Department of Defense
Fiscal Year (FY) 2016 President's Budget Submission

February 2015

Army

Justification Book of

Research, Development, Test & Evaluation, Army

RDT&E − Volume I, Budget Activity 3

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY

APPROPRIATION LANGUAGE

For expenses necessary for basic and applied scientific research, development, test and evaluation, including maintenance, rehabilitation, lease, and operation of facilities and equipment, $6,926,459,000.00 to remain available for obligation until September 30, 2017.

The following Justification Books were prepared at a cost of $1,187,353.84: Aircraft (ACFT), Missile (MSLS), Weapons & Tracked Combat Vehicles (WTCV), Ammunition (AMMO), Other Procurement Army (OPA) 1 - Tactical & Support Vehicles, Other Procurement Army (OPA) 2 – Communications & Electronics, Other Procurement Army (OPA) 3 & 4 - Other Support Equipment & Spares, Research, Development, Test and Evaluation (RDTE) for: Budget Activity 1, Budget Activity 2, Budget Activity 3, Budget Activity 4, Budget Activity 5A, Budget Activity 5B, Budget Activity 6, and Budget Activity 7.

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Department of Defense
FY 2016 President's Budget
Exhibit R-1 FY 2016 President's Budget
Total Obligational Authority
(Dollars in Thousands)

15 Jan 2015

Appropriation	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Research, Development, Test & Eval, Army	7,124,298	6,673,146	2,000	6,675,146	6,924,959	1,500	6,926,459
Total Research, Development, Test & Evaluation	7,124,298	6,673,146	2,000	6,675,146	6,924,959	1,500	6,926,459

Department of Defense
FY 2016 President's Budget
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Total Obligational Authority
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15 Jan 2015

Summary Recap of Budget Activities	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Basic Research	425,321	460,268		460,268	425,079		425,079
Applied Research	930,900	981,421		981,421	879,685		879,685
Advanced Technology Development	1,044,919	1,113,149		1,113,149	895,747		895,747
Advanced Component Development & Prototypes	424,652	302,922	2,000	304,922	498,659	1,500	500,159
System Development & Demonstration	1,955,833	1,622,353		1,622,353	2,068,950		2,068,950
RDT&E Management Support	1,317,280	1,015,139		1,015,139	1,027,542		1,027,542
Operational Systems Development	1,025,393	1,177,894		1,177,894	1,129,297		1,129,297
Total Research, Development, Test & Evaluation	7,124,298	6,673,146	2,000	6,675,146	6,924,959	1,500	6,926,459
Summary Recap of FYDP Programs							
Strategic Forces	58,383						
General Purpose Forces	581,979	716,615		716,615	693,053		693,053
Intelligence and Communications	201,878	165,416		165,416	163,446		163,446
Research and Development	6,222,823	5,710,126	2,000	5,712,126	6,015,482	1,500	6,016,982
Central Supply and Maintenance	54,392	76,187		76,187	48,442		48,442
Administration and Associated Activities	126						
Classified Programs	4,717	4,802		4,802	4,536		4,536
Total Research, Development, Test & Evaluation	7,124,298	6,673,146	2,000	6,675,146	6,924,959	1,500	6,926,459

Department of the Army
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(Dollars in Thousands)

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Department of the Army
FY 2016 President's Budget
Exhibit R-1 FY 2016 President's Budget
Total Obligational Authority
(Dollars in Thousands)

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Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
1	0601101A	In-House Laboratory Independent Research	01	21,255	13,427		13,427	13,018		13,018	U
2	0601102A	Defense Research Sciences	01	216,774	248,283		248,283	239,118		239,118	U
3	0601103A	University Research Initiatives	01	76,682	89,776		89,776	72,603		72,603	U
4	0601104A	University and Industry Research Centers	01	110,610	108,782		108,782	100,340		100,340	U
		Basic Research		425,321	460,268		460,268	425,079		425,079	
5	0602105A	Materials Technology	02	45,243	46,000		46,000	28,314		28,314	U
6	0602120A	Sensors and Electronic Survivability	02	42,677	46,258		46,258	38,374		38,374	U
7	0602122A	TRACTOR HIP	02	35,493	16,358		16,358	6,879		6,879	U
8	0602211A	Aviation Technology	02	54,667	63,414		63,414	56,884		56,884	U
9	0602270A	Electronic Warfare Technology	02	17,464	18,500		18,500	19,243		19,243	U
10	0602303A	Missile Technology	02	58,426	62,180		62,180	45,053		45,053	U
11	0602307A	Advanced Weapons Technology	02	25,310	38,513		38,513	29,428		29,428	U
12	0602308A	Advanced Concepts and Simulation	02	23,364	27,423		27,423	27,862		27,862	U
13	0602601A	Combat Vehicle and Automotive Technology	02	63,476	72,861		72,861	68,839		68,839	U
14	0602618A	Ballistics Technology	02	73,906	85,575		85,575	92,801		92,801	U
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	4,378	3,970		3,970	3,866		3,866	U
16	0602623A	Joint Service Small Arms Program	02	7,592	6,850		6,850	5,487		5,487	U
17	0602624A	Weapons and Munitions Technology	02	52,013	63,057		63,057	48,340		48,340	U
18	0602705A	Electronics and Electronic Devices	02	68,062	73,422		73,422	55,301		55,301	U

R-1C1: FY 2016 President's Budget (Published Version of PB Position), as of January 15, 2015 at 09:20:53

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(Dollars in Thousands)

15 Jan 2015

Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
19	0602709A	Night Vision Technology	02	42,624	44,935		44,935	33,807		33,807	U
20	0602712A	Countermine Systems	02	30,019	29,428		29,428	25,068		25,068	U
21	0602716A	Human Factors Engineering Technology	02	21,118	23,778		23,778	23,681		23,681	U
22	0602720A	Environmental Quality Technology	02	22,333	15,653		15,653	20,850		20,850	U
23	0602782A	Command, Control, Communications Technology	02	33,580	33,807		33,807	36,160		36,160	U
24	0602783A	Computer and Software Technology	02	10,232	10,761		10,761	12,656		12,656	U
25	0602784A	Military Engineering Technology	02	69,192	67,302		67,302	63,409		63,409	U
26	0602785A	Manpower/Personnel/Training Technology	02	17,395	23,288		23,288	24,735		24,735	U
27	0602786A	Warfighter Technology	02	30,950	32,044		32,044	35,795		35,795	U
28	0602787A	Medical Technology	02	81,386	76,044		76,044	76,853		76,853	U
		Applied Research		930,900	981,421		981,421	879,685		879,685	
29	0603001A	Warfighter Advanced Technology	03	64,337	78,109		78,109	46,973		46,973	U
30	0603002A	Medical Advanced Technology	03	100,646	106,264		106,264	69,584		69,584	U
31	0603003A	Aviation Advanced Technology	03	78,513	102,950		102,950	89,736		89,736	U
32	0603004A	Weapons and Munitions Advanced Technology	03	72,934	72,908		72,908	57,663		57,663	U
33	0603005A	Combat Vehicle and Automotive Advanced Technology	03	146,486	147,485		147,485	113,071		113,071	U
34	0603006A	Space Application Advanced Technology	03	10,706	6,880		6,880	5,554		5,554	U
35	0603007A	Manpower, Personnel and Training Advanced Technology	03	6,145	13,574		13,574	12,636		12,636	U

