch system prototype efforts and evaluation / qualification program at the ULTF. -Conduct an evaluation test readiness review. Test data will be analyzed and evaluated, leveraging the results as part of the design process to drive improvements, reduce risks and gain early insight into performance and reliability. Through continuous integration, test, and stakeholder demonstrations, weapon system capabilities are delivered incrementally. Multiple software demonstrations are planned to obtain feedback from stakeholders and end users to verify operational performance of the weapon system. -Increase efforts for weapon system development and integration activities including the design, development, and experimentation of hypersonic subsystems including: boosters; conventional warheads; thermal protection systems; guidance systems; payload modules; launch systems; fire control systems; and support equipment.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
(U) Flight Subsystem ($369.477M): -Continue and increase efforts for missile development and missile body flight articles. This includes the transition to production of prototype C-HGB. FY 2021 missile development activities include identifying and procuring initial materials and parts for missile test assets required for JFC-1. This testing will further enhance the capability of the C-HGB and includes the development and demonstration of the HBTD booster and associated missile body hardware compatible with deployment from submerged platforms. - Continue ongoing prototype design & development efforts for Box-Launch capability (including prototype canister), design efforts for Virginia Payload Module (VPM) modification, and design efforts for future deployment platforms. -Continue full-scale in-air launch testing at The Naval Air Warfare Center Weapons Division (NAWCWD) China Lake. The facility will house a prototype Launcher Test Assembly (LTA) and will utilize instrumentation outfitting on Inert Test Vehicles (ITVs) to demonstrate APM ejector and AUR Capsule functionality and performance, as well as fly out trajectories and loading. FY 2021 in-air launcher testing activities include demonstrating platform integration of AUR Canister, advanced payload module (APM), and Weapon Control System capabilities. (U) Platform Integration ($289.041M): -Continue to establish a comprehensive Integration and Test Program that addresses all CPS test activities for component- level, subsystem-level, system-level, interface, integration, environmental, safety, security/cyber, logistics, and flight tests. -Continue development of mission planning capability. -Commence initial development of SSGN Operational Alteration (OP-Alt). Integration of CPS on SSGNs is a multi-year effort that provides an opportunity for CPS payload testing while also supporting future CPS integration on VPM-equipped SSNs. In FY 2021, OP-Alt development will provide a CPS configuration for limited operational capability (LOC) which will include a launcher capability as well as weapon control, combat control, and information system modifications. (U) Advanced Research and Development ($27.782M): - Continue to develop, model, and refine CPS architecture designs, including hardware, software, computer software and computer software documentation and operator requirement allocations and support of external					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
system interfaces. Advanced R&D efforts support future spiral capabilities such as enhanced warhead, advanced communication, alternative navigation, and terminal sensor technology. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The FY 2020 to FY 2021 program increase of $496.149M provides for platform integration and development efforts, procurement of prototype C-HGBs, the increased development and procurement of missiles/missile body flight articles, conducting in-air launch testing, as well as increased effort associated with the design, development, and experimentation of hypersonic subsystems including: boosters, thermal protection systems, navigation, guidance and control systems, enhancements, payload modules, weapon control systems and interface to existing fire control systems, support equipment, and launcher systems.					
Accomplishments/Planned Programs Subtotals	10.809	512.226	1,008.375	0.000	1,008.375

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

CPS will utilize a Middle Tier Acquisition approach per Section 804 of the Fiscal Year (FY) 2016 National Defense Authorization Act (NDAA), as amended in FY 2017 NDAA (codified at 10 U.S.C. sub sec 2302 note) to deliver CPS capability to the Navy across multiple platforms. The CPS program is designed for flexibility to allow the program Acquisition Decision Authority to establish additional capability phases as the weapon system and warfighter requirements evolve.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Conventional Prompt Strike Weapon System	SS/CPFF	Lockheed Martin Corporation : Sunnyvale, CA	0.000	0.000		1.760	Oct 2019	199.269	Oct 2020	-		199.269	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	WR	Naval Air Weapons Station : China Lake, CA	0.000	0.000		84.520	Nov 2019	39.626	Oct 2020	-		39.626	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	MIPR	United States Army : Various	0.000	0.000		26.940	Feb 2020	34.000	Oct 2020	-		34.000	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	Various	Various : Various	0.000	1.759	Sep 2019	12.880	Dec 2019	16.720	Oct 2020	-		16.720	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	SS/CPFF	Johns Hopkins Univ. Applied Physics Lab : Baltimore, MD	0.000	0.000		16.490	Feb 2020	15.592	Oct 2020	-		15.592	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	WR	Naval Surface Warfare Center Crane : Crane, IN	0.000	0.000		18.800	Nov 2019	9.679	Oct 2020	-		9.679	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	C/CPFF	Systems Planning & Analysis : Alexandria, VA	0.000	0.000		2.700	Dec 2019	6.189	Oct 2020	-		6.189	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	MIPR	Missile and Space Intelligence Center : Huntsville, AL	0.000	0.000		1.040	Feb 2020	1.000	Oct 2020	-		1.000	Continuing	Continuing	Continuing
Conventional Prompt Strike Weapon System	MIPR	Lawrence Livermore National Laboratory : Livermore, CA	0.000	4.610	Apr 2019	0.000		0.000		-		0.000	0.000	4.610	-
Flight Subsystem	SS/CPFF	Lockheed Martin Corporation : Sunnyvale, CA	0.000	0.000		171.590	Oct 2019	169.456	Oct 2020	-		169.456	Continuing	Continuing	Continuing
Flight Subsystem	MIPR	Sandia National Laboratory : Albuquerque, NM	0.000	0.000		41.006	Feb 2020	90.652	Oct 2020	-		90.652	Continuing	Continuing	Continuing
Flight Subsystem	MIPR	United States Army : Various	0.000	0.000		27.500	Feb 2020	62.500	Oct 2020	-		62.500	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Flight Subsystem	WR	Naval Surface Warfare Center : Crane, IN	0.000	0.000		10.670	Dec 2019	19.980	Oct 2020	-		19.980	Continuing	Continuing	Continuing
Flight Subsystem	C/CPFF	Dynetics : Huntsville, AL	0.000	0.000		15.850	Feb 2020	15.444	Oct 2020	-		15.444	Continuing	Continuing	Continuing
Flight Subsystem	SS/CPFF	Draper : Boston, MA	0.000	0.000		8.290	Feb 2020	8.000	Oct 2020	-		8.000	Continuing	Continuing	Continuing
Flight Subsystem	Various	Various : Various	0.000	0.000		4.930	Dec 2019	3.445	Oct 2020	-		3.445	Continuing	Continuing	Continuing
Platform Subsystem	SS/CPFF	General Dynamics Electric Boat : Groton, CT	0.000	1.870	Apr 2019	21.760	Dec 2019	175.000	Oct 2020	-		175.000	Continuing	Continuing	Continuing
Platform Subsystem	SS/CPFF	Lockheed Martin Corporation : Sunnyvale, CA	0.000	0.000		8.280	Oct 2019	105.703	Oct 2020	-		105.703	Continuing	Continuing	Continuing
Platform Subsystem	SS/CPFF	Johns Hopkins Univ. Applied Physics Lab : Baltimore, MD	0.000	0.000		2.590	Feb 2020	2.810	Oct 2020	-		2.810	Continuing	Continuing	Continuing
Platform Subsystem	WR	Naval Undersea Warfare Division : Newport, RI	0.000	0.000		2.500	Oct 2019	5.000	Oct 2020	-		5.000	Continuing	Continuing	Continuing
Platform Subsystem	WR	Naval Surface Warfare Center : Dahlgren, VA	0.000	0.000		2.070	Oct 2019	0.528	Oct 2020	-		0.528	Continuing	Continuing	Continuing
Advanced Research and Development	MIPR	Lawrence Livermore National Laboratory : Livermore, CA	0.000	2.570	Apr 2019	13.470	Dec 2019	10.457	Oct 2020	-		10.457	Continuing	Continuing	Continuing
Advanced Research and Development	MIPR	Sandia National Laboratory : Albuquerque, NM	0.000	0.000		6.220	Feb 2020	8.714	Oct 2020	-		8.714	Continuing	Continuing	Continuing
Advanced Research and Development	SS/CPFF	Draper : Boston, MD	0.000	0.000		9.330	Feb 2020	6.448	Oct 2020	-		6.448	Continuing	Continuing	Continuing
Advanced Research and Development	SS/CPFF	Johns Hopkins Univ. Applied Physics Lab : Baltimore, MD	0.000	0.000		1.040	Feb 2020	2.163	Oct 2020	-		2.163	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	0.000	10.809		512.226		1,008.375		-		1,008.375	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	10.809		512.226		1,008.375		-		1,008.375	Continuing	Continuing	N/A

Remarks

Additional details on CPS efforts held at a higher classification.

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3334 / *Conventional Prompt Strike (CPS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3334				
Project 3334: C-HGB Block 0	1	2019	2	2020
Project 3334: FE-2	2	2020	2	2020
Project 3334: 1st and 2nd Stage Rocket Motor	2	2019	2	2021
Project 3334: Prototype Missile Body for C-HGB Block 1	2	2019	2	2021
Project 3334: AUR I&T	3	2021	1	2022
Project 3334: Weapon Control System Release 1.0	2	2020	2	2022
Project 3334: Launcher & Prototype Canister	2	2020	1	2022
Project 3334: Launcher, WCS, and AUR I&T	3	2020	4	2022
Project 3334: Weapon System I&T w/ Off Hull Mission Planning 1.0	2	2020	2	2023
Project 3334: Prototype Missile Body: C-HGB Block 2	2	2020	3	2022
Project 3334: Prototype APM & Canister	1	2022	2	2023
Project 3334: C-HGB Block 2	1	2021	2	2022
Project 3334: All Up Round Integration. w/ C-HGB Block 2	3	2022	3	2023
Project 3334: Weapon Control System Release 2.0	2	2021	3	2023
Project 3334: Weapon System Integration and Test w/ Advanced Payload Module	3	2020	1	2024
Project 3334: Integration and Test w/ Mission Planning	3	2022	2	2024
Project 3334: Final Development of Advanced Payload Module & Canister	3	2022	2	2024
Project 3334: Weapon Control System Release 3.0	3	2024	1	2025
Project 3334: SSGN Integration and Test	2	2020	2	2025
Project 3334: SSN Integration and Test	3	2020	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*				**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
3378: *Next Generation Land Attack Weapon (NGLAW)*	14.139	3.936	19.722	7.493	-	7.493	56.665	69.097	88.740	90.520	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
Project MDAP/MAIS Code: 570												

A. Mission Description and Budget Item Justification

Funding is provided for the Next Generation Strike Weapon (NGSW) Family of Systems (FoS) based on the NGLAW Analysis of Alternatives (AoA) completed with results briefed out to OSD. NGSW FoS more accurately reflects the surface/submarine capabilities for land-attack and maritime strike that the AoA results identified for the most capable and economic solutions fielding incrementally between 2020 and 2032. NGSW FoS Increments I and II will leverage mature as well as emerging technologies vice developing a single weapon. NGSW funding will maintain the security environment (enclave), facility, and study team to enable continuing analysis efforts across the FoS. The NGSW enclave ensures the Navy is able to maintain the most up to date modeled threats and validate the effectiveness of current US weapons, offensive and defensive, as well as future systems and concepts developed by industry and other DoD organizations. Maintaining this capability allows expedited analysis of systems and fully informed investment decisions. Further funding supports investment for technologies which enable Increment II capabilities (additional details are held at a higher classification).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Title: Next Generation Land Attack Weapon (NGLAW)	3.936	19.722	7.493	0.000	7.493
Articles:	-	-	-	-	-
FY 2020 Plans: Continue annual enclave security and IT updates, annual DSS updates for latest threat data and ownship defense, multi-domain assessment, expanding the US capabilities database, mission integration, and lifecycle cost estimate updates as applicable. In support of NGSW FoS and continued Offensive Anti-Surface Warfare (OASUW) analysis, modify Tactical Situations (TACSITs) and threat postures for air and surface/subsurface launched weapons, identify new launch points and concepts for employment, mission integration and cost estimate updates as applicable. Begin an Analysis of Alternatives study in support of Nuclear Missile Sea Launched Cruise Missile (SLCM-N). Conduct an Analysis of Alternatives study in support of OASUW to support Increment II development. To support Increment II development, funding will be allocated for technologies to enable capabilities identified in the NGLAW AoA for integration in future systems. Additional details are held at a higher classification.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue annual enclave security and IT updates, annual DSS updates for latest threat data and ownship defense, multi-domain assessment, expanding the US capabilities database, mission integration, and lifecycle cost estimate updates as applicable. In support of NGSW FoS and continued Offensive Anti-Surface Warfare (OASUW) analysis, continue to modify TACSITs and threat postures for air and surface/subsurface launched weapons, identify new launch points and concepts for employment, mission integration and cost estimate updates as applicable. Conduct Threat Updates and Threat Modeling in FY2021 to include threat systems against US offensive and defensive systems to ensure the enclave remains fully informed to assist senior leadership in investment decisions. Continue Analysis of Alternatives study in support of Nuclear Missile Sea Launched Cruise Missile (SLCM-N). To support Increment II development, continued funding will be allocated for technologies to enable capabilities identified in the NGLAW AoA for integration in future systems. Additional details are held at a higher classification. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY2020 to FY2021 decrease of $12.229M is due to completion of OASUW AOA and decreased SLCM-N AoA efforts.					
Accomplishments/Planned Programs Subtotals	3.936	19.722	7.493	0.000	7.493

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

NGSW FoS more accurately reflects the multi-domain capabilities for land-attack and maritime strike that the NGLAW AoA results identified for the most capable and economic solutions fielding incrementally between 2020 and 2032. NGSW FoS Increments I and II will leverage mature as well as emerging technologies vice developing a single weapon. NGSW funding will maintain the security environment (enclave), facility, and study team to enable continuing analysis efforts across the FoS. The NGSW enclave ensures the Navy is able to maintain the most up to date modeled threats and validate the effectiveness of current US weapons, offensive and defensive, as well as future systems and concepts developed by industry and other DoD organizations. Maintaining the enclave allows expedited analysis of systems and fully informed investment decisions.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

The SLCM-N recently completed the Navy R3B process and will shortly enter the Knowledge Management and Decision Support System (KMDS) for Joint Staff validation. OSD CAPE is refining their AoA guidance, but will likely direct Navy to investigate options derived from the NGLAW AoA and derivatives. Once approved and received, Navy will begin the AoA.