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36	0603008A	Electronic Warfare Advanced Technology	03	40,345	44,851		44,851				U
37	0603009A	TRACTOR HIKE	03	9,161	7,492		7,492	7,502		7,502	U
38	0603015A	Next Generation Training & Simulation Systems	03	13,168	16,740		16,740	17,425		17,425	U
39	0603020A	TRACTOR ROSE	03	10,662	14,483		14,483	11,912		11,912	U
40	0603125A	Combating Terrorism - Technology Development	03	14,546	24,257		24,257	27,520		27,520	U
41	0603130A	TRACTOR NAIL	03	3,192	3,440		3,440	2,381		2,381	U
42	0603131A	TRACTOR EGGS	03	2,366	2,406		2,406	2,431		2,431	U
43	0603270A	Electronic Warfare Technology	03	24,652	26,046		26,046	26,874		26,874	U
44	0603313A	Missile and Rocket Advanced Technology	03	81,951	79,934		79,934	49,449		49,449	U
45	0603322A	TRACTOR CAGE	03	11,857	11,105		11,105	10,999		10,999	U
46	0603461A	High Performance Computing Modernization Program	03	213,238	221,518		221,518	177,159		177,159	U
47	0603606A	Landmine Warfare and Barrier Advanced Technology	03	22,233	13,070		13,070	13,993		13,993	U
48	0603607A	Joint Service Small Arms Program	03	4,902	7,318		7,318	5,105		5,105	U
49	0603710A	Night Vision Advanced Technology	03	43,459	44,119		44,119	40,929		40,929	U
50	0603728A	Environmental Quality Technology Demonstrations	03	11,540	11,445		11,445	10,727		10,727	U
51	0603734A	Military Engineering Advanced Technology	03	23,838	17,606		17,606	20,145		20,145	U
52	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	34,042	39,149		39,149	38,163		38,163	U

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53	0603794A	C3 Advanced Technology	03					37,816		37,816	U
		Advanced Technology Development		1,044,919	1,113,149		1,113,149	895,747		895,747	
54	0603305A	Army Missle Defense Systems Integration	04	23,117	25,795		25,795	10,347		10,347	U
55	0603308A	Army Space Systems Integration	04	13,448	13,996		13,996	25,061		25,061	U
56	0603619A	Landmine Warfare and Barrier - Adv Dev	04					49,636		49,636	U
57	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04					13,426		13,426	U
58	0603639A	Tank and Medium Caliber Ammunition	04	31,580	29,318		29,318	46,749		46,749	U
59	0603653A	Advanced Tank Armament System (ATAS)	04	54,259							U
60	0603747A	Soldier Support and Survivability	04	11,513	6,997	2,000	8,997	6,258	1,500	7,758	U
61	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	10,390	8,953		8,953	13,472		13,472	U
62	0603774A	Night Vision Systems Advanced Development	04	8,760	3,050		3,050	7,292		7,292	U
63	0603779A	Environmental Quality Technology - Dem/Val	04	2,544	7,826		7,826	8,813		8,813	U
64	0603782A	Warfighter Information Network-Tactical - DEM/VAL	04	118,256							U
65	0603790A	NATO Research and Development	04	3,743	2,952		2,952	6,075		6,075	U
66	0603801A	Aviation - Adv Dev	04	4,848							U
67	0603804A	Logistics and Engineer Equipment - Adv Dev	04	11,623	13,380		13,380	21,233		21,233	U
68	0603807A	Medical Systems - Adv Dev	04	17,524	23,647		23,647	31,962		31,962	U

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69	0603827A	Soldier Systems - Advanced Development	04	13,844	6,828		6,828	22,194		22,194	U
70	0603850A	Integrated Broadcast Service	04	79							U
71	0604100A	Analysis Of Alternatives	04		9,910		9,910	9,805		9,805	U
72	0604115A	Technology Maturation Initiatives	04	10,741	44,214		44,214	40,917		40,917	U
73	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	7,500	9,925		9,925	30,058		30,058	U
74	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	76,559	96,131		96,131	155,361		155,361	U
75	0604785A	Integrated Base Defense (Budget Activity 4)	04	4,324							U
		Advanced Component Development & Prototypes		424,652	302,922	2,000	304,922	498,659	1,500	500,159	
76	0604201A	Aircraft Avionics	05	64,396	41,236		41,236	12,939		12,939	U
77	0604220A	Armed, Deployable Helos	05	26,000							U
78	0604270A	Electronic Warfare Development	05	134,260	5,999		5,999	18,843		18,843	U
79	0604280A	Joint Tactical Radio	05	30,752	9,827		9,827	9,861		9,861	U
80	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	22,553	9,725		9,725	8,763		8,763	U
81	0604321A	All Source Analysis System	05	4,837	5,532		5,532	4,309		4,309	U
82	0604328A	TRACTOR CAGE	05	28,229	19,929		19,929	15,138		15,138	U
83	0604601A	Infantry Support Weapons	05	82,332	34,575		34,575	74,128		74,128	U
84	0604604A	Medium Tactical Vehicles	05	2,068	210		210				U
85	0604611A	JAVELIN	05	4,471	4,164		4,164	3,945		3,945	U
86	0604622A	Family of Heavy Tactical Vehicles	05	23,944	12,906		12,906				U

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87	0604633A	Air Traffic Control	05	514	16,756		16,756	10,076		10,076	U
88	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05		2,769		2,769	40,374		40,374	U
89	0604710A	Night Vision Systems - Eng Dev	05	47,811	65,299		65,299	67,582		67,582	U
90	0604713A	Combat Feeding, Clothing, and Equipment	05	1,874	3,034		3,034	1,763		1,763	U
91	0604715A	Non-System Training Devices - Eng Dev	05	22,168	8,943		8,943	27,155		27,155	U
92	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	38,412	15,898		15,898	24,569		24,569	U
93	0604742A	Constructive Simulation Systems Development	05	19,596	4,394		4,394	23,364		23,364	U
94	0604746A	Automatic Test Equipment Development	05	6,498	11,079		11,079	8,960		8,960	U
95	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	12,193	10,022		10,022	9,138		9,138	U
96	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	26,720	34,712		34,712	21,622		21,622	U
97	0604798A	Brigade Analysis, Integration and Evaluation	05	91,427	85,246		85,246	99,242		99,242	U
98	0604802A	Weapons and Munitions - Eng Dev	05	16,770	14,998		14,998	21,379		21,379	U
99	0604804A	Logistics and Engineer Equipment - Eng Dev	05	43,497	24,566		24,566	48,339		48,339	U
100	0604805A	Command, Control, Communications Systems - Eng Dev	05	7,131	4,431		4,431	2,726		2,726	U
101	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	33,890	30,384		30,384	45,412		45,412	U
102	0604808A	Landmine Warfare/Barrier - Eng Dev	05	87,895	57,674		57,674	55,215		55,215	U

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103	0604814A	Artillery Munitions - EMD	05	6,352							U
104	0604818A	Army Tactical Command & Control Hardware & Software	05	22,900	29,675		29,675	163,643		163,643	U
105	0604820A	Radar Development	05	1,796	5,221		5,221	12,309		12,309	U
106	0604822A	General Fund Enterprise Business System (GFEBS)	05	3,218				15,700		15,700	U
107	0604823A	Firefinder	05	17,734	23,480		23,480	6,243		6,243	U
108	0604827A	Soldier Systems - Warrior Dem/Val	05	25,477	6,155		6,155	18,776		18,776	U
109	0604854A	Artillery Systems - EMD	05	117,241	1,911		1,911	1,953		1,953	U
110	0605013A	Information Technology Development	05	59,329	69,728		69,728	67,358		67,358	U
111	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	34,400	68,434		68,434	136,011		136,011	U
112	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	27,345	92,309		92,309	230,210		230,210	U
113	0605030A	Joint Tactical Network Center (JTNC)	05	65,849	8,436		8,436	13,357		13,357	U
114	0605031A	Joint Tactical Network (JTN)	05		17,989		17,989	18,055		18,055	U
115	0605032A	TRACTOR TIRE	05					5,677		5,677	U
116	0605035A	Common Infrared Countermeasures (CIRCM)	05		145,337		145,337	77,570		77,570	U
117	0605051A	Aircraft Survivability Development	05					18,112		18,112	U
118	0605350A	WIN-T Increment 3 - Full Networking	05		113,155		113,155	39,700		39,700	U
119	0605380A	AMF Joint Tactical Radio System (JTRS)	05	9,874	6,878		6,878	12,987		12,987	U
120	0605450A	Joint Air-to-Ground Missile (JAGM)	05	15,684	83,799		83,799	88,866		88,866	U
121	0605456A	PAC-3/MSE Missile	05	86,223	34,991		34,991	2,272		2,272	U

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122	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	358,192	152,516		152,516	214,099		214,099	U
123	0605625A	Manned Ground Vehicle	05	96,820	49,134		49,134	49,247		49,247	U
124	0605626A	Aerial Common Sensor	05	10,377	17,748		17,748	2		2	U
125	0605766A	National Capabilities Integration (MIP)	05	21,132	15,212		15,212	10,599		10,599	U
126	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	81,388	45,694		45,694	32,486		32,486	U
127	0605830A	Aviation Ground Support Equipment	05		10,036		10,036	8,880		8,880	U
128	0210609A	Paladin Integrated Management (PIM)	05		80,263		80,263	152,288		152,288	U
129	0303032A	TROJAN - RH12	05	3,463	983		983	5,022		5,022	U
130	0304270A	Electronic Warfare Development	05	10,801	8,961		8,961	12,686		12,686	U
		System Development & Demonstration		1,955,833	1,622,353		1,622,353	2,068,950		2,068,950	
131	0604256A	Threat Simulator Development	06	23,598	22,057		22,057	20,035		20,035	U
132	0604258A	Target Systems Development	06	13,139	10,037		10,037	16,684		16,684	U
133	0604759A	Major T&E Investment	06	38,534	56,285		56,285	62,580		62,580	U
134	0605103A	Rand Arroyo Center	06	18,281	20,601		20,601	20,853		20,853	U
135	0605301A	Army Kwajalein Atoll	06	187,225	175,956		175,956	205,145		205,145	U
136	0605326A	Concepts Experimentation Program	06	21,563	19,430		19,430	19,430		19,430	U
137	0605502A	Small Business Innovative Research	06	182,958							U
138	0605601A	Army Test Ranges and Facilities	06	335,270	274,980		274,980	277,646		277,646	U
139	0605602A	Army Technical Test Instrumentation and Targets	06	63,944	45,573		45,573	51,550		51,550	U

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Department of the Army
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Total Obligational Authority
(Dollars in Thousands)

15 Jan 2015

Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
140	0605604A	Survivability/Lethality Analysis	06	42,865	33,294		33,294	33,246		33,246	U
141	0605606A	Aircraft Certification	06	5,953	4,700		4,700	4,760		4,760	U
142	0605702A	Meteorological Support to RDT&E Activities	06	7,210	6,411		6,411	8,303		8,303	U
143	0605706A	Materiel Systems Analysis	06	19,694	20,744		20,744	20,403		20,403	U
144	0605709A	Exploitation of Foreign Items	06	7,125	7,015		7,015	10,396		10,396	U
145	0605712A	Support of Operational Testing	06	55,062	49,217		49,217	49,337		49,337	U
146	0605716A	Army Evaluation Center	06	64,425	55,031		55,031	52,694		52,694	U
147	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	1,239	1,124		1,124	938		938	U
148	0605801A	Programwide Activities	06	81,013	64,160		64,160	60,319		60,319	U
149	0605803A	Technical Information Activities	06	33,018	32,303		32,303	28,478		28,478	U
150	0605805A	Munitions Standardization, Effectiveness and Safety	06	56,543	64,027		64,027	32,604		32,604	U
151	0605857A	Environmental Quality Technology Mgmt Support	06	5,019	2,611		2,611	3,186		3,186	U
152	0605898A	Management HQ - R&D	06	53,476	49,583		49,583	48,955		48,955	U
153	0909999A	Financing for Cancelled Account Adjustments	06	126							U
	RDT&E	Management Support		1,317,280	1,015,139		1,015,139	1,027,542		1,027,542	
154	0603778A	MLRS Product Improvement Program	07	93,621	17,103		17,103	18,397		18,397	U
155	0603813A	TRACTOR PULL	07					9,461		9,461	U
156	0607131A	Weapons and Munitions Product Improvement Programs	07					4,945		4,945	U

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Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
157	0607133A	TRACTOR SMOKE	07					7,569		7,569	U
158	0607135A	Apache Product Improvement Program	07		86,099		86,099	69,862		69,862	U
159	0607136A	Blackhawk Product Improvement Program	07		48,446		48,446	66,653		66,653	U
160	0607137A	Chinook Product Improvement Program	07		35,424		35,424	37,407		37,407	U
161	0607138A	Fixed Wing Product Improvement Program	07		819		819	1,151		1,151	U
162	0607139A	Improved Turbine Engine Program	07		49,328		49,328	51,164		51,164	U
163	0607140A	Emerging Technologies from NIE	07		4,916		4,916	2,481		2,481	U
164	0607141A	Logistics Automation	07	3,592	3,652		3,652	1,673		1,673	U
165	0607664A	Biometric Enabling Capability (BEC)	07		1,332		1,332				U
166	0607665A	Family of Biometrics	07	7,160				13,237		13,237	U
167	0607865A	Patriot Product Improvement	07	33,935	57,962		57,962	105,816		105,816	U
168	0102419A	Aerostat Joint Project - EMD	07	58,383							U
169	0202429A	Aerostat Joint Project - COCOM Exercise	07	22,252	43,248		43,248	40,565		40,565	U
170	0203726A	Adv Field Artillery Tactical Data System	07	24,120	1,273		1,273				U
171	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07		36,658		36,658	35,719		35,719	U
172	0203735A	Combat Vehicle Improvement Programs	07	171,543	297,850		297,850	257,167		257,167	U
173	0203740A	Maneuver Control System	07	35,337	45,065		45,065	15,445		15,445	U
174	0203744A	Aircraft Modifications/Product Improvement Programs	07	227,333							U

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Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
175	0203752A	Aircraft Engine Component Improvement Program	07	309	381		381	364		364	U
176	0203758A	Digitization	07	5,978	5,993		5,993	4,361		4,361	U
177	0203801A	Missile/Air Defense Product Improvement Program	07	1,830	5,112		5,112	3,154		3,154	U
178	0203802A	Other Missile Product Improvement Programs	07	60,005	38,323		38,323	35,951		35,951	U
179	0203808A	TRACTOR CARD	07	18,768	22,691		22,691	34,686		34,686	U
180	0205402A	Integrated Base Defense - Operational System Dev	07		4,362		4,362	10,750		10,750	U
181	0205410A	Materials Handling Equipment	07		834		834	402		402	U
182	0205412A	Environmental Quality Technology - Operational System Dev	07		280		280				U
183	0205456A	Lower Tier Air and Missile Defense (AMD) System	07		78,720		78,720	64,159		64,159	U
184	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07		45,353		45,353	17,527		17,527	U
185	0208053A	Joint Tactical Ground System	07	14,504	10,209		10,209	20,515		20,515	U
187	0303028A	Security and Intelligence Activities	07	7,596	12,518		12,518	12,368		12,368	U
188	0303140A	Information Systems Security Program	07	9,040	14,167		14,167	31,154		31,154	U
189	0303141A	Global Combat Support System	07	39,834	4,525		4,525	12,274		12,274	U
190	0303142A	SATCOM Ground Environment (SPACE)	07	17,644	11,006		11,006	9,355		9,355	U
191	0303150A	WWMCCS/Global Command and Control System	07	13,852	2,150		2,150	7,053		7,053	U
193	0305179A	Integrated Broadcast Service (IBS)	07					750		750	U

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Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2014 (Base & OCO)	FY 2015 Base Enacted	FY 2015 OCO Enacted	FY 2015 Total Enacted	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Sec
194	0305204A	Tactical Unmanned Aerial Vehicles	07	33,515	22,870		22,870	13,225		13,225	U
195	0305206A	Airborne Reconnaissance Systems	07					22,870		22,870	U
196	0305208A	Distributed Common Ground/Surface Systems	07	27,607	20,155		20,155	25,592		25,592	U
197	0305219A	MQ-1C Gray Eagle UAS	07	13,074	46,472		46,472				U
198	0305232A	RQ-11 UAV	07	5,984							U
199	0305233A	RQ-7 UAV	07	12,025	16,389		16,389	7,297		7,297	U
200	0307665A	Biometrics Enabled Intelligence	07	7,443	1,973		1,973				U
201	0310349A	Win-T Increment 2 - Initial Networking	07		3,247		3,247	3,800		3,800	U
202	0708045A	End Item Industrial Preparedness Activities	07	54,392	76,187		76,187	48,442		48,442	U
9999	9999999999	Classified Programs		4,717	4,802		4,802	4,536		4,536	U
		Operational Systems Development		1,025,393	1,177,894		1,177,894	1,129,297		1,129,297	
Total Research, Development, Test & Eval, Army				7,124,298	6,673,146	2,000	6,675,146	6,924,959	1,500	6,926,459	