NGSW FoS funding will support Increment II development of technologies to enable capabilities identified in the NGLAW AoA for integration in future systems. Additional details are held at a higher classification.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
INC II Technologies	C/CPFF	TBD : TBD	0.000	0.000		12.300	Mar 2020	2.028	Mar 2021	-		2.028	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		12.300		2.028		-		2.028	Continuing	Continuing	N/A

Remarks

Development of technologies/components to support NGSW Increment II capabilities for integration in future systems. Additional details are held at a higher classification.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	NAWC-WD : China Lake, CA	2.475	0.000		0.112	Dec 2019	0.082	Dec 2020	-		0.082	Continuing	Continuing	Continuing
Development Support- AIR 4.0M	WR	NAWC-AD : Patuxent River, MD	3.114	0.000		0.440	Nov 2019	0.323	Nov 2020	-		0.323	Continuing	Continuing	Continuing
Development Support	SS/CPFF	JHU/APL : Laurel, MD	3.568	1.986	Feb 2019	1.210	Dec 2019	0.900	Dec 2020	-		0.900	Continuing	Continuing	Continuing
Weapons Control System	WR	NSWC-DD : Dahlgren, VA	0.050	0.000		0.275	Dec 2019	0.202	Dec 2020	-		0.202	0.000	0.527	Continuing
Development Support	WR	NSMA : JBAB, DC	4.313	1.950	Feb 2019	5.018	Nov 2019	3.682	Nov 2020	-		3.682	0.000	14.963	Continuing
Development Support	MIPR	NRO : Chantilly, VA	0.569	0.000		0.165	Jan 2020	0.121	Jan 2021	-		0.121	0.000	0.855	Continuing
Development Support	WR	NSWC-NPT : Newport, RI	0.050	0.000		0.180	Dec 2019	0.132	Dec 2020	-		0.132	0.000	0.362	Continuing
		Subtotal	14.139	3.936		7.400		5.442		-		5.442	Continuing	Continuing	N/A

Remarks

Annual enclave updates, annual DSS updates, multi-domain assessment, mission integration, support OASUW analysis, conduct SLCM-N AoA study.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Support	WR	NAWC-AD : Patuxent River, MD	0.000	0.000		0.022	Nov 2019	0.023	Nov 2020	-		0.023	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.022		0.023		-		0.023	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	14.139	3.936		19.722		7.493		-		7.493	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Next Generation Strike Weapon				
Code Study: Mission and Code Study Mission Modeling	2	2019	2	2019
NGSW Target Prioritization: NGSW Target Prioritization Prep and Mission Integration	2	2019	2	2019
Upper Cut: Upper Cut Tech and Prep Cost	2	2019	2	2019
Upper Cut: Upper Cut Mission Modeling	3	2019	3	2019
SLCM-N: SLCM-N CNA Data Collection and Study Plan	4	2019	4	2019
SLCM-N: SLCM-N CNA CONEMP Threats	1	2020	1	2020
SLCM-N: SLCM-N CNA Tech Assess Cost Preps	1	2020	1	2020
SLCM-N: SLCM-N Trade Space Analysis	2	2020	2	2020
SLCM-N: SLCM-N Analysis of Alternatives	1	2020	3	2021
OASuW: OASuW CONEMP Threat	2	2019	2	2019
OASuW: OASuW Tech Assessment Modeling Preparations	3	2019	3	2019
OASuW: OASuW Mission Modeling	1	2020	1	2020
OASuW: OASuW Integration: OASuW Integration Mission Integration Preps	4	2019	4	2019
OASuW: OASuW Integration: OASuW Integration Mission Integration	1	2020	1	2020
NGSW New Concepts: NGSW New Concepts CONEMP	3	2019	3	2019
NGSW New Concepts: NGSW New Concepts Tech Assess Modeling Prep	4	2019	4	2019
NGSW New Concepts: NGSW New Concepts Mission Modeling Mission Int	1	2020	1	2020
NGSW Threat Updates: NGSW Threat Updates IC Discussions	2	2019	2	2019
NGSW Threat Updates: NGSW Threat Updates IC Inputs	3	2019	3	2019
NGSW Threat Updates: NGSW FY20 Threat Update	2	2020	4	2020
NGSW Threat Updates: NGSW FY21 Threat Update	1	2021	4	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
NGSW Threat Updates: NGSW FY22 Threat Update	1	2022	4	2022
NGSW Threat Updates: NGSW FY23 Threat Update	1	2023	4	2023
NGSW Threat Updates: NGSW FY24 Threat Update	1	2024	4	2024
NGSW Threat Updates: NGSW FY25 Threat Update	1	2025	4	2025
NGSW Threat Updates: NGSW Threat Updates Modeling Updates	4	2019	4	2025
NGSW Threat Updates: NGSW Threat Updates Mission Modeling	1	2020	4	2025
NGSW Multi-Domain: NGSW Multi-Domain FY19 Threats CONEMP Tech Assessment	3	2019	3	2019
NGSW Multi-Domain: NGSW Multi-Domain FY19 Modeling Preparations	4	2019	4	2019
NGSW Multi-Domain: NGSW Multi-Domain FY19 Mission Modeling	1	2020	1	2020
NGSW Multi-Domain: NGSW Multi-Domain FY20 Threats CONEMP Tech Assessment	2	2020	3	2020
NGSW Multi-Domain: NGSW Multi-Domain FY20 Modeling Preparations	3	2020	4	2020
NGSW Multi-Domain: NGSW Multi-Domain FY20 Mission Modeling	4	2020	1	2021
NGSW Integration: NGSW Integration Modeling Preparations	1	2020	1	2020
NGSW Integration: NGSW Integration FY19 Mission Integration	2	2020	2	2020
NGSW Integration: NGSW Integration FY20 Mission Integration	3	2020	3	2020
NGSW Integration: NGSW Integration FY20 Mission Integration Increment 2	1	2021	1	2021
NGSW Increment I/II: Technology Investment Enablers for INC I / INC II Capabilities	1	2019	4	2023
Additional Studies: Study Opportunity	2	2020	1	2021
Facility: FY 19 Security and HW Update	2	2019	2	2019
Facility: FY 19 Info Update	3	2019	3	2019
Facility: FY 20 Security and HW Update	2	2020	2	2020
Facility: FY 20 Info Update	3	2020	3	2020
Facility: FY 21 Security and HW Update	2	2021	2	2021
Facility: FY 21 Info Update	3	2021	3	2021
Facility: FY 22 Security and HW Update	2	2022	2	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3378 / *Next Generation Land Attack Weapon (NGLAW)*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Facility: FY 22 Info Update	3	2022	3	2022
Facility: FY 23 Security and HW Update	2	2023	2	2023
Facility: FY 23 Info Update	3	2023	3	2023
Facility: FY 24 Security and HW Update	2	2024	2	2024
Facility: FY 24 Info Update	3	2024	3	2024
Facility: FY 25 Security and HW Update	2	2025	2	2025
Facility: FY 25 Info Update	3	2025	3	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3407 / *Air Launched Decoy Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3407: *Air Launched Decoy Development*	18.635	74.732	105.306	79.724	-	79.724	49.265	12.285	6.743	6.883	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops a Navy variant of the Miniature Air Launched Decoy (MALD). The variant will address current and future advanced Integrated Air Defense System (IADS) threats by bringing an air-launched, stand-in EW capability to Department of the Navy (DON) suppression of enemy air defenses/destruction of enemy air defenses (SEAD/DEAD) and standoff conventional land strike. A Navy variant of MALD with stand-in capability increases the range and duration of EW systems while providing flexibility to commanders for employment. To the maximum extent possible, the Navy will utilize existing technology from the current MALD-J production line and other common components (e.g. navigation, communication, guidance and control, payload) to reduce cost, shorten development timelines and promote interoperability. OPNAV approved requirements in a Capability Development Document (CDD) 2Q2018.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Miniature Air Launched Decoy (MALD)	74.732	105.306	79.724	0.000	79.724
Articles:	-	-	-	-	-

FY 2020 Plans:
FY 2020 builds upon the FY 2019 Engineering and Manufacturing Development (EMD) effort. FY 2020 continues component maturation toward Production Readiness Review, to verify production capability prior to Low Rate Initial Production decision and prepare for Test Readiness Assessment, prior to first free flight test. Integrated Test and Evaluation (IT&E) to continue to progress towards IOC will begin in FY 2020.

FY 2021 Base Plans:
FY 2021 builds upon the FY 2020 EMD effort. FY 2021 will complete component maturation through Production Readiness Review and Test Readiness Review in support of free flight test event. FY 2021 will continue integration of IOC software and ramp up IT&E efforts in support of Initial Operational Capability (IOC).

FY 2021 OCO Plans:
N/A

FY 2020 to FY 2021 Increase/Decrease Statement:
The FY 2020 to FY 2021 funding request was reduced by $14.201 million to account for the availability of prior year execution balances, $0.103 million for NWCF rate adjustments and $11.278 million is due to progression in

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3407 / *Air Launched Decoy Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
developmental efforts as material purchases ramp down and the program transitions into integrated test. Total reduction amount $25.582 million.					
Accomplishments/Planned Programs Subtotals	74.732	105.306	79.724	0.000	79.724

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• WPN/2285: *Drones and Decoys*	0.000	0.000	41.256	-	41.256	84.129	133.686	136.356	79.082	0.000	474.509

Remarks

D. Acquisition Strategy

The MALD-N Acquisition Category (ACAT) II program is an evolution from the previous United States Air Force (USAF) MALD-J program and is managed by Program Executive Office, Unmanned Aviation & Strike Weapons (PEO(U&W)), PMA-201 Precision Strike Weapons Program Office. PEO(U&W) has been delegated Milestone Decision Authority (MDA) and chairs quarterly Executive Steering Boards which ensure timely communications. MALD-N is being implemented as a Model 4 acquisition program to expedite the fielding of capability to the Fleet. The MALD-N program will use event-driven "Knowledge Points" (KP) at key program strategic inflection points to brief progress to stakeholders throughout the program life-cycle. The program met the statutory requirements associated with Milestone B at Knowledge Point 2 (1Q FY2019). With the removal of FY 2020 production funding, a Quick Reaction Assessment (QRA) to support an FY 2021 Early Operational Capability (EOC) will not be conducted. The MALD-N program will continue to progress towards Initial Operational Capabilities (IOC) which will be achieved by Initial Operational Test and Evaluation (IOT&E) in FY 2022. MALD-N will use a capabilities-based acquisition approach to characterize performance and evolve an IOC system for Fleet integration.

MALD is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. The development and acquisition of MALD has been structured to be fielded at a pace relevant to maintain overmatch against long-term strategic competition. Specifically MALD supports greater performance of the acquisition system and is demonstrating the delivery of performance at the speed of relevance; organizational structure that supports innovation with a rapid approach that dramatically decreases the timeline from development to fielding.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0604659N / *Precision Strike Weapons Development Program*	Project (Number/Name) 3407 / *Air Launched Decoy Development*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/CPIF	Raytheon Missle Systems : Tucson, AZ	12.183	46.785	Jan 2019	75.424	Nov 2019	42.504	Jan 2021	-		42.504	Continuing	Continuing	Continuing
		Subtotal	12.183	46.785		75.424		42.504		-		42.504	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NAWC AD : Patuxent River, MD	2.000	5.250	Nov 2018	6.983	Nov 2019	7.200	Nov 2020	-		7.200	Continuing	Continuing	Continuing
Government Support	WR	NAWC WD : China Lake, CA	2.931	11.177	Nov 2018	5.750	Nov 2019	5.888	Nov 2020	-		5.888	Continuing	Continuing	Continuing
Government Support	WR	NAWC WD : Point Mugu, CA	0.515	3.270	Nov 2018	4.184	Nov 2019	4.284	Nov 2020	-		4.284	Continuing	Continuing	Continuing
		Subtotal	5.446	19.697		16.917		17.372		-		17.372	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NAWC AD : Patuxent River, MD	0.000	4.954	Nov 2018	7.639	Nov 2019	12.600	Nov 2020	-		12.600	Continuing	Continuing	Continuing
Government Support	WR	NAWC WD : China Lake, CA	0.000	2.500	Nov 2018	4.200	Nov 2019	5.800	Nov 2020	-		5.800	Continuing	Continuing	Continuing
		Subtotal	0.000	7.454		11.839		18.400		-		18.400	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3407 / *Air Launched Decoy Development*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NAWC AD : Patuxent River, MD	0.500	0.333	Nov 2018	0.564	Nov 2019	0.575	Nov 2020	-		0.575	Continuing	Continuing	Continuing
Government Support	WR	NAWC WD : China Lake, CA	0.256	0.171	Nov 2018	0.170	Nov 2019	0.173	Nov 2020	-		0.173	Continuing	Continuing	Continuing
Project Management Support	C/CPFF	NAWC AD : Patuxent River, MD	0.200	0.212	Nov 2018	0.312	Mar 2020	0.600	Mar 2021	-		0.600	Continuing	Continuing	Continuing
Travel	Various	NAVAIR : Patuxent River, MD	0.050	0.080	Nov 2018	0.080	Nov 2019	0.100	Nov 2020	-		0.100	Continuing	Continuing	Continuing
		Subtotal	1.006	0.796		1.126		1.448		-		1.448	Continuing	Continuing	N/A

Remarks

Increases in Project Management support provides additional support for test and evaluation which ramps up in FY 2021.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	18.635	74.732		105.306		79.724		-		79.724	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3407 / *Air Launched Decoy Development*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3407 / *Air Launched Decoy Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Miniature Air Launched Decoy				
Milestones: Initial Operational Capablity	4	2022	4	2022
Product Development: Contract Award: EMD Contract Award	2	2019	2	2019
Product Development: Product Development: Engineering and Manufacturing Development	2	2019	4	2022
Product Development: Product Development: Follow-on Development	1	2023	4	2025
Test and Evaluation: Modeling and Simulation	1	2020	3	2022
Test and Evaluation: Ground / Qual Test	2	2020	3	2021
Test and Evaluation: IOT&E	3	2022	4	2022
Test and Evaluation: FOT&E	1	2024	2	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3409 / *Advanced Aerial Refueling System*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3409: *Advanced Aerial Refueling System*	0.000	0.000	0.000	5.995	-	5.995	6.994	6.994	0.000	0.000	0.000	19.983
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Advanced Aerial Refueling Store (AARS) incorporates new technologies to be the next generation of Aerial Refueling. This variant will increase safety of flight, facilitate unmanned tanker to refuel receiver aircraft, incorporate better health and diagnostics information and improved fail-safe technology. The AARS will increase reliability and decrease aerial refueling mishaps.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Advanced Aerial Refueling System	0.000	0.000	5.995	0.000	5.995
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: New Start in FY 2021. Funding provided for the development and testing of the next generation of aerial refueling stores, to include the development of drawings and specifications for prototypes.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Increase of $5.999 million in FY 2021 for the first year of the project to develop and test a prototype of the next generation Advanced Aerial Refueling Store (AARS).					
Accomplishments/Planned Programs Subtotals	0.000	0.000	5.995	0.000	5.995

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• APN/0720: *War Consumables*	42.035	32.086	40.633	-	40.633	43.383	44.297	51.191	61.096	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3409 / *Advanced Aerial Refueling System*