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Appropriation 2040: Research, Development, Test & Evaluation, Army

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30	03	0603002A	Medical Advanced Technology	25
31	03	0603003A	Aviation Advanced Technology	51
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33	03	0603005A	Combat Vehicle and Automotive Advanced Technology	85
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35	03	0603007A	Manpower, Personnel and Training Advanced Technology	114
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47	03	0603606A	Landmine Warfare and Barrier Advanced Technology	192
48	03	0603607A	Joint Service Small Arms Program	198
49	03	0603710A	Night Vision Advanced Technology	203
50	03	0603728A	Environmental Quality Technology Demonstrations	215
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Joint Service Small Arms Program	0603607A	48	03	198
Landmine Warfare and Barrier Advanced Technology	0603606A	47	03	192
Manpower, Personnel and Training Advanced Technology	0603007A	35	03	114
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Military Engineering Advanced Technology	0603734A	51	03	227
Missile and Rocket Advanced Technology	0603313A	44	03	164
Next Generation Training & Simulation Systems	0603015A	38	03	132
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Warfighter Advanced Technology	0603001A	29	03	1
Weapons and Munitions Advanced Technology	0603004A	32	03	65

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	64.337	78.109	46.973	-	46.973	38.831	40.937	43.523	44.355	-	-
242: *Airdrop Equipment*	-	3.664	3.208	2.696	-	2.696	3.669	3.778	3.858	3.935	-	-
543: *Ammunition Logistics*	-	2.429	2.818	2.738	-	2.738	2.284	2.325	2.341	2.387	-	-
C07: *Joint Service Combat Feeding Tech Demo*	-	3.681	3.012	2.155	-	2.155	2.083	2.091	2.105	2.145	-	-
J50: *Future Warrior Technology Integration*	-	36.996	48.369	32.621	-	32.621	26.550	29.310	31.764	32.364	-	-
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	10.000	13.000	-	-	-	-	-	-	-	-	-
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	7.567	7.702	6.763	-	6.763	4.245	3.433	3.455	3.524	-	-

Note

FY16 funds decreased to support the strategic S&T shift from 6.3 to 6.2 human performance efforts.

A. Mission Description and Budget Item Justification

This program element (PE) provides Soldiers and Small Combat Units with the most effective personal clothing, equipment, combat rations, shelters, and logistical support items with the least weight and sustainment burden. This PE supports the maturation and demonstration of technologies associated with aerial delivery of personnel and cargo (Project 242), rapid ammunition/munitions deployability and resupply (Project 543), combat rations and combat feeding equipment (Project C07), combat clothing and personal equipment (including protective equipment such as personal armor, helmets, and eyewear) (Project J50), and expeditionary base camps (Project VT5). The projects in this PE adhere to Tri-Service Agreements on clothing, textiles, and food with coordination provided through the Cross-Service Warfighter Equipment Board, the Soldier as a System Integrated Concepts Development Team, and the DoD Combat Feeding Research and Engineering Board.

Efforts in this program element support the Army science and technology Soldier/Squad portfolio.

Work in this PE is related to, and fully coordinated with, PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0622787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0622308A (Advanced Concepts and Simulation), PE 0633015A (Next Generation Training and Simulation Systems), PE 0602705A (Electronics and Electronic Devices), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*

Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PEs 0602623A and 0603607A (Joint Service Small Arms Program), PE 0603710A (Night Vision Advanced Technology), PE 0602784A (Military Engineering Technology), and PE 0603734A (Military Engineering Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

Work is led, performed and/or managed by the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA and the Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	66.025	65.139	52.083	-	52.083
Current President's Budget	64.337	78.109	46.973	-	46.973
Total Adjustments	-1.688	12.970	-5.110	-	-5.110
• Congressional General Reductions	-	-0.030			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	13.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.688	-			
• Adjustments to Budget Years	-	-	-5.110	-	-5.110

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Program Increase*	10.000	1.000
Congressional Add: *Environmental Control Systems*	-	12.000
Congressional Add Subtotals for Project: J52	10.000	13.000
Congressional Add Totals for all Projects	10.000	13.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 242 / *Airdrop Equipment*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
242: *Airdrop Equipment*	-	3.664	3.208	2.696	-	2.696	3.669	3.778	3.858	3.935	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates equipment and innovative techniques for precision aerial delivery of cargo and personnel. Aerial delivery is a key capability for rapid force projection and global precision delivery. These efforts are designed to advance state of the art precision delivery technologies such as parachutes, guidance, navigation, and control (GNC) components and subsystems, tracking sensors, software algorithms, and safety rigging which integrate with currently equipped aircraft, unmanned aerial systems (UAS), and advanced rotary wing aircraft. These efforts provide the Warfighter with highly accurate, timely cargo/payload delivery and resupply in all terrain and weather conditions. Precision delivery/resupply reduces vulnerability of ground Soldiers, aircraft, and aircrew. Precision aerial delivery supports remote warfare with activities such as placement of battlefield sensors, reduction of Soldier load, and initial delivery of key expeditionary base camp assets. Demonstrated technologies transition to Product Manager (PM)-Force Sustainment Systems (PM FSS), PM-Soldier Clothing and Individual Equipment (PM SCIE) as well as other Army PMs.

Efforts in this program element support the Army science and technology Soldier/Squad portfolio.

Work in this project is fully coordinated with PE 0602786A (Warfighter Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Airdrop/Aerial Delivery	3.664	3.208	2.696
Description: This effort matures and demonstrates parachute materials and designs, precision guidance and navigation software and hardware, and tracking sensors and safety devices to increase the accuracy in the delivery of cargo to remote locations and/or complex terrains, as well as increase safety of personnel insertions into theaters of operations. This work further evolves breakthroughs from PE 0602786A/Project 283 and is coordinated with PE0602786A/Project VT4. This effort supports capability demonstrations for the Army Top Challenge of easing overburdened Soldiers in small units through the use of tactical aerial resupply technologies.			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 242 / *Airdrop Equipment*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Integrated and demonstrated net-centric in-flight collision avoidance and wind sharing technologies into the precision aerial delivery system for the Ultra Light Weight (<500 pounds) payload weight class to prevent midair collisions of payloads and to optimize aerial resupply to Soldiers as a means of reducing carried weight; matured and demonstrated technologies to create the capability for multiple airdrops from a single helicopter via sling load release that increases effectiveness and efficiency for logistic delivery of personnel and equipment; matured and demonstrated sensor technologies and software algorithms for real-time monitoring and systems communication between payloads and ground stations to support tactical aerial resupply; demonstrated accuracy of parafoil to increase accuracy of payload resupply; reduced cost as well as equipment retrograde/retrieval weight and volume to decrease the burden of Soldiers engaged in airborne operations. ***FY 2015 Plans:*** Matures and demonstrates in-flight Joint Precision Aerial Delivery System (JPADS) collision avoidance capability to reduce collision/catastrophic damage and loss of vital supplies; matures precision delivery and landing accuracy for lifecycle cost reduction efficiencies and lower retrograde; begins demonstration of next generation high altitude Parachutist Oxygen Breathing System technology to provide parachutists with sufficient oxygen at higher altitudes and with slower descent rates; optimizes large scale helicopter auto hookup prototypes for multiple airdrops to increase ground operator safety; demonstrates both half- and full-scale technologies for passively stabilizing the flight characteristics with helicopter sling load payloads; demonstrates low-cost, low-weight skidboard to reduce materials and decrease manufacturing and transportation costs; matures and demonstrates a tactical aerial resupply capability to resupply/unburden the small unit/squad. ***FY 2016 Plans:*** Will demonstrate precision airdrop functionality and reliability while intentionally interjecting faults into the system in order to gather statistical data in an operationally relevant environment; focus on accuracy and survivability improvements: guidance, navigation, and control improvements in heavy/variable winds, cost reductions and minimization of retrograde weight/volume; demonstrate and transition the high altitude low opening parachute capability for 100-500 lb. payloads utilizing main parachutes currently in the Army inventory; demonstrate auto hook up and improvement in payload stability for helicopter sling loads.			
Accomplishments/Planned Programs Subtotals	3.664	3.208	2.696

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 242 / *Airdrop Equipment*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 543 / *Ammunition Logistics*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
543: *Ammunition Logistics*	-	2.429	2.818	2.738	-	2.738	2.284	2.325	2.341	2.387	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies for rapidly deploying and resupplying munitions while also improving the return of unused ammunition from deployment. This effort contributes to force readiness and reduction in the logistics footprint through improvements in Materials Handling Equipment (MHE), ammunition, and lethality packaging/palletization, explosives safety, weapons re-arm, and asset throughput/management.