D. Acquisition Strategy

The Advanced Aerial Refueling Store (AARS) program will develop, prototype and test the next generation Aerial Refueling Store utilizing a Model 8 Hybrid Program structure. The program will evaluate technologies matured under science and technology initiatives for inclusion into the AARS to maximize reliability and safety while making improvements that reduce refueling time and system drag. AARS is managed by Program Executive Office, Unmanned Aviation & Strike Weapons (PEO(U&W)), PMA-201 Precision Strike Weapons Program Office.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3409 / *Advanced Aerial Refueling System*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Development	SS/CPFF	CTSi : Patuxent River, MD	0.000	0.000		0.000		4.500	Jan 2021	-		4.500	7.500	12.000	-
Government Systems Engineering	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.000		1.495	Dec 2020	-		1.495	3.844	5.339	-
		Subtotal	0.000	0.000		0.000		5.995		-		5.995	11.344	17.339	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Integrated Test	WR	NAWCAD Pax : Patuxent River, MD	0.000	0.000		0.000		0.000		-		0.000	2.644	2.644	-
		Subtotal	0.000	0.000		0.000		0.000		-		0.000	2.644	2.644	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		5.995		-		5.995	13.988	19.983	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3409 / *Advanced Aerial Refueling System*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3409 / *Advanced Aerial Refueling System*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3409				
System Development: System Development Contract Award	2	2021	2	2021
System Development: Engineering Development	2	2021	3	2024
System Development: Prototype Delivery	1	2022	1	2022
Test: Integrated Test	2	2021	4	2023
Test: Component Flight Test	2	2022	3	2022
Test: Demo/ Flight Test	2	2023	4	2023
Production: Release AARS RFP	4	2023	4	2023
Production: Award Production Contract	3	2024	3	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3411 / *CAD/PAD Digital Twin Modeling*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3411: *CAD/PAD Digital Twin Modeling*	0.000	0.000	0.000	0.800	-	0.800	0.800	0.700	0.699	0.499	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Cartridge Actuated Devices/ Propellant Actuated Devices (CAD/PAD) Digital Twin Modeling will develop and validate models and algorithms for the Department of the Navy (DoN). Digital Twin is a software model that predicts service life of a components' energetic material. This will be used to move towards a Condition Based Maintenance Model vice restrictive service life. The development will be phased over three efforts, specific to Navy AirCrew Common Ejection Seats (NACES). These models will be used as a starting point for a condition based service life for CAD/PAD. A condition based service life will result in long term cost savings for the DoN by enabling CAD/PAD to be installed for full useful service life. These models will also be used to support initial service life decisions, service life extension decisions, and address obsolescence.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: CAD/PAD Digital Twin Modeling	0.000	0.000	0.800	0.000	0.800
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: New start will begin in FY 2021. Software development efforts begin initiating software validation of the digital twin model. Test articles will be obtained, and testing will start for the digital twin in FY21.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Funding increased from $0 in FY 2020 by $0.8 million in FY 2021 to develop and validate the digital twin model to support initial service life decisions and service life extension decisions.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	0.800	0.000	0.800

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3411 / *CAD/PAD Digital Twin Modeling*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• PANMC/0180: *CARTRIDGE ACTUATED DEVICES/ PROPELLANT ACT DEVICES*	64.056	52.941	64.694	3.927	68.621	69.937	71.144	72.342	74.110	Continuing	Continuing

Remarks

The software development for CAD/PAD products to support inventory objectives by transitioning to condition based maintenance. Recent investigations into life cycle cost savings, safety mitigation and reliability of products indicate that a substantial costs savings could be realized, address obsolescence, as well as improve readiness.

D. Acquisition Strategy

Lone Star, LLC has a proven methodology to develop computer models (digital twin) relevant to the thermal loading CAD/PAD items are subjected to. A sole source contract will be let to Lone Star, LLC to develop a digital twin using their proprietary software, Tru Navigator. The Tru Navigator software will use as its input, key areas of degradation to CAD/PAD items (temperature, humidity, shock, vibration and thermal cycling) and its output will be the cumulative degradation to the CAD/PAD item. Additional technologies and associated vendors will also be evaluated as necessary.

All other efforts; procurement of CAD/PAD test items, test and evaluation, and model validation will be sourced using competitive contracting strategies.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3411 / *CAD/PAD Digital Twin Modeling*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/CPIF	Lone Star, LLC : Addison, TX	0.000	0.000		0.000		0.400	Feb 2021	-		0.400	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		0.400		-		0.400	Continuing	Continuing	N/A

Remarks

A sole source contract to Lone Star, LLC will be executed to develop the digital twin models using Tru Navigator.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NSWC : Indian Head	0.000	0.000		0.000		0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		0.400		-		0.400	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		0.800		-		0.800	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3411 / *CAD/PAD Digital Twin Modeling*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604659N / *Precision Strike Weapons Development Program*	**Project (Number/Name)** 3411 / *CAD/PAD Digital Twin Modeling*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
CAD/PAD Digital Twin Modeling				
Product Development: Contract Awards: FY21 Lone Star Contract Award	2	2021	2	2021
Product Development: Contract Awards: FY23 Lone Star Contract Award	2	2023	2	2023
Product Development: Model Validation Phase I: Model Validation Phase I	2	2021	3	2023
Product Development: Product Test and Development Phase II: Product Test and Development Phase II	2	2021	1	2025
Product Development: Product Test and Development Phase III: Product Test and Development Phase III	2	2021	1	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing
2356: *Maritime Concept Generation & Development*	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Maritime Concept Generation & Development (MCGD) project (2356) focuses on the generation, development and validation of warfighting concepts, Concept of Operations (CONOPS) and doctrine in order to eliminate war fighting gaps. Naval Warfare Development Command (NWDC) also manages the Fleet Experimentation program (formerly Sea Trial). In FY2019 the project will execute a number of new experimentations in the areas of Electromagnetic Maneuver Warfare (EMW), Mine Warfare, Naval Integrated Fires, and Unmanned systems and conduct experiments (war simulations, Modeling & Simulation (M&S), at-sea events) to develop emerging Naval concepts.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	7.230	5.263	8.662	-	8.662
Current President's Budget	6.952	5.263	7.657	-	7.657
Total Adjustments	-0.278	0.000	-1.005	-	-1.005
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.278	0.000			
• Program Adjustments	0.000	0.000	-1.000	-	-1.000
• Rate/Misc Adjustments	0.000	0.000	-0.005	-	-0.005

Change Summary Explanation

The FY 2021 funding request was reduced by $1.000 million to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0604707N / *SEW Architecture/Eng Support*				Project (Number/Name) 2356 / *Maritime Concept Generation & Development*			
COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2356: *Maritime Concept Generation & Development*	33.415	6.952	5.263	7.657	-	7.657	9.774	9.802	9.591	9.783	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Maritime Concept Generation and Development (MCGD) funding provides naval warfare subject matter expertise, experiment planning expertise, Modeling and Simulation (M&S) support, and analysis expertise to enable execution of the planned experiment efforts (and the individual experiment initiatives contained within) focused on critical warfighting capabilities and the development of Distributed Military Operations and other emerging Naval concepts.
Typical deliverables for each experimental effort include:
- Experiment control plan
- Data Collection and Analysis Plan (DCAP)
- Experiment Analysis Summary Reference Document
- Experiment Engineering Plan
- Final Experiment Report (with DOTMLPF recommendations)
- New/refined doctrine/Tactics, Techniques and Procedures (TTP).

The Maritime Concept Generation and Concept Development project funds four main efforts:
(1) Provides critical concept development and experimentation manpower and warfighting subject matter expertise aligned with the Concept Generation/Concept Development (CG/CD) program. The priorities for the CG/CD program are to develop concept/concept of operations and explore near/far-term technological and non-technological solutions to war fighting gaps across all naval warfare areas. The associated experimentation efforts include planning, systems engineering and integration, modeling and simulation support, event execution,
data collection, analysis, and assessment for a wide-range of experimentation efforts including the examination of prototypes, tactical development and evaluation, support for Science and Technology (S&T) innovation, and program of record system development; venues such as workshops, seminars, war games, limited objective experiments, limited technical experiments, and live at-sea events are used to execute these experimentation efforts.
(2) Provides naval warfare subject matter expertise, experiment planning expertise, and analysis expertise to plan, execute, and assess experimentation for the fleets and warfighting development centers (WDC) at the operational and tactical levels. This includes a focus on WDC integration role, maritime command and control (C2), advanced cross-domain warfighting, and maritime operations centers (MOCS)/operational level of war (OLW) lines of operations. Seeks to solve fleet-identified warfighting gaps (referenced within the Integrated Prioritized Capability Lists (IPCL), Urgent Operational Needs Statements (UONS), Fleet Commander's Guidance, etc.). The experimentation and prototyping efforts support the "last tactical mile" of many Navy S&T programs by supporting those programs where the technology is mature enough, but requires evaluation on or by a "fleet asset" - ships, airplanes, submarines, and sailors.
(3) Provides modeling and simulation (M&S) support to Navy experimentation efforts. M&S is used to stimulate decision making during seminar-style and system war gaming experiments and provides the simulated operational environment and capabilities with high-fidelity models such as the Joint Semi-Automated Force (JSAF)

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

program. Additionally, where applicable, the Navy Simulation System (NSS) "Monte Carlo" model is also used to give high confidence solutions and outcomes to complex warfighting problems.
(4) Provides for focused, solution-driven tactics development and evaluation through experimentation. This effort is focused on developing near-term doctrine solutions to address specific fleet-identified tactical issues.

Maritime Concept Generation and Concept Development products include:
- Concepts (signed by the CNO that influence future funding and technological development)
- Enabling concepts
- Concepts of operations (CONOPS)
- Final experimentation reports (including findings, insights, and recommendations and DOTMLPF change recommendations and plans for action)
- Experiment Analysis Summary Reference Documents
- New/revised doctrinal and Tactics/Techniques/Procedures publications
- White papers (think pieces) intended to generate further discussion within Navy leadership

Specific products are listed in the Accomplishments/Plans section of this exhibit.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Maritime Concept Generation and Development	6.952	5.263	7.657	0.000	7.657
Articles:	-	-	-	-	-

FY 2020 Plans:
Through FY20 Maritime Concept Generation and Development (MDGD) experiment efforts, Navy will continue to provide experiment, analytical and naval mission subject matter expertise support throughout the planning and execution process; identify warfighting deficiencies through experimentation; identify and capture innovative solutions for experiments that address prioritized warfighting gaps; and identify suitable events to support the execution of the following Experimentation Campaigns:

FLEET DESIGN EXPERIMENTS
In keeping with the CNO's Design for Maintaining Maritime Superiority, the emerging concept "Fleet Design" has been developed. Continuing the development of the supporting doctrine, Tactics, Techniques and Procedures (TTP), Command and Control (C2) as well as the integration and interoperability required between weapon systems and decision makers requires a methodical experimental approach. FY20 experiments (both at-sea and via war simulation) will strive to achieve the objectives as laid out in the accompanying action/implementation plan. Specific events planned for FY20 include:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
HUMAN-MACHINE INTEGRATION (HMI) OF ARTIFICIAL INTELLIGENCE (AI) EXPERIMENTATION - This effort will examine the incorporation of AI capabilities into Naval technologies, TTPs, and C2 processes such as the development of AI-enabled Tactical Decision Aids that autonomously transition data into information. ELECTROMAGNETIC MANEUVER WARFARE (EMW) EXPERIMENTATION Navy will conduct multiple events designed to synchronize and align experiment initiatives with Electromagnetic Maneuver Warfare (EMW) tasks to provide solutions to EMW capability gaps and to ensure development of doctrine and Tactics, Techniques and Procedures (TTP) is synchronized with the introduction of new technology and provides the Fleet and Fleet trainers with required doctrine tools at the tactical and operational levels. OFFICE OF NAVAL RESEARCH (ONR) TECHNOLOGY INNOVATION GAMES (TIGS). This series of workshops executed in conjunction with ONR will give Fleet operators the opportunity to examine emerging capabilities and determine potential concepts of employment to effectively incorporate innovative capabilities into Fleet warfighting missions and tasks. MARITIME CYBERSPACE EXPERIMENT - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary cyber capabilities. PANDARRA WAVE 20 At-Sea Experiment - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary Intelligence, Surveillance, and Reconnaissance (ISR) capabilities. RED NITRUM 20 At-Sea Experiment - This classified effort builds upon prior year experiments to further examine Navy vulnerabilities to adversary electronic attack capabilities. COUNTER-UNMANNED SYSTEMS (C-UXS) EXPERIMENT SERIES - This effort will build upon prior year experimentation by examining emerging TTPs and technologies to counter the proliferation of unmanned undersea, surface, and air vehicles. The series will consist of workshops focused on countering various types of unmanned systems culminating in an at-sea cross domain Counter-Unmanned Systems (C-UxS) experiment. NAVAL FORCE INTEGRATION EXPERIMENTATION Naval Force Integration experiments (workshops, War simulations, and at-sea events) will examine integration and interoperability issues associated with coordinated USN-USMC operations. The primary goal of the					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
campaign is to reexamine Navy and Marine Corps organizational and command relationships in order to enable effective Naval operations across the maritime domain. Specific events currently planned for FY20 include: LARGE SCALE EXERCISE (LSE) 2020 - This Naval exercise at the Operational to Tactical Level of War in a maritime theater with assigned live and synthetic assets in stressing competitor conditions will provide a comprehensive assessment of the three enabling components of Fleet design - Integration, Distribution, and Maneuver. MINE WARFARE (MIW) EXPERIMENTATION Through workshops, war simulations and at-sea events, the FY20 efforts will continue to examine TTP and C2 construct for our future Mine Counter Measures (MCM) force as new programs of record and unmanned systems come on line, and legacy systems begin to decommission. OPERATIONAL LEVEL OF WAR/TACTICAL LEVEL OF WAR (OLW/TLW) INTEGRATION EXPERIMENTATION OLW/TLW Integration experiments (workshops, war simulations and at-sea events) will examine current and emerging TTPs and current and emerging technologies with a goal of identifying innovative solutions that will support the capstone naval concept of a Fleet Design based on integration, distribution, and maneuver. Specific events planned for FY20 include: DISTRIBUTED MARITIME OPERATIONS (DMO) Experimentation - This effort will address key DMO concept action plan items such as the examination of Fleet Command and Maritime Operation Center (MOC) capabilities, and the employment of unmanned systems in support of DMO. SPACE EXPERIMENT SERIES - This effort will build upon prior year experimentation on the employment of space-based capabilities at the OLW/TLW. EMERGING CONCEPTS WAR SIMULATIONS - This effort will employ multiple seminar war simulations to examine emerging concepts such as Fleet Design, Distributed Maritime Operations, and multiple feeder concepts. FOR FY20 CONCEPT GENERATION/CONCEPT DEVELOPMENT (CG/CD) Continue CG/CD development efforts that carry-over from FY19:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Additional concepts and CONOPs to be developed in FY20 will be determined through the CG/CD development process and additional external factors. Concepts under consideration include Unmanned Systems in support of DMO, Command and Control in support of DMO, Offensive Mine Warfare, Targeting in support of DMO, and Advanced Autonomous/Semi-autonomous Sustainment Systems.					
FY 2021 Base Plans: FY21 MCGD experiment efforts, NWDC will continue to provide experiment, analytical and naval mission subject matter expertise support throughout the planning and execution process; identify fleet warfighting deficiencies through experimentation; identify and capture innovative solutions for fleet experiments that address prioritized fleet warfighting gaps. Experiments will address the following areas: COUNTER-INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE AND TARGETING (ISRT) This series of experiments will build upon similar Electromagnetic Maneuver Warfare (EMW)-related experiments completed in recent years to explore technologies and associated Tactics, Techniques and Procedures (TTP). DECEPTION This series of experiments will explore technologies and associated TTP designed to provide the Fleet with effective deception capabilities. RESILIENT COMMUNICATIONS AND MISSION COMMAND This series of experiments will explore technologies and associated TTP designed to provide the Fleet with communication capabilities that can be relied upon in contested environments. LOGISTICS MOBILITY, CAPACITY, AND PROTECTION This series of experiments will explore technologies and associated TTP designed to enhance Fleet logistics capabilities to support operations in contested environments. SPACE AND CYBERSPACE INTEGRATION This series of experiments will explore technologies and associated TTP designed to enhance the capability to integrate space and cyberspace operations. REMOTE AND PASSIVE SENSING INTEGRATION					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
This series of at-sea events and workshops will explore technologies and associated TTP designed to enhance capability to take advantage of all available sensor data. LONG RANGE FIRES This series of experiments will explore technologies and associated TTP designed to enhance long range fires capabilities. POINT DEFENSE This series of experiments will explore technologies and associated TTP designed to enhance the capability to provide "last line" of defense against adversary manned and unmanned threats. NAVAL OPERATIONAL ARCHITECTURE This series of experiments will explore technologies and associated TTP designed to provide an integrated operational architecture. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY20 to FY21 increase of $2.394 million provides for experiment planning and execution support for events designated in the experimentation plan approved by the Commander, United States Fleet Forces (CUSFF), Commander, Pacific Fleet (CPF), and Commander, Naval Forces Europe (NAVEUR). The increase supports the expansion from three (3) to six (6) experiment teams required to support the FY21 experiment execution schedule. The FY 2021 funding request was reduced by $1.000 million to account for the availability of prior year execution balances.					
Accomplishments/Planned Programs Subtotals	6.952	5.263	7.657	0.000	7.657