Efforts in this project support the Army science and technology Lethality and Ground Maneuver portfolio. Work in this project is related to, and fully coordinated with PE0603005 and 0602601.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

Work in this project is performed and managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ in collaboration with the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Automated Material Handling Technology	0.391	2.418	1.583
Description: This effort demonstrates smart sensors and robotic load handling equipment as add-on kits for side loading forklifts used in ammunition storage igloos and tactical forklifts to provide quick, safe, and cost effective transfer of munitions pallets between storage areas and transportation assets.			
FY 2014 Accomplishments: Provided preliminary design architecture of an autonomous material handling applique kit for the 5,000 lb capacity tactical forklift.			
FY 2015 Plans: Complete tactical navigation development and adapt robotic add-on kits to rough terrain environment for 5,000 lb forklift; demonstrate the integrated system.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 543 / *Ammunition Logistics*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will complete development of the robotic add-on kit for rough terrain 5,000 lb forklift and conduct the final demonstration.			
Title: Adaptive Packaging ***Description:*** This effort demonstrates a lightweight multi-modal pallet with embedded container restraint systems. The system automatically locks down onto the top surface of a redesigned advanced cargo platform to form a multimodal distribution capability for rapid, more efficient deployment and sustainment operations. ***FY 2014 Accomplishments:*** Completed material market survey; initiated and evaluated the prototype pallet and platform designs.	1.648	-	-
Title: Explosive Safety for Automated Base Camp Planning ***Description:*** This effort integrates explosives safety site planning software with the automated base camp planning tool to reduce the time to plan base camps and improve soldier safety. ***FY 2014 Accomplishments:*** Completed preliminary system integration and engineering tests of automated base camp planning software that incorporates explosives safety. ***FY 2015 Plans:*** Complete database and ammunition planning/management software module integration; validate the module compatibility with base camp planning. ***FY 2016 Plans:*** Will complete validation testing of ammunition planning/management software module with ammunition management system; conduct integrated demonstration with the Virtual Forward Operating Base (VFOB) planning tool.	0.390	0.400	0.400
Title: Total Ammunition Logistics Knowledge (TALK) ***Description:*** This effort will develop state of the art embedded micro sensors and Automated Identification Technologies that provide the capability for ammunition to communicate key characteristics, or information about itself to various interrogators throughout the logistics life-cycle from the ammunition load plant to the weapon in the field to improve ammunition management, reliability, and performance. ***FY 2016 Plans:*** Will conduct preliminary design of environmental monitoring and data delivery mechanisms for artillery ammunition.	-	-	0.755
Accomplishments/Planned Programs Subtotals	2.429	2.818	2.738

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 543 / *Ammunition Logistics*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** C07 / *Joint Service Combat Feeding Tech Demo*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
C07: *Joint Service Combat Feeding Tech Demo*	-	3.681	3.012	2.155	-	2.155	2.083	2.091	2.105	2.145	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies for military combat feeding systems and combat rations. Areas of emphasis include: enhanced nutrient composition to maximize cognitive and physical performance on the battlefield; cutting edge food stabilization and preservation techniques that increase the variety and quality of rations used by the Joint Services; novel ration packaging solutions to minimize degradation of combat rations during storage; field portable biosensors for food-borne pathogen detection and identification as well as predictive modeling tools to protect the Warfighter from food-borne illnesses. This project demonstrates combat feeding equipment with reduced logistics (in component parts, weight, volume, fuel and water) and labor requirements, while improving the quality of food service. The project, a Department of Defense (DoD) program for which the Army has Executive Agent responsibility, provides technology development for Joint Service Combat Feeding. The DoD Combat Feeding Research and Engineering Board provides oversight for this project. Demonstrated field feeding equipment is transitioned to Product Manager (PM)-Force Sustainment Systems (PM FSS).

Efforts in this program element support the Army science and technology Soldier/Squad portfolio.

Work in this project complements and is fully coordinated with PE 0602787A (Medical Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Joint Combat Feeding Equipment Technology	2.454	-	-
Description: Beginning in FY15, this effort is renamed from Joint Combat Feeding Equipment Technology to Joint Combat Feeding Equipment and Food Protection Technology Demonstration. This effort demonstrates technologies in support of DoD Veterinary Service Activity (VSA) to improve field detection and identification capabilities for the presence of chemical and biological threats in foods and provide new techniques and sensors for food inspectors in support of field feeding operations. This			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** C07 / *Joint Service Combat Feeding Tech Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
effort demonstrates equipment and energy technologies to expand capability and reduce the logistics footprint of field feeding systems. ***FY 2014 Accomplishments:*** Conducted technical demonstrations of new refrigeration technologies to improve fuel efficiency, increase operation in hot environments, and reduce failure rates as well as procurement and maintenance costs; integrated new power technologies to demonstrate self-sustaining appliances that reduce reliance on field generators in field kitchens as well as to reduce fuel costs and resupply demands.			
Title: Joint Combat Feeding Equipment and Food Protection Technology Demonstration ***Description:*** Beginning in FY15, this effort is renamed from Joint Combat Feeding Equipment Technology to Joint Combat Feeding Equipment and Food Protection Technology Demonstration. This effort demonstrates technologies in support of DoD VSA to improve field detection and identification capabilities for the presence of chemical and biological threats in foods and provide new techniques and sensors for food inspectors in support of field feeding operations. This effort demonstrates equipment and energy technologies to expand capability and reduce the logistics footprint of field feeding systems. ***FY 2015 Plans:*** Demonstrates novel field sensor technologies to detect and identify toxic chemicals in food; evaluates and demonstrates commercial off the shelf technologies in support of DoD VSA mission; continues demonstration of novel technologies to improve fuel efficiency, increases operation in harsh environments and improves mean time between failure for field feeding equipment; demonstrates reduced reliance on field generators in field kitchens, thus decreasing fuel costs, resupply demands, and risk to logistics/resupply personnel.	-	1.747	-
Title: Ration Stabilization, Packaging, Nutrient Delivery, and Food Safety Technology ***Description:*** Beginning in FY15, this effort is renamed from Ration Stabilization, Packaging, Nutrient Delivery, and Food Safety to Ration Stabilization and Nutrient Delivery Technology Demonstration. This effort matures and demonstrates novel nutritional biochemistry, food processing, and packaging technologies to enhance nutrition and improve food stabilization and ration packaging to support Warfighter physical and cognitive performance on the battlefield. ***FY 2014 Accomplishments:*** Demonstrated reduction of secondary packaging by utilizing emerging polymer materials and manufacturing methods to reduce packaging bulk/weight and eliminate field waste; validated increased availability and stability of anti-oxidants within ration	1.227	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** C07 / *Joint Service Combat Feeding Tech Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
components to improve Warfighter performance and recovery time; verified safety, acceptability, cost, and shelf-life of meat/ seafood processed in novel drying processes for application to group rations options and expanded shelf-life.			
Title: Ration Stabilization and Nutrient Delivery Technology Demonstration ***Description:*** Beginning in FY15, this effort is renamed from Ration Stabilization, Packaging, Nutrient Delivery, and Food Safety to Ration Stabilization and Nutrient Delivery Technology Demonstration. This effort matures and demonstrates novel nutritional biochemistry, food processing, and packaging technologies to enhance nutrition and improve food stabilization and ration packaging to support Warfighter physical and cognitive performance on the battlefield. ***FY 2015 Plans:*** Demonstrates increased bio-availability and stability of phytonutrients within ration components to improve Warfighter performance and recovery time; validates safety, acceptability, cost, and shelf-life of rations processed in novel stabilization technologies for application to operational rations and extended shelf-life; demonstrates increased availability of nutrition components for Soldier post-mission physical recovery.	-	1.265	-
Title: Joint Service Combat Feeding Technical Demonstration ***Description:*** Beginning in FY16, Joint Combat Feeding Equipment and Food Protection Technology Demonstration and Ration Stabilization and Nutrient Delivery Technology Demonstration will be combined and renamed to Joint Service Combat Feeding Technical Demonstration. This effort matures and demonstrates novel nutritional biochemistry, food processing, and packaging technologies to enhance nutrition and improve food stabilization and ration packaging to support Warfighter physical and cognitive performance on the battlefield. This effort will demonstrate technologies in support of DoD VSA to improve field detection and identification capabilities for the presence of chemical and biological threats in foods and provide new techniques and sensors for food inspectors in support of field feeding operations. This effort demonstrates equipment and energy technologies to expand capability and reduce the logistics footprint of field feeding systems. ***FY 2016 Plans:*** Will exploit and demonstrate novel field feeding technologies to promote Joint field feeding operations and reduce field feeding costs/logistical footprint through increased commonality across Services, in support of DoD operational energy goals; demonstrate novel food pathogen extraction methods and commercial-of-the-shelf (COTS) diagnostic technologies; develop and demonstrate technologies to stabilize amino acids to improve protein quality and functionality; demonstrate novel ration processing techniques for significant cost reductions while expanding nutrient retention within shelf stable components; demonstrate technology for next generation of ration components with increased nutrient density to decrease sustainment burden, improve performance and	-	-	2.155