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

D. Acquisition Strategy

This funding is used to acquire intellectual capital in emerging conceptual and technical areas through contracts providing expertise in concepts and experiment design, execution and analysis to mitigate fleet-identified current and future war fighting gaps.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Test and Evaluation	C/CPFF	Defense Technical Information Center : Ft Belvoir VA	16.493	3.870	Jan 2019	2.315	Jun 2020	3.525	Dec 2020	-		3.525	Continuing	Continuing	Continuing
System Test and Evaluation	Various	NIWC Atlantic : Charleston, SC	2.734	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
System Test and Evaluation	Various	ONR : Washington, DC	1.370	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
System Test and Evaluation	Various	NAVSEA : Washington, DC	1.334	0.000		0.000		0.000		-		0.000	0.000	1.334	-
System Test and Evaluation	PO	Naval Underwater Warfare Center : Newport RI	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
System Test and Evaluation	C/CPFF	NAVSUP : Norfolk VA	8.120	3.082	Jan 2019	2.948	Jun 2020	4.132	Feb 2021	-		4.132	0.000	18.282	-
Center for Naval Analysis	IA	Center for Naval Analysis : Norfolk, VA	0.154	0.000		0.000		0.000		-		0.000	0.000	0.154	-
		Subtotal	30.705	6.952		5.263		7.657		-		7.657	Continuing	Continuing	N/A

Remarks

The vast majority of the contract costs are for contract labor; primarily on two large Multi-Award contracts, one through DTIC (Defense Services MAC) and one through Joint Staff J-7 MAC. Task orders on the DS MAC contract provide the majority of the Modeling & Simulation support for experimentation and some of the experiment planner support. Task orders on the JS J-7 MAC provide the majority of the experiment design, planner, and execution support.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	C/FFP	Navy Warfare Development Command : Norfolk, VA	2.710	0.000		0.000		0.000		-		0.000	0.000	2.710	-
		Subtotal	2.710	0.000		0.000		0.000		-		0.000	0.000	2.710	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	33.415	6.952		5.263		7.657		-		7.657	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Proj 2356																												
Maritime Concept Generation and Development Efforts: Emergent Concepts and Enabling Concepts	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Maritime Concept Generation and Development Efforts: Develop Distributed Maritime Operations Concept / Enabling Concepts																					■	■	■	■				
Maritime Concept Generation and Development Efforts: Unmanned Systems Concept	■	■	■	■	■	■	■	■	■	■	■	■																
Maritime Concept Generation and Development Efforts: Mining Concept	■	■	■	■	■	■	■	■	■	■	■	■																
Experimentation Efforts: Electromagnetic Maneuver Warfare Enablers Experimentation Campaign	■	■	■	■																								
Experimentation Efforts: Unmanned Systems experiment series	■	■	■	■																								
Experimentation Efforts: Counter unmanned Systems experiment series	■	■	■	■																								
Experimentation Efforts: Space Experiment SHF SATCOM Agility	■	■	■	■																								
Experimentation Efforts: Red Nitrum At-Sea Experiment	■	■	■	■																								
Experimentation Efforts: Maritime Cyberspace Experiment Workshop	■	■	■	■																								
Experimentation Efforts: Naval Tactical Grid Enablers At-Sea Experiment Series	■	■	■	■																								

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2356				
Maritime Concept Generation and Development Efforts: Emergent Concepts and Enabling Concepts	1	2019	4	2025
Maritime Concept Generation and Development Efforts: Develop Distributed Maritime Operations Concept / Enabling Concepts	1	2019	4	2024
Maritime Concept Generation and Development Efforts: Unmanned Systems Concept	1	2019	4	2021
Maritime Concept Generation and Development Efforts: Mining Concept	1	2019	4	2021
Experimentation Efforts: Electromagnetic Maneuver Warfare Enablers Experimentation Campaign	1	2019	4	2019
Experimentation Efforts: Unmanned Systems experiment series	1	2019	4	2019
Experimentation Efforts: Counter unmanned Systems experiment series	1	2019	4	2019
Experimentation Efforts: Space Experiment SHF SATCOM Agility	1	2019	4	2019
Experimentation Efforts: Red Nitrum At-Sea Experiment	1	2019	4	2019
Experimentation Efforts: Maritime Cyberspace Experiment Workshop	1	2019	4	2019
Experimentation Efforts: Naval Tactical Grid Enablers At-Sea Experiment Series	1	2019	4	2019
Experimentation Efforts: ONR Technology Innovation Game (TIG) Workshops- Article Mobile Observation System	1	2019	4	2019
Experimentation Efforts: ONR Technology Innovation Game (TIG) Workshops Artificial Intelligence	1	2019	4	2019
Experimentation Efforts: Distributed Maritime Operations Exeriment Series	1	2019	4	2024
Experimentation Efforts: MCM Adapative Force Package (AFP) at sea experiment	1	2019	4	2019
Experimentation Efforts: Fleet Deception Experiment Series	1	2020	4	2024
Experimentation Efforts: FLEX in Large Scale Exercise (LSE) 2020	1	2019	4	2020

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604707N / *SEW Architecture/Eng Support*	**Project (Number/Name)** 2356 / *Maritime Concept Generation & Development*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Experimentation Efforts: Counter-ISRT Experiment Series	1	2020	4	2025
Experimentation Efforts: Resiliant Communications and Mission Command Experiment Series	1	2020	4	2025
Experimentation Efforts: Logistics Mobility, Capacity and Protection Experiment Series	1	2020	4	2025
Experimentation Efforts: Space and Cyberspace Integration Experiment Series	1	2020	4	2025
Experimentation Efforts: Remote and Passive Sensing Experiment Series	1	2020	4	2025
Experimentation Efforts: Long Range Fires Experiement Series	1	2020	4	2025
Experimentation Efforts: Point Defense Experiment Series	1	2020	4	2025

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,160.116	141.383	115.419	35.750	-	35.750	29.840	0.000	0.000	0.000	0.000	1,482.508
3337: *Offensive Anti-Surface Warfare (OASuW) Weapon*	1,160.116	122.076	65.419	35.750	-	35.750	29.840	0.000	0.000	0.000	0.000	1,413.201
9999: *Congressional Adds*	0.000	19.307	50.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	69.307

Program MDAP/MAIS Code:
Project MDAP/MAIS Code(s): P449

A. Mission Description and Budget Item Justification

Offensive Anti-Surface Warfare (OASuW) will be an offensive weapon system that can be air, surface, and subsurface launched in the maritime battle space environment. OASuW is a vital component of the Joint Force Anti-Surface Warfare capability and incorporate new and emergent technologies to support an increased offensive strike capability. Due to emerging threats, the fleet issued an Urgent Operational Needs Statement (UONS) that identified a capability gap for a long-range anti-ship missile to be filled by 2018. Directly supporting this UONS and significantly reducing Joint Force warfighting risks, the U.S. Navy initiated OASuW Increment 1 (OASuW-1), which leverages the Defense Advanced Research Projects Agency (DARPA)/Office of Naval Research Long Range Anti-Ship Missile (LRASM) demonstration program to deliver an Early Operational Capability (EOC) in the required timeframe. LRASM fills the most urgent air-launched capability gap to complement existing ASuW weapon systems and positions the Department of Defense to address evolving surface warfare threats. LRASM is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. The development and acquisition of LRASM has been structured to be fielded at a pace relevant to maintain overmatch against long-term strategic competition. Specifically, LRASM directly contributes to building a more lethal force and is a critical enabler for joint lethality in contested environments; deterring adversaries from aggression; ensuring common domains remain open and maintaining favorable regional balances of power.

The OASuW program is part of the Navy's Integrated Fire Control (IFC) approach to address advanced threat capabilities in the Anti-Access/Area-Denial (A2AD) environment. IFC solutions enable individual system capabilities to be leveraged across an effects chain, placing the full spectrum of tactical capability in the hands of the warfighter. IFC solutions that push engagement distances beyond the launch platform's radar horizon and allows the U.S. Navy to operate in, and control, contested battle space in littoral waters and A2/AD environments are increasingly critical as more and more scenarios require compressed and coordinated fire control timelines.

Budget Item Justification: OASuW-1
The program is leveraging DoDI 5000.02i Model 4 to structure the acquisition strategy, which includes a highly integrated and concurrent transition design, integration, and developmental / operational test program to meet the EOC schedule required by the UONS. To manage the accelerated timeline and resulting concurrency, the program uses a structured Knowledge Point review process that support decisions regarding significant program events such as transition from design to integration phase and contract awards. These reviews also provide senior DoD leadership the opportunity to provide focused support and active management of technical and acquisition risk and are chaired by the Service Acquisition Executive, ASN(RDA). The knowledge points are similar to acquisition milestone reviews, but occur more frequently and are tailored to program-specific milestone events. The program met statutory requirements associated with Milestone B at Knowledge Point 3. In

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*

addition to the Knowledge Point reviews, the program also conducts Executive Steering Board reviews, chaired by the MDA. Supporting these reviews, the associated engineering approach is designed to mitigate resulting risk by implementing a rolling-wave engineering progression based on the NAVAIR Systems Engineering Technical Review (SETR) process to enable detailed planning and decisions as the system matures. This process includes capstone SETR events that are tailored reviews using standard design review criteria. Subsequent to baseline OASuW Increment 1, the LRASM v1.1 capability improvements program will continue in the same manner with continued reviews and test events to achieve incorporation of those improvements in future production units.

This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	139.261	65.419	40.438	-	40.438
Current President's Budget	141.383	115.419	35.750	-	35.750
Total Adjustments	2.122	50.000	-4.688	-	-4.688
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	50.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	5.500	0.000			
• SBIR/STTR Transfer	-3.378	0.000			
• Program Adjustments	0.000	0.000	-5.150	-	-5.150
• Rate/Misc Adjustments	0.000	0.000	0.462	-	0.462

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Operational Test Requirements for Additional Capabilities*	19.307	0.000
Congressional Add: *LRASM 1.1 capability improvements*	0.000	50.000
Congressional Add Subtotals for Project: 9999	19.307	50.000
Congressional Add Totals for all Projects	19.307	50.000

Change Summary Explanation

LRASM v1.1 capability improvements efforts that initiated in FY 2019 continue through FY 2022 to ensure tactical dominance for the warfighter over a longer period of time by providing sanctuary employment against capital warships. Enhancements include range increase, improved communication capabilities, increased survivability and the associated testing for LRASM. Decrease in FY 2021 funding from FY 2020 is due to LRASM v1.1 developmental material

procurements already on order. FY 2021 funds continue labor for development integration and testing of the v1.1 capability. The FY 2021 funding request was reduced by $5.0M to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3337: *Offensive Anti-Surface Warfare (OASuW) Weapon*	1,160.116	122.076	65.419	35.750	-	35.750	29.840	0.000	0.000	0.000	0.000	1,413.201
Quantity of RDT&E Articles	13	-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: P449

A. Mission Description and Budget Item Justification

Offensive Anti-Surface Warfare (OASuW) is an offensive weapon system that can be air, surface, and subsurface launched in the maritime battle space environment. OASuW is a vital component of the Joint Force Anti-Surface Warfare capability and incorporate new and emergent technologies to support an increased offensive strike capability. Due to emerging threats, the fleet issued an Urgent Operational Needs Statement (UONS) that identified a capability gap for a long-range anti-ship missile to be filled by 2018. Directly supporting this UONS and significantly reducing Joint Force warfighting risks, the U.S. Navy initiated OASuW Increment 1 (OASuW-1), which leverages the Defense Advanced Research Projects Agency(DARPA)/Office of Naval Research Long Range Anti-Ship Missile (LRASM) demonstration program to deliver an Early Operational Capability (EOC) in the required timeframe. LRASM fills the most urgent air-launched capability gap to complement existing ASuW weapon systems and positions the Department of Defense to address evolving surface warfare threats. LRASM is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. The development and acquisition of LRASM has been structured to be fielded at a pace relevant to maintain overmatch against long-term strategic competition. Specifically, LRASM directly contributes to building a more lethal force and is a critical enabler for joint lethality in contested environments; deterring adversaries from aggression; ensuring common domains remain open and maintaining favorable regional balances of power.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: OASuW Development Program	122.076	65.419	35.750	0.000	35.750
Articles:	-	-	-	-	-
FY 2020 Plans: The development, integration and test phase of the program will continue in FY 2020 for the Long Range Anti-Shape Missile (LRASM) v1.1 capability improvements efforts. Continued development for LRASM v1.1 capability improvements is programmed to ensure tactical dominance for the warfighter over a longer period of time by providing sanctuary employment against capital warships. This continued development expands the mission set to address evolving, persistent and dynamic threats and continues to fill gaps in strike warfare. The development and follow-on test efforts added include range increase, improved communication capabilities, and increased survivability. These expanded mission set efforts will integrate into future Lot procurements.					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continued development, integration and test for the OASUW Increment 1 LRASM v1.1 capability improvements to ensure tactical dominance for the warfighter over a longer period of time by providing sanctuary employment against capital warships. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease of $29.699 million from FY 2020 to FY 2021 due to progression of development efforts; developmental related material has previously been ordered and FY 2021 funds continued labor to support integration and testing. The FY 2021 funding request was also reduced by $5.0M to account for the availability of prior year execution balances.					
Accomplishments/Planned Programs Subtotals	122.076	65.419	35.750	0.000	35.750

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• WPN/2291: *LRASM*	119.790	72.544	168.845	-	168.845	164.846	164.669	160.646	60.512	0.000	1,091.028
• MPAF/8010: *LRASM*	54.385	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	187.524

Remarks

U.S. Navy WP,N funding supports the following quantities:

FY17 - 15 (FY17 funding procured 14 Lot 1 units and 1 unit that was priced at and part of the Lot 2 procurement)
FY18 - 34 (Lot 2)
FY19 - 33 (Lot 3)
FY20 - 17 (Lot 4)
FY21 - 48 (Lot 5)
FY22 - 48 (Lot 6)
FY23 - 48 (Lot 7)
FY24 - 48 (Lot 8)
FY25 - 18 (Lot 9)

U.S. Air Force MP,AF funding supports the following quantities:

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost

FY17 - 19 (Lot 1)
FY18 - 16 (1 unit is priced at and part of FY 2017 Lot 1 procurement to achieve 20 total Air Force units in Lot 1; 15 units are with the FY 2018 Lot 2 procurement)
FY19 - 15 (Lot 3)
USAF currently working outyears budget profile (FY 2023 - FY 2025)

D. Acquisition Strategy

OASuW-1 is using an accelerated acquisition approach, with streamlined governance to transition the DARPA/ONR-demonstrated Long Range Anti-Ship Missile (LRASM) for use as an air-launched weapon from USAF and USN platforms. LRASM is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. LRASM supports greater performance of the acquisition system and is demonstrating the delivery of performance at the speed of relevance; organizational structure that supports innovation with a rapid approach that dramatically decreases the timeline from development to fielding. The program is leveraging DoDI 5000.02i Model 4 to structure the acquisition strategy, which includes a highly integrated and concurrent transition design, integration, and developmental / operational test program which successfully met the Early Operation Capability (EOC) fielding threshold required by an Urgent Operational Need Statement (UONS) issued by the fleet. The program is structured in three phases: Technology Maturation, Integration and Test, and Procurement. To manage the accelerated timeline and resulting concurrency, the program uses a structured Knowledge Point review process that support decisions regarding significant program events such as transition from design to integration phase and contract awards. These reviews also provide senior DoD leadership the opportunity to provide focused support and active management of technical and acquisition risk and are chaired by the Service Acquisition Executive, ASN(RDA) (delegated MDA), and the Deputy Director of DARPA. The knowledge points are similar to acquisition milestone reviews, but occur more frequently. Knowledge Point 7 supported Lot 3 procurement and Knowledge Point 8 supported USN EOC decision. The program met the statutory requirements associated with Milestone B at Knowledge Point 3. In addition to the Knowledge Point reviews, the program also conducts Executive Steering Board reviews (also chaired by the MDA). Supporting these reviews, the associated engineering approach is designed to mitigate resulting risk by implementing a rolling-wave engineering progression based on the NAVAIR Systems Engineering Technical Review (SETR) process to enable detailed planning and decisions as the system matures. The LRASM v1.1 capability improvements program, which initiated in FY 2019, follows in the same manner with continued reviews and test events to achieve incorporation of those improvements on future production units.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPIF	Lockheed Martin Missile and Fire Control : Orlando, FL	846.797	79.248	Oct 2018	43.147	Apr 2020	16.999	Oct 2020	-		16.999	14.179	1,000.370	1,000.107
Product Development	C/CPFF	Boeing : St. Louis, MO	60.539	0.964	Mar 2019	0.630	Mar 2020	0.256	Mar 2021	-		0.256	0.000	62.389	62.613
		Subtotal	907.336	80.212		43.777		17.255		-		17.255	14.179	1,062.759	N/A

Remarks

Lockheed Martin (LM) costs include all integration and test efforts for LRASM v1.1 capability improvements development by LM and associated sub-contractors. FY 2021 includes continued product development for LRASM v1.1 integration and testing and receipt of previously ordered material to support those activities.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NAWC AD : Patuxent River,MD	8.577	1.413	Nov 2018	1.245	Nov 2019	0.990	Nov 2020	-		0.990	1.100	13.325	-
Government Support	WR	NAWC WD : China Lake, CA	50.689	8.668	Nov 2018	2.640	Nov 2019	1.250	Nov 2020	-		1.250	1.180	64.427	-
Development Support	WR	NSMA : Washington, DC	22.987	6.746	Dec 2018	1.015	Nov 2019	1.150	Nov 2020	-		1.150	1.100	32.998	34.928
Contractor Support	C/CPFF	JHU/APL : Laurel, MD	12.256	0.480	Jul 2019	0.500	Jul 2020	0.000		-		0.000	0.000	13.236	13.236
Contractor Support	C/FFP	Gryphon - Schafer Corporation : Arlington, VA	20.744	2.710	Jun 2019	3.140	Jun 2020	1.100	May 2021	-		1.100	0.980	28.674	28.700
Mission Planning Support	C/CPFF	Northrop Grumman : Bethpage, NY	9.988	0.969	Oct 2018	0.950	Feb 2020	0.300	Feb 2021	-		0.300	0.000	12.207	12.207
Contractor Support	C/FFP	Engility : Patuxent River, MD	0.936	0.945	Jun 2019	1.100	Jun 2020	1.000	Jun 2021	-		1.000	0.780	4.761	4.761
Contractor Support	Various	Various : Various	10.986	0.858	Oct 2018	0.850	Oct 2019	0.500	Nov 2020	-		0.500	0.400	13.594	13.594
Government Support	Various	Various : Various	6.185	0.608	Nov 2018	0.085	Nov 2019	0.050	Nov 2020	-		0.050	0.000	6.928	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Prior Yr Supp no longer funded in the FYDP	Various	Various : Various	2.800	0.000		0.000		0.000		-		0.000	0.000	2.800	-
		Subtotal	146.148	23.397		11.525		6.340		-		6.340	5.540	192.950	N/A

Remarks

Support costs consist of support from Government offices and Contractor Support experts associated with engineering, threat analysis, CONOPs, and Training and Tactical assessments for continued development of the LRASM v1.1 capability improvements.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support	WR	NAWC WD : China Lake, CA	50.276	11.174	Nov 2018	6.455	Nov 2019	7.350	Nov 2020	-		7.350	6.205	81.460	-
Development Support	WR	NAWC AD : Patuxent River, MD	29.537	4.262	Nov 2018	1.020	Nov 2019	2.275	Nov 2020	-		2.275	1.604	38.698	-
Development Support	WR	COTF : Norfolk, VA	0.222	0.175	Sep 2019	0.182	Sep 2020	0.185	Sep 2021	-		0.185	0.190	0.954	-
Development Support	MIPR	USAF : Various	5.819	0.081	Oct 2018	0.175	Apr 2020	0.000		-		0.000	0.000	6.075	-
Contractor Eng Support	C/CPFF	NAVSUP : Port Hueneme, CA	0.075	0.000		0.075	Apr 2020	0.075	Sep 2021	-		0.075	0.075	0.300	0.300
Prior Yr T&E no longer funded in the FYDP	Various	Various : Various	4.494	0.000		0.000		0.000		-		0.000	0.000	4.494	-
		Subtotal	90.423	15.692		7.907		9.885		-		9.885	8.074	131.981	N/A

Remarks

Test and Evaluation costs support flight testing, system qualifications, range time, and target costs needed for LRASM v1.1 capability improvements. Supports the integrated test program for development test and operational test for LRASM. Increases from FY 2020 to FY 2021 due to increased flight testing related activities for LRASM v1.1 based on progression of development efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	WR	NAWC AD : Patuxent River, MD	8.688	1.839	Nov 2018	1.100	Nov 2019	1.145	Nov 2020	-		1.145	0.995	13.767	-
Government Support	WR	NAWC WD : China Lake, CA	4.556	0.791	Nov 2018	0.960	Nov 2019	0.975	Nov 2020	-		0.975	0.980	8.262	-
Project Management Support	C/CPFF	NAWC AD : Patuxent River, MD	1.600	0.000		0.000		0.000		-		0.000	0.000	1.600	1.600
Travel	Various	NAWC AD : Patuxent River, MD	1.365	0.145	Oct 2018	0.150	Oct 2019	0.150	Oct 2020	-		0.150	0.150	1.960	-
		Subtotal	16.209	2.775		2.210		2.270		-		2.270	2.125	25.589	N/A

Remarks

Management Services costs consist of Non-Headquarters Program Office Management team (Government labor and Contractor support services) required for the management of the program. FY 2021 continues management services to support the LRASM v1.1 capability improvements.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1,160.116	122.076		65.419		35.750		-		35.750	29.918	1,413.279	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Offensive Anti-Surface Weapon (OASuW) Page 1				
Development: Knowledge Point 8	4	2019	4	2019
Development: Early Operational Capability (EOC) Air Force	1	2019	1	2019
Development: Early Operational Capability (EOC) Navy	1	2020	1	2020
Development: Knowledge Point 9 (LRASM v1.1)	1	2021	1	2021
Development: Knowledge Point 10 (LRASM v1.1)	1	2023	1	2023
Development: Early Operational Capability (LRASM v1.1) Navy	1	2023	1	2023
Development: LRASM 1.0 Integration & Test	1	2019	2	2020
Development: LRASM 1.1 Integration & Test	3	2019	1	2023
Development: J2 Wing Develpment (LRASM v1.1)	1	2019	3	2022
Development: LRASM 1.1 Integration & Test PDR	4	2020	4	2020
Development: LRASM 1.1 Integration & Test CDR (SETR-9)	3	2021	3	2021
Development: A/C Software Integration	4	2019	3	2022
Development: Diminishing Manufacturing Sources / Cost Reduction Initiative (Radio Frequency Sensor)	2	2019	3	2021
Development: VIASAT 2.0	4	2019	1	2021
Development: ESAF Sled / SNORT (Fuze)	1	2021	1	2022
Development: Free Flight Evaluation Missile (FFEM)-1	1	2022	1	2022
Development: FFEM-2	2	2022	2	2022
Development: FFEM-3	2	2022	2	2022
Development: Integrated Test Event (ITE)-10	2	2022	2	2022
Development: ITE-11	3	2022	3	2022

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 3337 / *Offensive Anti-Surface Warfare (OASuW) Weapon*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Development: Quick Reaction Assessment Testing (Navy)	1	2023	1	2023
Production: FY18 Production Buy - 50 units (16 AF, 34 NAVY)	1	2019	1	2019
Production: FY19 Production Buy - 48 units (15 AF, 33 NAVY)	2	2020	2	2020
Production: FY20 Production Buy - 48 units (17 NAVY)	1	2021	1	2021
Production: FY21 Production Buy - 48 units (48 NAVY)	1	2021	1	2021
Production: FY22 Production Buy - 48 units (48 NAVY)	1	2022	1	2022
Production: FY23 Production Buy - 48 units (48 NAVY)	1	2023	1	2023
Production: FY24 Production Buy - 48 units (48 NAVY)	1	2024	1	2024
Production: FY25 Production Buy - 18 units (18 NAVY)	1	2025	1	2025
Production: FY17 Deliveries - 34 units	1	2019	4	2020
Production: FY18 Deliveries - 50 units	4	2020	4	2021
Production: FY19 Deliveries - 48 units	1	2022	1	2023
Production: FY20 Deliveries - 48 units	1	2023	1	2024
Production: FY21 Deliveries - 48 units	1	2024	1	2025
Production: FY22 Deliveries - 48 units	1	2025	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy												Date: February 2020
Appropriation/Budget Activity 1319 / 4					**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*				**Project (Number/Name)** 9999 / *Congressional Adds*			
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	19.307	50.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	69.307
Quantity of RDT&E Articles		3	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Offensive Anti-Surface Warfare (OASuW) is an offensive weapon system that can be air, surface, and subsurface launched in the maritime battle space environment. OASuW is a vital component of the Joint Force Anti-Surface Warfare capability and incorporate new and emergent technologies to support an increased offensive strike capability. Due to emerging threats, the fleet issued an Urgent Operational Needs Statement (UONS) that identified a capability gap for a long-range anti-ship missile to be filled by 2018. Directly supporting this UONS and significantly reducing Joint Force warfighting risks, the U.S. Navy initiated OASuW Increment 1 (OASuW-1), which leverages the Defense Advanced Research Projects Agency(DARPA)/Office of Naval Research Long Range Anti-Ship Missile (LRASM) demonstration program to deliver an Early Operational Capability (EOC) in the required timeframe. LRASM fills the most urgent air-launched capability gap to complement existing ASuW weapon systems and positions the Department of Defense to address evolving surface warfare threats. LRASM is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. The development and acquisition of LRASM has been structured to be fielded at a pace relevant to maintain overmatch against long-term strategic competition. Specifically, LRASM directly contributes to building a more lethal force and is a critical enabler for joint lethality in contested environments; deterring adversaries from aggression; ensuring common domains remain open and maintaining favorable regional balances of power.