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** C07 / *Joint Service Combat Feeding Tech Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
reduce Soldier load; demonstrate novel ration packaging material technologies (e.g., bio-based hybrid materials) to reduce ration packaging waste.			
Accomplishments/Planned Programs Subtotals	3.681	3.012	2.155

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
J50: *Future Warrior Technology Integration*	-	36.996	48.369	32.621	-	32.621	26.550	29.310	31.764	32.364	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures, demonstrates, and integrates lightweight and multifunctional materials and components to provide the Soldier and small units with the most effective personal protection, electronics connectivity, and mission specific equipment while evaluating the potential to reduce physical weight, cognitive burden, and sustainment needs within the required protection and functional capabilities for the small unit. This project develops, matures, and maintains a Soldier Systems Engineering Architecture (SSEA) framework commensurate with other major Army platforms. Efforts in this project focus on maturing, integrating, and demonstrating personal protection (such as armor, headgear, eyewear, and hearing protection), durable clothing for all weather conditions, and power management solutions.
In addition, special focus is on understanding and demonstrating the impacts of physical and cognitive load on Soldier mission performance and quality of life by implementing strategies to reduce load and/or optimize loads to reduce injuries. These efforts integrate geographically dispersed laboratory environments to conduct comprehensive assessments and report the technical viability of Soldier system solutions and conducts field demonstrations to obtain relevant feedback for user acceptance and performance validation.

Efforts in this program element support the Army science and technology Soldier/Squad portfolio.

Work in this project complements and is fully coordinated with PEs 0602786A (Warfighter Technology), PE 0602618A (Ballistics Technology), PE 0602105A (Materials Technology), PE 0622787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0622308A (Advanced Concepts and Simulation), PE 0633015A (Next Generation Training and Simulation Systems), PE 0602705A (Electronics and Electronic Devices), PE 0603710A (Night Vision Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603008A (Electronic Warfare Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Soldier/Small Unit Integrated Protection	10.291	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort matures and demonstrates proven components and material advancements which are integrated into experimental ensembles or prototypes that have potential to significantly increase protection of individual Soldiers and/or reduce physical load at equal or better capability. This work is fully coordinated with PE 060786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/Project H94. Demonstrated technologies transition to various PEO-Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. Beginning in FY15, efforts for Soldier/Small Unit Integrated Protection will be captured within two paragraphs titled "Soldier/Small Unit Ballistic and Blast Protection" and "Soldier/ Small Unit Multi-threat Protection". ***FY 2014 Accomplishments:*** Matured and demonstrated lightweight multifunctional materials for protective clothing and individual equipment to increase protection to vital areas such as pelvis, torso, extremity, head, and face; validated protective area of coverage and weight balance for shoulders and hips to optimize Soldier protective armor design; matured hearing protection that mitigates impulse noise exposure without diminishing auditory situational awareness; conducted field assessments and modeling and simulation to optimize the design of multi threat protective components incorporating capabilities such as signature management, environmental protection (flame/thermal, cold/wet, insect), and hygiene management; transitioned technologies, metrics, and tools matured in this effort to PEO Soldier Product Managers, to TRADOC for future requirements development, and into the Soldier Systems Engineering Architecture.			
Title: Soldier/Small Unit Ballistic and Blast Protection ***Description:*** Beginning in FY15, ballistic and blast efforts previously performed under Soldier/Small Unit Integrated Protection will be captured within this effort. Soldier/Small Unit Ballistic and Blast Protection utilizes a cross-disciplinary, human-centric approach to mature and demonstrate technologies which optimize tradeoffs in ballistic and blast protective component design. This effort focuses on maturing and demonstrating proven components, which are integrated into experimental ensembles or prototypes that have potential to significantly increase protection for individual Soldiers and/or reduce physical load at equal or better capability. This work is fully coordinated with PE 0602786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/ Project H94. Demonstrated technologies will transition to various PEO-Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2015 Plans:*** Demonstrates combat eye protection technologies that provide 15% improved ballistic performance without degradation in optical quality and scratch resistance; provides weight versus threat-standoff trade space analysis to inform reduced weight small arms protective insert development; demonstrates relevant technologies and validated methods to enable assessment and verification of service life requirements for body armor components; develops knowledge products from successfully demonstrated protection	-	4.108	4.275

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
technologies to allow for transition of test methodologies and human centric design parameters to inform current and future requirements, programs, and framework of Soldier Systems Engineering Architecture. ***FY 2016 Plans:*** Will optimize non-destructive inspection technologies for evaluation of effects of environmental aging and mechanical damage on helmet and armor system performance; integrate ballistic and blast protection capabilities into extremity protection equipment; exploit organ allometry data set to improve biofidelity of casualty reduction models and account for individual Soldier variability in design of optimized vital torso coverage area; verify and validate improved casualty reduction model with the ability to fully pose digitally scanned Soldier and equipment models in operationally relevant scenarios; demonstrate prototype of self-powering single lens protective eyewear system with sun, ballistic, and laser protective capabilities; demonstrate integration of active auditory protection with ballistic protection eyewear.			
Title: Soldier/Small Unit Multi-threat Protection ***Description:*** Beginning in FY15, integrated multi-threat protection efforts (such as environmental protection, flame protection, and camouflage) previously performed under Soldier/Small Unit Integrated Protection will be captured within this effort. Soldier/Small Unit Multi-threat Protection focuses maturing and demonstrating multifunctional protective component materials, sub-systems, and hearing protection technologies that have potential to significantly increase protection of individual Soldiers. This work is fully coordinated with PE 0602786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/Project H94. Demonstrated technologies transition to various PEO-Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2015 Plans:*** Matures and demonstrates improved multifunctional protective textile technologies with enhanced durability, signature management performance, insect resistance, and flame resistance; matures and integrates hearing protection technology that mitigates noise exposure while maintaining auditory situational awareness; demonstrates the viability of using environmental/ biological hazard and injury analyses, along with materials performance data and uniform design features, as a means of designing uniforms that provide capability sets tailored to specific geographical regions; develops knowledge products from successfully demonstrated technologies to allow for transition of test methodologies and human centric design parameters to inform current and future requirements, programs, and framework of Soldier Systems Engineering Architecture. ***FY 2016 Plans:*** Will exploit the multi-threat protective technologies for clothing and individual equipment for various environmental conditions (e.g. tropical, arctic/cold weather) to identify technology gaps and inform future requirements; demonstrate prototype uniforms with thermal signature management technologies in a wide range of environmental conditions; complete trade analysis of relative	-	9.131	7.560