Budget Item Justification: Funding in this project is for OASuW Increment I / LRASM v1.1 capability improvements to include OT requirements.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2019**	**FY 2020**
Congressional Add: Operational Test Requirements for Additional Capabilities ***FY 2019 Accomplishments:*** Funding that was Congressionally directed to be utilized for LRASM v1.1 capability improvements Operational Test (OT) requirements procured 3 test assets for OT. ***FY 2020 Plans:*** N/A	19.307	0.000
Congressional Add: LRASM 1.1 capability improvements ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** FY 2020 funding supports development of LRASM 1.1 capability improvements including beyond line of sight capabilities, survivability enhancements, range improvements and obsolescence upgrades	0.000	50.000
Congressional Adds Subtotals	19.307	50.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

OASuW-1 is using an accelerated acquisition approach, with streamlined governance to transition the DARPA/ONR-demonstrated Long Range Anti-Ship Missile (LRASM) for use as an air-launched weapon from USAF and USN platforms. LRASM is integral to realizing the National Defense Strategy of combat-credible military forces to deter war, protect the security of our nation and to enable the Joint Force to win should deterrence fail. LRASM supports greater performance of the acquisition system and is demonstrating the delivery of performance at the speed of relevance; organizational structure that supports innovation with a rapid approach that dramatically decreases the timeline from development to fielding. The program is leveraging DoDI 5000.02i Model 4 to structure the acquisition strategy, which includes a highly integrated and concurrent transition design, integration, and developmental / operational test program which successfully met the Early Operation Capability (EOC) fielding threshold required by an Urgent Operational Need Statement (UONS) issued by the fleet. The program is structured in three phases: Technology Maturation, Integration and Test, and Procurement. To manage the accelerated timeline and resulting concurrency, the program uses a structured Knowledge Point review process that support decisions regarding significant program events such as transition from design to integration phase and contract awards. These reviews also provide senior DoD leadership the opportunity to provide focused support and active management of technical and acquisition risk and are chaired by the Service Acquisition Executive, ASN(RDA) (delegated MDA), and the Deputy Director of DARPA. The knowledge points are similar to acquisition milestone reviews, but occur more frequently. Knowledge Point 7 supported Lot 3 procurement and Knowledge Point 8 supported USN EOC decision. The program met the statutory requirements associated with Milestone B at Knowledge Point 3. In addition to the Knowledge Point reviews, the program also conducts Executive Steering Board reviews (also chaired by the MDA). Supporting these reviews, the associated engineering approach is designed to mitigate resulting risk by implementing a rolling-wave engineering progression based on the NAVAIR Systems Engineering Technical Review (SETR) process to enable detailed planning and decisions as the system matures. The LRASM v1.1 capability improvements program, follows in the same manner with continued reviews and test events to achieve incorporation of those improvements on future production units.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPIF	Lockheed Martin Missile and Fire Control : Orlando, FL	0.000	0.000		50.000	May 2020	0.000		-		0.000	0.000	50.000	-
		Subtotal	0.000	0.000		50.000		0.000		-		0.000	0.000	50.000	N/A

Remarks

FY 2020 Congressional increase of funding for LRASM 1.1 capabilities improvements.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Support (OT)	C/CPIF	Lockheed Martin Missile and Fire Control : Orlando, FL	0.000	19.307	Jun 2019	0.000		0.000		-		0.000	0.000	19.307	19.307
		Subtotal	0.000	19.307		0.000		0.000		-		0.000	0.000	19.307	N/A

Remarks

FY 2019 Congressional direction for funding to be utilized for Offensive Anti-Surface Warfare (OASuW) Increment I / Long Range Anti-Ship Missile (LRASM) operational test requirements for 1.1 additional capabilities.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	19.307		50.000		0.000		-		0.000	0.000	69.307	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

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Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0604786N / *Offensive Anti-Surface Warfare Weapon Dev*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Offensive Anti-Surface Warfare (OASuW)				
Test & Evaluation: Operational Testing (OT) (LRASM v1.1)	3	2019	4	2022

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	53.931	8.889	9.991	9.151	-	9.151	9.335	10.722	10.938	11.157	Continuing	Continuing
0490: *Airborne Acoustic Intelligence (AAI)*	53.931	8.889	9.991	9.151	-	9.151	9.335	10.722	10.938	11.157	Continuing	Continuing

A. Mission Description and Budget Item Justification

The mission of Airborne ASW Intelligence (AAI) (CNO Project K-0416) is to provide advanced Anti-Submarine Warfare (ASW) capabilities through rapid development of new technology and prototype mechanisms for the collection of ASW related intelligence. This includes full spectrum intelligence collections and cataloging of current targets of interest. The program develops and swiftly deploys disruptive innovation to counter emerging threats in order to maintain the United States' current undersea warfare superiority. AAI employs the capability to quickly reconstruct and analyze passive and active measurements of submarine vulnerabilities providing actionable intelligence to fleet commanders. The AAI data collection program provides full spectrum intelligence data essential for the design and development of advanced sensors, weapon systems, environmental models, and tactical decision aids. AAI collection systems are installed and employed on uniquely configured aircraft, specially configured ground support facilities, ships, and other assets as required for the collection, processing, exfiltration, and dissemination of undersea intelligence. AAI includes recording systems, advanced detection and tracking systems, specially designed sensors, advanced processing systems and techniques, and specially derived tactics.

Furious Krypton is a Line of Sight (LOS) and Over the Horizon (OTH) data link utilizing a Naval Research Laboratory (NRL) communications payload onboard the Broad Area Maritime Surveillance-Demonstrator (BAMS-D) and Triton platform. The demonstration will show utilization of the payload to collect and retransmit sonobuoy data to both LOS and OTH receivers.

This is a Military Intelligence Program (MIP).

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPES because it includes all efforts necessary to evaluate integrated technologies, representative models or prototype systems in a high fidelity and realistic operating environment.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	8.889	9.991	9.158	-	9.158
Current President's Budget	8.889	9.991	9.151	-	9.151
Total Adjustments	0.000	0.000	-0.007	-	-0.007
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	-0.007	-	-0.007

Change Summary Explanation

Technical: Not Applicable

Schedule: Not Applicable

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0490: *Airborne Acoustic Intelligence (AAI)*	53.931	8.889	9.991	9.151	-	9.151	9.335	10.722	10.938	11.157	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The mission of Airborne ASW Intelligence (AAI)(CNO Project K-0416) is to provide advanced Anti-Submarine Warfare (ASW) capabilities through rapid development of new technology and prototype mechanisms for the collection of ASW related intelligence. This includes full spectrum intelligence collections and cataloging of current targets of interest. The program develops and swiftly deploys disruptive innovation to counter emerging threats in order to maintain the United States' current undersea warfare superiority. AAI employs the capability to quickly reconstruct and analyze passive and active measurements of submarine vulnerabilities providing actionable intelligence to fleet commanders. The AAI data collection program provides full spectrum intelligence data essential for the design and development of advanced sensors, weapon systems, environmental models, and tactical decision aids. AAI collection systems are installed and employed on uniquely configured aircraft, specially configured ground support facilities, ships, and other assets as required for the collection, processing, exfiltration, and dissemination of undersea intelligence. AAI includes recording systems, advanced detection and tracking systems, specially designed sensors, advanced processing systems and techniques, and specially derived tactics.

Furious Krypton is a Line of Sight (LOS) and Over the Horizon (OTH) data link utilizing a Naval Research Laboratory (NRL) communications payload onboard the Broad Area Maritime Surveillance-Demonstrator (BAMS-D) and Triton platform. The demonstration will show utilization of the payload to collect and retransmit sonobuoy data to both LOS and OTH receivers.

This is a Military Intelligence Program (MIP).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Systems Engineering / Aircraft Mods Active Acoustic Program	1.399	1.399	1.426	0.000	1.426
Articles:	-	-	-	-	-
FY 2020 Plans: Engineering support of Acoustic Intelligence (ACINT) Collection Suites (ACS) for certified AAI collection platforms and management of full spectrum database. Engineering support for design upgrades to ACINT Collection Suites for certified AAI collection platforms. Evaluate additional P-8 aircraft sensor station for in-flight analysis of ACINT. Continue evaluation of Fleet software releases for Office of Naval Intelligence(ONI)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
certification aboard ASW collection platforms. Continue upgrades and development for unique airborne avionics and sensors. Continue fielding ACS kits in support of P-8A deployments. ***FY 2021 Base Plans:*** Engineering support of Acoustic Intelligence (ACINT) Collection Suites for certified AAI collection platforms and management of full spectrum database. Engineering support for design upgrades to ACINT Collection Suites for certified AAI collection platforms. Evaluate additional P-8 aircraft sensor station for in-flight analysis of ACINT. Continue evaluation of Fleet software releases for Office of Naval Intelligence(ONI) certification aboard ASW collection platforms. Continue upgrades and development of hardware and software for unique airborne avionics and sensors. Continue fielding ACS kits in support of P-8A deployments. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to inflation.					
Title: Data Collection and Analysis	1.044	1.098	1.120	0.000	1.120
Articles:	-	-	-	-	-
FY 2020 Plans: Data collection support at Operational Wings and Tactical Anti-Submarine Warfare (ASW) commands. Ongoing collection of high interest acoustic and non-acoustic data in support of Measurement and Signatures Intelligence (MASINT)/Office of Naval Intelligence (ONI) threat assessment and trend analysis requirements for further development of future USN Undersea Warfare Warfighting (USW) capabilities. Characterization, analysis and certification of the upgraded Fleet MASINT collection assets. Reduction, Analysis and Fleet Rapid Feedback. Conduct special operations support. Essential performance modeling and evaluation for advanced technology sensor systems design and Fleet tactics development. Develop post mission analysis hardware, software and processes in response to evolving enemy capabilities. ***FY 2021 Base Plans:*** Data collection support at Operational Wings and Tactical Anti-Submarine Warfare (ASW) commands. Ongoing collection of high interest acoustic and non-acoustic data in support of MASINT/ONI threat assessment and trend analysis requirements for further development of future USN Undersea Warfare Warfighting (USW) capabilities. Characterization, analysis and certification of the upgraded Fleet MASINT collection assets. Reduction, Analysis and Fleet Rapid Feedback. Conduct special operations support. Essential performance					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
modeling and evaluation for advanced technology sensor systems design and Fleet tactics development. Develop post mission analysis hardware, software and processes in response to evolving enemy capabilities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to inflation.					
Title: Active Measurement Validation	0.143	0.146	0.148	0.000	0.148
Articles:	-	-	-	-	-
FY 2020 Plans: Active Measurement Validation of targets of interest. Provides the acoustic analysis of echo characterization (which includes: signal excess measurements, peak frequency, trend analysis and pulse duration measurements) and target strength. ***FY 2021 Base Plans:*** Active Measurement Validation of targets of interest. Provides the acoustic analysis of echo characterization (which includes: signal excess measurements, peak frequency, trend analysis and pulse duration measurements) and target strength. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to inflation.					
Title: Navy Underwater Active Multiple Ping (NUAMP) Product Development	5.103	5.144	5.209	0.000	5.209
Articles:	-	-	-	-	-
FY 2020 Plans: Continue sonic frequency design, development, integration and test for remaining sonic frequencies of the NUAMP sonobuoy family. Procure prototype systems for data collection activities. ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Continue sonic frequency design, development, integration and test for remaining sonic frequencies of the NUAMP sonobuoy family. Procure prototype systems for data collection activities. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to inflation.					
Title: Passive Extended Range Sonobuoy System (PERSS) Product Development	1.200	1.225	1.248	0.000	1.248
Articles:	-	-	-	-	-
FY 2020 Plans: Continue development of disruptive innovative sensors by experimenting and prototyping in a high fidelity and realistic operating environment. Transition various laboratory sonobuoy subsystems by proving the subsystems maturity in real world environments. Perform risk reduction technology demonstration efforts using high gain beamforming sonobuoy transducer assemblies. ***FY 2021 Base Plans:*** Continue development of disruptive innovative sensors by experimenting and prototyping in a high fidelity and realistic operating environment. Transition various laboratory sonobuoy subsystems by proving the subsystems maturity in real world environments. Perform risk reduction technology demonstration efforts using high gain beamforming sonobuoy transducer assemblies. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase is due to inflation.					
Title: Furious Krypton	0.000	0.979	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: Develop and demonstrate a disruptive innovative method to provide Tactical Anti-Submarine Warfare (ASW) data to multiple users both Beyond Line of Sight (BLOS) and via Satellite Communications (SATCOM). ***FY 2021 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No funding is provided in FY21 for Furious Krypton.					
Accomplishments/Planned Programs Subtotals	8.889	9.991	9.151	0.000	9.151

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Airborne ASW Intelligence (AAI) is a CNO Special Project. The included technology developments are primarily in-house with contractor participation through existing vehicles.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Active Measurement Validation	WR	NAWCAD : PATUXENT RIVER, MD	2.031	0.143	Dec 2018	0.146	Dec 2019	0.148	Dec 2020	-		0.148	Continuing	Continuing	Continuing
Ancillary Hdw Development	WR	NAWCAD : PATUXENT RIVER, MD	6.514	0.500	Dec 2018	0.515	Dec 2019	0.525	Dec 2020	-		0.525	Continuing	Continuing	Continuing
Ancillary Hdw Development Cont	Various	VARIOUS : VARIOUS	2.131	0.593	Dec 2018	0.600	Dec 2019	0.612	Dec 2020	-		0.612	Continuing	Continuing	Continuing
Systems Eng	WR	NAWCAD : PATUXENT RIVER, MD	6.483	0.676	Dec 2018	0.690	Dec 2019	0.699	Dec 2020	-		0.699	Continuing	Continuing	Continuing
Systems Eng	Various	VARIOUS : VARIOUS	3.058	0.723	Dec 2018	0.717	Dec 2019	0.727	Dec 2020	-		0.727	Continuing	Continuing	Continuing
Primary Hdw Development	SS/CPIF	ERAPSCO : COLUMBIA CITY, IN	29.140	6.004	Dec 2018	7.069	Dec 2019	6.182	Dec 2020	-		6.182	Continuing	Continuing	Continuing
		Subtotal	49.357	8.639		9.737		8.893		-		8.893	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mgt & Prof Spt Svcs (Non-FFRDC)	Various	VARIOUS : VARIOUS	3.675	0.205	Dec 2018	0.209	Dec 2019	0.213	Dec 2020	-		0.213	Continuing	Continuing	Continuing
Travel	Various	VARIOUS : VARIOUS	0.280	0.045	Dec 2018	0.045	Dec 2019	0.045	Dec 2020	-		0.045	Continuing	Continuing	Continuing
Prior year Mgmt Svcs no longer funded in the FYDP	Various	VARIOUS : VARIOUS	0.619	0.000		0.000		0.000		-		0.000	0.000	0.619	-
		Subtotal	4.574	0.250		0.254		0.258		-		0.258	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	53.931	8.889		9.991		9.151		-		9.151	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0303354N / *ASW Systems Development - MIP*	**Project (Number/Name)** 0490 / *Airborne Acoustic Intelligence (AAI)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj: 0490 Airborne Acoustic Intelligence (AAI)				
Systems Engineering: P-3/P-8 Avionics Suite: P-3/P-8/MH-60R Avionics Suite	1	2019	4	2025
Sys Eng Tactical Acoustic Processor (TAPS): Sys Eng Tactical Acoustic Processor (TAPS)	1	2019	4	2025
Product Development: Furious Krypton Development	1	2020	4	2025
Product Development: Passive Extended Range Sonic Sensor	1	2019	4	2025
Product Development: Data Collection and Analysis	1	2019	4	2025
Product Development: Active Target Strength sensor processing development	1	2019	4	2025
Test & Evaluation: Technical Evaluation	1	2019	4	2025
Airborne Avionics Deliveries: Prototype 6	2	2019	2	2019
Airborne Avionics Deliveries: Prototype 7	2	2020	2	2020
Airborne Avionics Deliveries: Prototype 8	2	2021	2	2021
Airborne Avionics Deliveries: Prototype 9	2	2022	2	2022
Airborne Avionics Deliveries: Prototype 10	2	2023	2	2023
Airborne Avionics Deliveries: Prototype 11	2	2024	2	2024
Airborne Avionics Deliveries: Prototype 12	2	2025	2	2025

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	5.200	17.554	45.407	22.589	-	22.589	27.063	63.451	63.028	64.288	Continuing	Continuing
3135: *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*	4.978	12.708	12.907	22.589	-	22.589	27.063	63.451	63.028	64.288	Continuing	Continuing
3427: *KMAX Experimentation and Support*	0.222	4.846	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	5.068
9999: *Congressional Adds*	0.000	0.000	32.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	32.500

A. Mission Description and Budget Item Justification

This program element provides for development and capability requirements for Advanced Tactical Unmanned Aerial Vehicles in support of expeditionary efforts.