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
effects of pattern size and color on visual signature management; demonstrate improved flame resistant fabric with enhanced durability and reduced cost.			
Title: System Integration of Soldier and Small Unit Operated Electronics ***Description:*** This effort (previously titled Small Unit C4 Interfaces) matures and integrates hardware and software components into a robust and effective information system of systems for Soldier and small unit. The goal of this effort is to define standard electronic interfaces for select platforms and aggregate information from unattended robotic assets that support small unit operations. Effort is coordinated with PE 0602786A/Project H98, PE 0603710A/Project K70, PE 0602624A/Project H18, PE 0603005A/Project 497, PE 0603008A/TR1, and PE 0603004A/Project 232. In FY13-14, this effort supports capability demonstrations for the Army Top Challenge of easing overburdened Soldiers in small units. Beginning in FY15, efforts for integration of Soldier and Small Unit Operated Electronics will be captured within the effort titled Soldier and Small Unit Systems Integration and Demonstration. ***FY 2014 Accomplishments:*** Matured and demonstrated Soldier/Small Unit load planning tool and decision support software for reducing individual Soldier load by distributing mission specific combat loads across the unit based on mission and physical metrics (e.g., mission environment, terrain, physical condition, load as a percentage of body weight, etc.); building on work completed in FY13, demonstrated optimized information portrayal integration from handheld un-manned air and ground sensors relayed to Soldier-borne electronic devices.	4.900	-	-
Title: Soldier and Small Unit Systems Integration and Demonstration ***Description:*** This effort integrates and demonstrates a breadth of Soldier and small unit capabilities across multiple mission sets and a wide range of environmental conditions. It integrates and influences test venue architectures and analytic designs to improve demonstration and experimentation capabilities relevant for Soldier/Small Units. It also integrates and demonstrates relevant mature technologies from the Army Soldier S&T community. Conduct risk reduction demonstrations and produce validated analytical results for decision makers. Effort is coordinated with PE 0602786A/Project H98, PE 0603710A/Project K70, PE 0602624A/Project H18, PE 0603005A/Project 497, PE 0603008A/TR1, and PE 0603004A/Project 232. In FY15, this effort supports capability demonstrations for the Army Top Challenge of easing overburdened Soldiers in small units and force protection for Soldiers and small units. In FY16, demonstration efforts for force protection for Soldiers and small units will be captured within Soldier/Small Unit Multi-threat Protection. ***FY 2015 Plans:*** Conducts integrated, operationally-relevant systems-level demonstrations with the potential to increase protective equipment performance against a wide range of threats while decreasing weight; conducts system assessment and documents system	-	11.446	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
performance parameters for a dismounted route planning tool, which interfaces with three existing military mission planning platforms; matures and demonstrates tactically relevant performance of handheld unmanned sensor platform in simulated operational environments; demonstrates capabilities to offload Soldier's carried weight such as providing Soldier the ability to digitally request and track aerial resupply missions in real-time and combining various offloading technologies for Small Unit operations; participates in significant Army demonstrations, exercises, and wargames to demonstrate Soldier and Small Unit capabilities in below battalion level operations in order to inform future S&T efforts, close capability gaps, and inform S&T prioritization.			
Title: Soldier Systems Engineering Architecture (SSEA)	12.236	11.854	12.261
Description: This effort (previously titled System Integration Laboratory for Evaluation of Emerging Technological Capabilities) is renamed to Soldier Systems Engineering Architecture (SSEA) which pursues a mature and maintainable architecture for a biological (human) platform architecture that utilizes a common Soldier, Equipment, Task (SET) framework at the system level to provide a unifying performance construct that considers human dimension, equipment capability resulting in a desired tactical outcome by applying systems engineering processes, analytical tools, and models to assess the complex Soldier as a System and conduct system level trade-off . This capability is used to assess new and emerging Soldier clothing and equipment components as well as configurations against established baselines using Human-in-the-Loop principles. This effort also matures and integrates associated foundations efforts including human performance assessment measures and evaluation devices required at various testing locations, and develops standardized methodologies required for demonstrations to provide operationally relevant assessments. This effort is coordinated with PE 0602716A/Project H70, PE 0602786A/Project H98, 0633015A/Project S28, PE 0603710A/Project K70, PE 0622308A/Project C90, PE 0622787A/Project 869, and 0603004A/Project 232. In FY13-14, this effort supports capability demonstrations for the Army Top Challenges of easing overburdened Soldiers in small units and force protection for Soldiers and small units. ***FY 2014 Accomplishments:*** Developed and matured a Soldier Systems Engineering Architecture with an established Soldier baseline platform; applied system integration tools to conduct lab and field assessments in relevant environments to demonstrate and validate integrated load planning tools with capabilities such as equipment cross-loading options across the small unit, expedited route planning, metabolic cost estimation, and initial validation for heat strain prediction; built on FY13 body armor system integration laboratory assessment tools and assess emerging body armor systems for improved Soldier combat effectiveness and survivability relative to system sizing, weight, and configuration; provided knowledge products such as empirical component and systems performance data, TRL assessments, trade-off analyses, and standardized performance metrics for capability demonstrations and acquisition decisions and future requirements development. ***FY 2015 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Leads the Army development and maturation of the SSEA using the SET framework developed during FY14 for conducting assessments and decomposing identified needs into measures of performance and system requirements; identifies required improvements to modeling and simulation capabilities to perform and support quantitative analyses and evaluations; develops the Soldier biological (human) platform architecture, and Soldier and squad level metrics gaps; enhances capabilities for virtual simulation for Soldier and small units; advances data collection tools to support the integration and measurement of the effects of Soldier-worn equipment in the SSEA; exercises the architecture as it is developed to test and refine its capabilities; provides knowledge products such as verified component and systems performance data, TRL assessments, trade-off analyses, and standardized performance metrics for capability demonstrations and acquisition decisions and future requirements development. ***FY 2016 Plans:*** Will continue to build the systems engineering framework by collecting, analyzing, and cataloging equipment technical data, current training and human performance measures and metrics, dismounted modeling capabilities, test methods and measures, and the technical attributes of current human systems and subsystems interfaces to determine compatibility gaps among all capability areas for integration into the SET framework; mature the framework to create design criteria to experiment, demonstrate, verify, and validate technical maturity and military utility of future technologies; integrate logical structure and shared repository for the Soldier community; demonstrate SSEA capabilities with pilot case studies by conducting analysis of human physical, cognitive, and social characteristics to predict Soldier performance outcomes for human optimization.			
Title: Soldier and Small Unit Mission Command/Situational Awareness (SA) and Power and Energy Integration ***Description:*** Efforts for information portrayal for situational awareness as well as lightweight Soldier power storage, generation, and power management components and subsystems previously under Soldier and Small Unit Systems Integration and Demonstration will be renamed to Soldier and Small Unit Mission Command/Situational Awareness and Power and Energy Integration. These efforts mature and demonstrate mission command and power and energy technology development for the dismounted Soldier and small unit. The goal is to fully support the situational awareness mission information tools and power needs of a dismounted mission in an electronically equipped battlefield. This effort is fully coordinated with PE 0602705A/Projects H11 and H94. ***FY 2016 Plans:*** Will begin to integrate situational awareness and power capabilities to include information portrayal software, display technology, data collection and analyzing devices, augmented reality display overlays that provide terrain and structures information in addition to entities appearing from local and remote reference sources, route planning altitude, and heat into mobility planning tools; assess cognitive load associated with all mission information systems; improve the capability of Soldier integration lab live simulation by integrating cognitive measures into operational scenario (e.g., cordon and search); integrate and demonstrate mission performance impacts using handheld information portrayal technologies for applications such as aerial resupply and factors related to Soldier readiness; mature and demonstrate kinetic power generating capabilities integrated into existing clothing	-	-	5.819

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and individual equipment from Soldiers' movement (e.g., knee movement) to reduce power requirements and resupply needs for Soldiers.			
Title: Soldier and Small Unit Human Systems Performance	9.569	11.830	2.706

Description: This effort (previously named Soldier and Small Unit Load Management is renamed to Soldier and Small Unit Human Systems Performance) matures and validates human performance metrics (e.g., physiological, psychophysical, biomechanical, etc.) which have the potential to reduce or mitigate negative impacts of Soldier physical carried load and improve operationally relevant human performance. This work is fully coordinated with PE 060786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/Project H94. In FY12-FY14, this effort supports capability demonstrations for the Army Top Challenge of easing overburdened Soldiers in small units. Technologies, metrics and tools developed in this effort will transition to PEO Product Managers and TRADOC and be integrated into the SSEA and Systems Integration Laboratory environment.