Project 3135 - This project provides technical concept maturation and prototyping for the Marine Air Ground Task Force (MAGTF) Unmanned Aircraft System (UAS) Expeditionary (MUX) with Vertical/Short Take-Off and Vertical Landing (V/STOVL) capability allowing for runway independence. MUX is determined to be a critical capability for current and future USMC expeditionary operations. These MUX efforts will include refinement of program requirements and Concept of Operations (CONOPS), modeling and simulation of mission payloads with minimized Space, Weight, Power, and Cooling (SWaP-C), development of system architectures, development of air vehicle concepts, development of a Common Control Station (CCS) compliant Mission Control Station, and modeling and simulation of various air vehicle designs that would lead to rapid prototyping of a Minimum Viable Product (MVP) to inform a future MUX program of record. Resulting work products will mitigate technical risks through analysis, modeling and simulation matched with refined CONOPS development, industry payload, air vehicle concepts, CCS compliant MCS roadmap, and will leverage real-time data used on deployed USMC MQ-9 and USN M-8B/C. Threshold prototype capabilities will include; Airborne Early Warning, Intelligence Surveillance Reconnaissance (ISR), Electronic Warfare (EW) and Communications/Data Relay-Control (DR). Provides USMC with MUX MVP aircraft capability when prototype funding is available.

Project 3427 - This project provides experimentation and support of the CQ-24A Cargo UAS (commonly referred to as KMAX), which was used for experimentation to inform the unmanned cargo resupply requirements of future programs of record to include MUX and unmanned logistics system-air, ULS-A. Experimentation includes payloads/sensor integration, control station integration, CONOPS and Tactics, Techniques, and Procedures (TTP) development. The experimentation efforts informed program capability documents, supports military demonstrations, and advance technologies. This program allows for government, industry teams, and other stakeholders to collaboratively develop key sensor technologies for obstacle avoidance on future unmanned and manned aircraft. These efforts include continued development of autonomous obstacle avoidance systems that have dual military-commercial use, such as natural disaster response, combatting wild fires, and enabling cargo delivery in austere environments.

Cost estimate for Cost to Complete and Total Cost for both project units are being developed and will be promulgated in a future budget request.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	17.561	21.157	26.649	-	26.649
Current President's Budget	17.554	45.407	22.589	-	22.589
Total Adjustments	-0.007	24.250	-4.060	-	-4.060
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-8.250			
• Congressional Rescissions	-	-			
• Congressional Adds	-	32.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.007	0.000			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	-4.152	-	-4.152
• Rate/Misc Adjustments	0.000	0.000	0.092	-	0.092

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: 9999: *Congressional Adds*		
Congressional Add: *Mobile unmanned/manned distributed lethality airborne network and fused integrat*	0.000	14.000
Congressional Add: *Large unmanned logistics systems air development*	0.000	18.500
Congressional Add Subtotals for Project: 9999	0.000	32.500
Congressional Add Totals for all Projects	0.000	32.500

Change Summary Explanation

Schedule:

Project 3135 - Updated to reflect Program Acquisition Strategy, which includes use of Prize Challenge to refine MUX requirements and validate capability performance in a laboratory. Additional program technical analysis will be conducted with, but not limited to software, scientific and technology solutions that help achieve program/service missions. This update also includes changes to Modeling and Simulation, and Test & Evaluation requirements.

The FY 2021 funding request was reduced by $4.152 million to account for the availability of prior year execution balances.

Project 3427 - Not applicable

Technical: Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3135: *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*	4.978	12.708	12.907	22.589	-	22.589	27.063	63.451	63.028	64.288	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Funding provides for the development of system architectures, development of air vehicle concepts, development of a CCS compliant Mission Control Station, experimentation, key technology maturation, and concept refinement for the Marine Air Ground Task Force (MAGTF) Unmanned Aircraft System (UAS) Expeditionary (MUX) with Vertical/Short Take-Off and Vertical Landing (V/STOVL) capability. The MUX UAV supports Expeditionary Force 21 Operating Concepts , the 2017 Marine Aviation Plan (AvPlan), US Military Strategy, and the US Maritime Strategy which require an advanced, multi-mission ship-based Group 5 UAS in support of Marine Expeditionary Force/Marine Expeditionary Brigade-sized MAGTF to address capability gaps. The future MUX UAV system will provide a weaponized, payload flexible, shipboard capable/expeditionary system that is runway independent for all weather, long range/persistence, operations from the sea in a contested environment. This next generation UAV capability will have far greater range, endurance, altitude, and payload capability than the current conventional Vertical Take Off and Landing (VTOL) technology can provide from air capable ships. The MUX system Initial Capabilities Document (ICD) was approved in Oct 2016.

This effort will continue to refine program scope, phasing, and cost for development of the MUX capability. The funds will allow for data analysis in the MUX lab. FY22 funds the evaluation of the air vehicle data through model based systems engineering, as well as continuing lab-based simulation with data supplied by the payload and air vehicle prize challenges. Additional efforts will support the initiation of rapid prototyping with engineering analysis, program management, and sustainment planning. The program will continue leveraging other technology developmental programs, such as developmental communications/networking payloads capabilities, and USMC MQ-9 and USN MQ8, allowing for continued technical maturation effort, rapid prototyping, and effective transition to a MUX POR.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: MUX Studies, Analysis, and Concept Refinement	10.068	7.005	13.549	0.000	13.549
Articles:	-	-	-	-	-
FY 2020 Plans: Planned efforts include continued development of system architecture focusing on the air vehicle, model based system engineering from payload prize challenges to assess and develop a design system architecture. Validate CONOPS requirement documentation to support future design development, and rapid prototyping efforts. Supports refinement of the MUX concept through wargame simulation and analysis. Conduct lab-based simulation with payloads and control station data supplied by the payload prize challenges to refine tactical					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
unmanned system Performance Parameters, tactics, and support follow-on rapid prototyping. Continue program support for the second prize challenge and program document development. ***FY 2021 Base Plans:*** Planned efforts include evaluation of the air vehicle design through engineering analysis, continued CONOPs refinement, modeling & simulation using payloads prize challenge data. Continue lab-based simulation with data obtained through completed prize challenges. Additional efforts will support prototyping concepts with engineering analysis, program management, and sustainment planning. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due to commencement of prototype development and to evaluate the air vehicle prize challenge data.					
Title: Test, Technical, Engineering and Management Services	2.640	5.902	9.040	0.000	9.040
Articles:	-	-	-	-	-
FY 2020 Plans: Provide Government Engineering support, Contractor support, Program support and travel for execution of MUX studies, experimentation, rapid prototyping, and concept refinement and related acquisition activities to support a future MUX program of record. MUX architecture development, component-level prototyping, modeling & simulation, and analysis of data provided by DOD developmental programs. ***FY 2021 Base Plans:*** Provide Government Engineering support, Contractor VTOL - applicable, support, Program support and travel for execution of MUX concept development. Efforts include modeling and simulation of prize challenge data, evaluation of air vehicle data and development of prototype contract requirements. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase in engineering support required to evaluate the air vehicle prize challenge data and preparation for prototype contract actions.					
Accomplishments/Planned Programs Subtotals	12.708	12.907	22.589	0.000	22.589

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The MUX will utilize a Prize Challenge and other transactional authorities concept to promote competition and innovative concepts focused on system architecture, payloads, and air vehicle concepts. These efforts will be assessed through model based system engineering evaluations. Lab-based simulation will be used to refine tactical unmanned system Performance Parameters, tactics, and support potential follow-on rapid prototyping. Additionally, the program will leverage other technology developmental programs, such as developmental communications/networking payloads capabilities.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MUX Studies and Experimentation	Various	TBD : TBD	1.500	8.045	Nov 2018	1.734	Nov 2019	2.170	Nov 2020	-		2.170	Continuing	Continuing	Continuing
Requirements Analysis and Engineering Assessments	WR	Various : Various	2.150	2.023	Nov 2018	0.960	Nov 2019	1.991	Nov 2020	-		1.991	Continuing	Continuing	Continuing
Prototype Development	Various	NAWCAD : Patuxent River, MD	0.000	0.000		0.000		5.428	Nov 2020	-		5.428	0.000	5.428	-
Prize Challenge Award	Various	Various : Various	0.000	0.000		4.000	Nov 2019	0.000		-		0.000	0.000	4.000	-
Modeling and Simulation	Various	NAWAD : Patuxent River, MD	0.000	0.000		0.311	Nov 2019	3.960	Nov 2020	-		3.960	0.000	4.271	-
		Subtotal	3.650	10.068		7.005		13.549		-		13.549	Continuing	Continuing	N/A

Remarks

Increases from FY20 to FY21 reflects changes in acquisition strategy utilizing a Prize Challenge and Rapid Prototyping Concept requiring additional technical effort.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation	Various	NAWCAD : Patuxent River, MD	0.000	0.000	Dec 2018	0.220	Nov 2019	1.100	Nov 2020	-		1.100	0.000	1.320	-
		Subtotal	0.000	0.000		0.220		1.100		-		1.100	0.000	1.320	N/A

Remarks

Increase from FY20 to FY21 reflect use of capabilities based testing to be planned and implemented in a lab environment.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NAWCAD : Patuxent River, MD	0.635	1.252	Nov 2018	2.377	Nov 2019	4.896	Nov 2020	-		4.896	0.000	9.160	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	Various	Various : Various	0.600	1.268	Nov 2018	3.119	Nov 2019	2.554	Nov 2020	-		2.554	0.000	7.541	-
Travel	WR	NAWCAD : Patuxent River, MD	0.093	0.120	Nov 2018	0.186	Nov 2019	0.490	Nov 2020	-		0.490	0.000	0.889	-
		Subtotal	1.328	2.640		5.682		7.940		-		7.940	0.000	17.590	N/A

Remarks

Increases from FY20 to FY21 due to engineering and program management effort to support Prize Challenge evaluation, additional engineering to support simulation using vendor data, additional program management for prototype contract development and increased travel to support technical and programmatic meetings.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	4.978	12.708		12.907		22.589		-		22.589	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

2021PB - 0304240M - 3135

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3135 / *USMC MUX Medium Altitude - Long Endurance (MALE) Group 5 UAV*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3135				
Middle Tier Acquistion Milestones: Middle Tier Acquistion	3	2021	4	2025
System Development: Hardware: Prototype Development	1	2021	4	2025
System Development: Technical Review and Analysis: Model Based Systems Engineering (MBSE)	1	2019	4	2025
System Development: Technical Review and Analysis: Knowledge Point (KP) 1	4	2019	4	2019
System Development: Technical Review and Analysis: Knowledge Point (KP) 2	3	2020	3	2020
System Development: Technical Review and Analysis: Knowledge Point (KP) 3	2	2021	2	2021
Test & Evaluation: Technical Evaluation: Technical Evaluation (TE) 1	1	2020	1	2020
Test & Evaluation: Technical Evaluation: Technical Evaluation (TE) 2	1	2021	1	2021
Test & Evaluation: Technical Evaluation: Technical Evaluation (TE) 3	3	2025	3	2025
Test & Evaluation: Developmental Test: Developmental Test (DT)	1	2024	2	2024
Test & Evaluation: Developmental Test: Developmental Test (DT) 2	3	2024	2	2025
Test & Evaluation: Developmental Test: Developmental Test (DT) 3	4	2025	4	2025
Test & Evaluation: Laboratory Test: Capabilites Based Test	1	2022	4	2025
Progam Milestones: Prize Challenges: Payloads Award	1	2020	1	2020
Progam Milestones: Contract Award: Prototype Build	2	2022	2	2022
Progam Milestones: Deliveries: Prototype Build Delivery	1	2024	1	2024

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3427 / *KMAX Experimentation and Support*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3427: *KMAX Experimentation and Support*	0.222	4.846	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	5.068
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Funding provided for experimentation for unmanned cargo operations and includes complementary collision avoidance, payloads, advanced sensors, autonomy; efforts refined requirements and Concept of Operations (CONOPS); and support of future unmanned programs of record. Funding supported government and industry teams to develop key sensor technologies needed for future VTOL aircraft. This included continued development of autonomous obstacle avoidance and landing systems for dual military-commercial use, such as natural disaster response and combatting wild fires, allowing for cargo delivery in austere environments. Additionally, funding supported the continued development and integration of unique satellite communication systems designed for over-the-horizon use and operation in line-of-sight constrained environments. The combined capability will be demonstrated on the CQ-24A.

Currently, there is no additional funding planned for KMAX Experimentation and Support (PU 3427) through the FYDP.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: CQ-24A Cargo UAS Experimentation and Support Services	4.605	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: N/A					
FY 2021 OCO Plans: N/A					
Title: Technical and Engineering Services	0.241	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3427 / *KMAX Experimentation and Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Test component and system level payloads as they relate to unmanned air vehicle performance. Analyze test data and operational effectiveness. Develop CONOPS and tactics, techniques, and procedures for future unmanned military or civilian use. ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	4.846	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The CQ-24A Cargo UAS experimentation and support activities were contracted through a sole source contract with the aircraft prime vendor and through other contracts to sensor/communication vendors that are currently developing the AACUS and SATCOM capabilities for NAVAIR, including the use of small business.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3427 / *KMAX Experimentation and Support*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
CQ-24A Cargo UAS Experimentation	Various	USAF : Rome, NY	0.222	4.553	Apr 2019	0.000		0.000		-		0.000	0.000	4.775	4.750
Requirements and Analysis, and Engineering Assessments	WR	NAWCAD : Patuxent River, MD	0.000	0.052	May 2019	0.000		0.000		-		0.000	0.000	0.052	1.190
		Subtotal	0.222	4.605		0.000		0.000		-		0.000	0.000	4.827	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Govt Engineering Support	WR	FRC : Cherry Point, NC	0.000	0.241	Feb 2019	0.000		0.000		-		0.000	0.000	0.241	-
		Subtotal	0.000	0.241		0.000		0.000		-		0.000	0.000	0.241	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.222	4.846		0.000		0.000		-		0.000	0.000	5.068	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3427 / *KMAX Experimentation and Support*

2021DON - 0304240M - 3427

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3427 / *KMAX Experimentation and Support*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3427				
Acquisition Milestones: Experimentation and concept refinement of USMC CONOPS, tactics, and doctrine	1	2019	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	32.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	32.500
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project C553 - Manned-Unmanned Distributed Lethality Airborne Network (MUDLAN) provides prototype development, testing, fleet experimentation, and concept refinement for next generation high speed ISR data link to connect and distribute multi-users / multi domains with 5G like speeds.
The modern protected communications capabilities allow manned and unmanned aircraft to share and disseminate large amounts of data using improved emergent communications technologies for multi-platform/ multi-service interoperability through Line-of-Sight (LOS) tactical data networks. These high-speed tactical data links are required at the forward edge where satellite services are not optimal and where existing airborne tactical data links do not support 4G and 5G wireless speeds. Additionally, the funding supports USMC Fused Integrated Naval Network (FINN), which is leveraging the new MUDLAN technology for Navy-USMC tactical data link interoperability. MUDLAN also supports Navy's Distributed Maritime Operations (DMO) objectives as a key enabler for communications and dissemination.

Project C554 - Unmanned Logistics Support - Air (ULS-A) provides for experimentation for unmanned cargo operations and includes complementary Intelligence, Surveillance, and Reconnaissance (ISR), payloads, advanced sensors, autonomy; efforts refined requirements and concept of operations (CONOPS). This includes continued development of autonomous obstacle avoidance and landing system, and the continued development and integration of unique satellite communication systems designed for over-the-horizon use and operation in line-of-sight constrained environments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Mobile unmanned/manned distributed lethality airborne network and fused integrat ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** N/A	0.000	14.000
Congressional Add: Large unmanned logistics systems air development ***FY 2019 Accomplishments:*** N/A ***FY 2020 Plans:*** N/A	0.000	18.500
Congressional Adds Subtotals	0.000	32.500

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

The MUDLAN/FINN experimentation will leverage MUDLAN JCTD and MUDLAN SBIR prior efforts. The the use of Small Business contractors,the effort will focus on continued innovation of antenna, radio and networking capabilities. Experimentation and maturation will continue to inform end user operational requirements and build on USMC, Joint service, OSD(R&E) successes. Transition will occur through future acquisition plans once the hardware is mature and the Joint service requirements are validated to enable follow-on fleet integration.

The ULS-A demonstration will be combined with the current unmanned logistics capability and will support planned demonstrations associated with CQ-24A as part of a Cooperative Research and Development Agreement (CRADA) between the Navy and industry partners.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
CONOPS, Interface Control Documents	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.500	Feb 2020	0.000		-		0.000	0.000	0.500	-
MUDLAN FINN Pod development and flight demonstration	C/FPIF	Various : Various	0.000	0.000		5.200	Mar 2020	0.000		-		0.000	0.000	5.200	-
MUDLAN communications equipment and demonstrations	C/CPIF	Various : Various	0.000	0.000		4.900	Mar 2020	0.000		-		0.000	0.000	4.900	-
ULS-A Experimentation	Various	USAF : Rome, NY	0.000	0.000		12.572	Apr 2020	0.000		-		0.000	0.000	12.572	-
ULS-A Requirements and analysis, and engineering assessements	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.750	Feb 2020	0.000		-		0.000	0.000	0.750	-
ULS-A GFE	MIPR	NSWC : Crane, IN	0.000	0.000		2.360	Mar 2020	0.000		-		0.000	0.000	2.360	-
		Subtotal	0.000	0.000		26.282		0.000		-		0.000	0.000	26.282	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Logistics Support	Various	Various : Various	0.000	0.000		1.200	Apr 2020	0.000		-		0.000	0.000	1.200	-
		Subtotal	0.000	0.000		1.200		0.000		-		0.000	0.000	1.200	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Range Demo Costs	Various	Various : Patuxent River, MD	0.000	0.000		2.100	Mar 2020	0.000		-		0.000	0.000	2.100	-
SAIL Cost	Various	Various : Patuxent River, MD	0.000	0.000		0.500	Apr 2020	0.000		-		0.000	0.000	0.500	-
		Subtotal	0.000	0.000		2.600		0.000		-		0.000	0.000	2.600	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	Various	Various : Various	0.000	0.000		0.800	Feb 2020	0.000		-		0.000	0.000	0.800	-
Government Engineering Support	WR	NAWCAD : Patuxent River, MD	0.000	0.000		1.468	Feb 2020	0.000		-		0.000	0.000	1.468	-
Travel	WR	NAWCAD : Patuxent River, MD	0.000	0.000		0.150	Feb 2020	0.000		-		0.000	0.000	0.150	-
		Subtotal	0.000	0.000		2.418		0.000		-		0.000	0.000	2.418	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		32.500		0.000		-		0.000	0.000	32.500	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*

2021PB - 0304240M - 9999

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240M / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 9999 / *Congressional Adds*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 9999				
MUDLAN / FINN: Requirements / CONOPS	2	2020	3	2021
MUDLAN / FINN: MUDLAN FINN Pod development	2	2020	2	2021
MUDLAN / FINN: Maturation and prototyping of key MUDLAN communications equipment and demonstrations	2	2020	4	2021
MUDLAN / FINN: MUDLAN FINN Operational Flight Demo	3	2020	4	2020
MUDLAN / FINN: MUDLAN Flight Technical Demonstrations	4	2020	4	2021
ULS-A: ULS-A Product Development	3	2020	4	2021
ULS-A: ULS-A Requirements and Engineering Assessments	2	2020	2	2021
ULS-A: ULS-A GFE	2	2020	3	2021

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	9.300	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.300
3429: *TERN UAS*	0.000	9.300	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.300

Note

FY 2019 funding does not reflect the enacted rescission amount of $4.809 Million.

A. Mission Description and Budget Item Justification

The Navy identified capability gaps in the Navy's Distributed Maritime Operations (DMO) concept that could be addressed with a next generation, sea-based Medium Altitude Long Endurance (MALE) Unmanned Aerial Vehicle (UAV) operating from Surface Combatant Ships. This program element provided for the maturation, prototyping, and demonstration of advanced platform, payload, networking, and enabling technologies. Technologies that required further maturation included advanced Vertical Take-off and Landing air vehicles, advanced data networks that support distributed unmanned operations, and other technologies that enable maritime over the horizon targeting and early warning at safe stand-off distances. All results from these demonstrations are available to refine requirements for the next generation of maritime aviation Family of Systems (FOS), and may directly support capability gaps associated with the Future Surface Combatant (FSC).

This project provided for trade studies, analysis, and continued prototype development, testing, fleet experimentation, and concept refinement for next generation manned-unmanned aviation technologies to meet Navy Fleet and Combatant Commander (COCOM) classified warfighter gaps in a DMO construct. This project conducted requirements analysis and studies for allocation of requirements for manned/unmanned platforms needed for DMO and for operations on FSC. Candidate technologies were focused on developing new DMO platforms and the required sensors and communications relay payloads that are enabling technologies for DMO.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	9.300	0.000	0.000	-	0.000
Current President's Budget	9.300	0.000	0.000	-	0.000
Total Adjustments	0.000	0.000	0.000	0.000	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Change Summary Explanation

Schedule: Not Applicable

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304240N *I (U)Advanced Tactical Unmanned Aircraft System*

Technical: Not Applicable
Cost: Not Applicable

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3429 / *TERN UAS*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3429: *TERN UAS*	0.000	9.300	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.300
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This program was established to develop technologies to allow for their evaluation in the Distributed Maritime Operations (DMO) construct to support requirements refinement for aviation support to current and future surface combatants to include the Future Surface Combatant (FSC) program. This program conducted studies and analysis of requirements to determine the most effective allocation of mission requirements to aviation platforms and between manned and unmanned platforms to enable future DMO and FSC operations. Areas of analysis included, but were not limited to, over-the horizon communications, targeting, distributed maneuvering, manned-unmanned platform mix, and optimized sensor payload configurations to satisfy DMO mission gaps. The program demonstrated organic shipboard platforms capable of providing persistent 24/7 Intelligence, Surveillance, and Reconnaissance (ISR), targeting, early warning, and anti-surface strike capabilities at long radius orbits. To achieve these goals, the program investigated new concepts for aircraft launch and recovery, logistics, and maintenance in maritime operating conditions. This effort assisted in funding mission utility technical assessment of a Medium-Altitude, Long-Endurance Unmanned Aerial Vehicle (MALE UAV) technology demonstrators intended for surface combatants.

This program conducted advancement and experimentation of the enabling sensor technologies required to operate in the DMO environment, such as demonstrating sense and avoid sensors and autonomy software in real world environments and advanced ice detection systems to avoid potential loss of aircraft when operating at extreme ranges. Additionally, the project supported prototype development and fleet experimentation of other mission payloads required for DMO gaps.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: MALE (TERN) UAV Technical Maturation and Experimentation	8.909	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: FY 2019 funding does not reflect the enacted rescission amount of $4.809 Million. ***FY 2020 Plans:*** N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Title: Technical and Engineering Services	0.391	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3429 / *TERN UAS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	9.300	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The program conducted experimentation efforts leveraging DARPA/ONR contracts for Tern. SBIR contracts were utilized for safety and mission systems payloads that were originally awarded under small business contract actions.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3429 / *TERN UAS*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MALE (TERN) UAV Technical Maturation & Experimentation	C/CPIF	Northrop Grumman : San Diego, CA	0.000	8.909	Dec 2018	0.000		0.000		-		0.000	0.000	8.909	4.100
		Subtotal	0.000	8.909		0.000		0.000		-		0.000	0.000	8.909	N/A

Remarks

FY 2019 funding does not reflect the enacted rescission amount of $4.809 Million.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	NAWCAD : Patuxent River, MD	0.000	0.356	Jan 2019	0.000		0.000		-		0.000	0.000	0.356	-
Program Management Support	Various	SPAWAR : North Charleston, SC	0.000	0.035	May 2019	0.000		0.000		-		0.000	0.000	0.035	-
		Subtotal	0.000	0.391		0.000		0.000		-		0.000	0.000	0.391	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	9.300		0.000		0.000		-		0.000	0.000	9.300	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3429 / *TERN UAS*

2021DON - 0304240N - 3429

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304240N / *(U)Advanced Tactical Unmanned Aircraft System*	**Project (Number/Name)** 3429 / *TERN UAS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3429				
Technical and Engineering Services: Wargaming, Studies, Analysis of Alternatives	1	2019	4	2019
Technical and Engineering Services: Model Base Engineering Assessments	1	2019	4	2019
MALE (TERN) UAV Technical Maturation and Experimentation: Envelope Expansion, Flight Testing, & Demonstration	1	2019	4	2019

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	5.495	0.466	0.609	0.809	-	0.809	0.578	0.576	0.576	0.571	Continuing	Continuing
2260: *Specific Emitter ID*	5.495	0.466	0.609	0.809	-	0.809	0.578	0.576	0.576	0.571	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports systems development and collection of Specific Emitter Identification (SEI) information from National Technical Means (NTM) to track commercial ships over 200 gross registered tons world-wide. Research and development will cover improvements and enhancements to Electronic Intelligence technology. This will include improved/next generation SEI technology for miniaturization and automation of hardware, national collection systems, signal processing and analysis, and de-interleaving of signals. Propagation in a multi-path signal environment will also be assessed. All work on this project will be undertaken in pursuit of goals stated by the Office of Naval Intelligence and the National Security Agency in support of the Worldwide Ship Tracking Program.

Advanced Component Development and Prototypes (ACD&P) efforts necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment are funded in this PE. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 6 (system/subsystem model or prototype demonstration in a relevant environment) and TRL 7 (system prototype demonstration in an operational environment).

This PE is a Military Intelligence Program (MIP).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.466	0.609	0.561	-	0.561
Current President's Budget	0.466	0.609	0.809	-	0.809
Total Adjustments	0.000	0.000	0.248	-	0.248
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	0.001	-	0.001
• Rate/Misc Adjustments	0.000	0.000	0.247	-	0.247

Change Summary Explanation

Funding: No significant change

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2021 Navy	**Date:** February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
2260: *Specific Emitter ID*	5.495	0.466	0.609	0.809	-	0.809	0.578	0.576	0.576	0.571	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports systems development and collection of Specific Emitter Identification (SEI) information from National Technical Means (NTM) to track commercial ships over 200 gross registered tons world-wide. Research and development will cover improvements and enhancements to Electronic Intelligence technology. This will include improved/next generation SEI technology for miniaturization and automation of hardware, national collection systems, signal processing and analysis, and de-interleaving of signals. Propagation in a multi-path signal environment will also be assessed. All work on this project will be undertaken in pursuit of goals stated by the Office of Naval Intelligence and the National Security Agency in support of the Worldwide Ship Tracking Program.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Sensor Fusion	0.130	0.167	0.172	0.000	0.172
Articles:	-	-	-	-	-
Description: This effort supports systems development and information fusion of improved SEI technology for automation of hardware, national collection systems, signal processing and analysis, and de-interleaving of signals. ***FY 2020 Plans:*** This subarea develops advanced technologies that support the tracking of commercial ships over 200 gross registered tons through improvements in signal processing, de-interleaving of signals, information fusion, and hardware of national collection systems which employ SEI technology. ***FY 2021 Base Plans:*** Development of advanced technologies to improve signal processing, signal characterization, de-interleaving of signals, and sensor fusion for national collection systems which employ SEI technology will continue. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant changes from FY 2020 to FY 2021; no programmatic impact.					
Title: System Automation	0.149	0.196	0.410	0.000	0.410
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Description: This effort supports development of an autonomous surveillance system capable of providing emitter signal information to a central location. ***FY 2020 Plans:*** This subarea develops technologies that support improvements and enhancements to Electronic Intelligence capabilities using associated technology that provides emitter signal information to a central location from an autonomous surveillance system. ***FY 2021 Base Plans:*** Development of technologies for an autonomous surveillance system that provides emitter signal information to a central location will continue. Develop improvements and automation of Specific Emitter Identification (SEI) certification hardware and software. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant changes from FY 2020 to FY 2021; no programmatic impact.					
Title: Technology Refresh and Communication Enhancement	0.187	0.246	0.227	0.000	0.227
Articles:	-	-	-	-	-
Description: This effort improves SEI system performance, real-time communication and tactical use of SEI which will be expanded with next generation SEI technology. ***FY 2020 Plans:*** This subarea improves next generation SEI system performance, situational awareness and the tactical employment of SEI technology through developmental improvements in software and real-time communications. ***FY 2021 Base Plans:*** Improving next generation SEI system performance through developmental improvements in SEI hardware, software and real-time communications remains a priority.					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Originate evaluations of new SEI hardware subsystems for improved SEI system performance. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** No significant changes from FY 2020 to FY 2021; no programmatic impact.					
Accomplishments/Planned Programs Subtotals	0.466	0.609	0.809	0.000	0.809

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
NRL	TBD	Not Specified : Not Specified	5.495	0.466	Jan 2019	0.609	Jan 2020	0.809	Jan 2021	-		0.809	Continuing	Continuing	Continuing
		Subtotal	5.495	0.466		0.609		0.809		-		0.809	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.495	0.466		0.609		0.809		-		0.809	Continuing	Continuing	N/A

Remarks

Exhibit R-4, **RDT&E Schedule Profile:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*

Exhibit R-4A, **RDT&E Schedule Details:** PB 2021 Navy		**Date:** February 2020
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0304270N / *Electronic Warfare Development - MIP*	**Project (Number/Name)** 2260 / *Specific Emitter ID*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2260				
Demonstration: Installation and Testing	1	2019	4	2024