FY 2014 Accomplishments:
Matured and demonstrated weight reduction technologies and load management concepts identified in FY12 and FY13 that reduce the physical carried load of dismounted Soldiers at the squad level without negatively impacting Soldier performance and squad effectiveness; demonstrated reductions in Soldier carried load through integration of technologies such as materiel weight reductions (e.g., clothing and equipment, power and energy, weapons and ammo) gained from lightweight multifunctional materials and reduction of size and cube of Soldier carried items; demonstrated the impact of incorporating Soldier performance prediction capabilities into the mission planning process as a means to manage individual and squad carried loads in concert with emerging tactical aerial resupply or off-loading options; validated human performance and musculoskeletal injury reduction metrics and tools to diagnose and visualize load effects of equipment as well as measure mission effectiveness and mobility; matured and demonstrated select off-loading technologies such as augmentation and weight distribution devices and determine the applicability of these technologies in dismounted and forward operations missions.

FY 2015 Plans:
Validates individual Soldier mission relevant human performance metrics sensitive to equipment load and fatigue; optimizes operationally relevant physical and cognitive measures to quantify the effect associated with physically and mentally demanding workloads; provides data and modeling approaches whose outputs make explicit trade-space between human functional capability and equipment configuration that supports informed technology development; field-validates laboratory data on changes in biomechanical and cognitive performance as a function of mission-contextual factors to determine the impact of Soldier borne load on mission performance; matures personal augmentation design for opportunities such as simple mechanical augmentation; transitions mature knowledge products for human performance (e.g., thermal burden models, load-related metabolic energy

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
cost, etc); validates operationally relevant human performance metrics under current clothing and individual equipment (CIE) configurations that can be used in future testing to demonstrate the impacts of the configuration on the individual's performance. ***FY 2016 Plans:*** Will optimize biomechanic tools and metrics to quantify performance effects of Soldier and small unit load and protective clothing on Soldier effectiveness; correlate operational field relevance with laboratory research to mimic impacts of physical fatigue, load redistribution, personal augmentation, agility, and weight sensitivity on performance and injury; demonstrate algorithms on biomechanical and cognitive performance changes as a function of time, terrain, and load, which can be input to mission planning tools and other modeling efforts; establish the impact of load carriage over variable grades to inform future requirements for load carriage; identify markers of fatigue that may predict declines in cognitive performance; optimize understanding of the effects of exoskeleton designs on gait and energy.			
Accomplishments/Planned Programs Subtotals	36.996	48.369	32.621

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J52 / *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	10.000	13.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Advanced Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase ***FY 2014 Accomplishments:*** Program increase for warfighter advanced technology ***FY 2015 Plans:*** Program increase for warfighter advanced technology	10.000	1.000
Congressional Add: Environmental Control Systems ***FY 2015 Plans:*** Congressional increase for Environmental Control Systems	-	12.000
Congressional Adds Subtotals	10.000	13.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** VT5 / *Expeditionary Mobile Base Camp Demonstration*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	7.567	7.702	6.763	-	6.763	4.245	3.433	3.455	3.524	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates mission-specific plug and play components, subsystems, and modules designed to optimize manpower requirements, improve situational awareness, increase Soldier readiness and survivability, improve habitation, reduce logistics footprint, enhance supportability, and reduce cost. Expeditionary Base Camp (EBC) systems (or remote command outposts) provide an operational capability for Small Combat Units (battalion and below) and Soldiers, which are rapidly deployable/re-locatable and require no Military Construction and limited materiel handing support. The need for this technologically enabled capability has arisen as a result of new tactics, techniques, and procedures used in austere, remote, and challenging environments in which stability operations, counterinsurgency operations, and peace keeping missions are conducted. The Army envisions continuing to conduct this full range of operations worldwide, particularly in the Asia Pacific and Middle East regions. This project integrates mature technologies to create mission specific lab demonstrators and evaluates the performance capabilities using metrics and methodologies developed under PE 0602786A/Project VT4.

Efforts in this project support the Army science and technology Soldier/Squad portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

Work in this project is led, performed and/or managed by the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA and fully coordinated with PE 0602786A (Warfighter Technology), PE 0602784A and 0603734A (Military Engineering), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Expeditionary Base Camp (EBC) Technology Demonstrations	7.567	7.702	6.763
Description: This effort assesses and integrates maturing technologies required to plan, establish, operate, protect, sustain, and redeploy a holistic small unit base camp system and manage its power, waste, and water resources. This effort supports Basing Sustainment and Logistics capability demonstrations.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** VT5 / *Expeditionary Mobile Base Camp Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Matured self-sustaining contingency basing and system technologies that are modular and man-portable to support the needs of the Squad and Small Unit by providing a high quality of living in efficient and expeditionary systems; demonstrated technical performance parameters identified in FY13 to assess basing manpower needs, operational energy efficiency, water demand and waste remediation, and sub-system interoperability; demonstrated contingency basing technologies to assess the performance of an integrated basing system with reduced sustainment requirements that limit the delivery of water and fuel as well as the need for collecting, managing, and disposing of solid and liquid waste. ***FY 2015 Plans:*** Begins demonstrations of integrated/matured technology and non material solutions for reducing small contingency base operation sustainment requirements thru more efficient management of energy and water consumption and solid/liquid waste production; demonstrates self-sustaining living module(s); integrates technology concept(s) and systems engineering models for handling and treatment of black waste, and demonstrates technical feasibility; mature, analyze, and demonstrates water demand reduction technologies for developing a method to trade off net water savings with potential energy consumption increases; further improves photovoltaic power generating solar shade system technology for demonstration; optimizes concepts, models, components, and systems for sustainability/logistics demonstration. ***FY 2016 Plans:*** Will validate base camp technology component performance data using a model-based systems engineering approach with approved sustainability and logistics baseline; optimize technology integration to improve small contingency base camp operations and conduct integrated demonstrations; validate and determine maturity of industry based technology solutions applicable to sustainment and logistics of expeditionary basing gaps; mature and demonstrate water demand reduction technologies to reduce logistical tail to base operations; demonstrate integrated components of the black waste treatment technologies; optimize a highly mobile shelter design to enable a leaner force and a highly expeditionary force; demonstrate cooling technologies for small basing applications that will decrease logistic demands and improve Soldier readiness.			
Accomplishments/Planned Programs Subtotals	7.567	7.702	6.763

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** VT5 / *Expeditionary Mobile Base Camp Demonstration*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	100.646	106.264	69.584	-	69.584	68.365	70.847	71.919	73.341	-	-
810: *Ind Base Id Vacc&Drug*	-	17.096	18.269	18.719	-	18.719	16.696	17.889	18.052	18.406	-	-
814: *NEUROFIBROMATOSIS*	-	15.000	15.000	-	-	-	-	-	-	-	-	-
840: *Combat Injury Mgmt*	-	30.633	29.321	30.572	-	30.572	31.189	32.247	32.798	33.448	-	-
945: *BREAST CANCER STAMP PROCEEDS*	-	0.497	-	-	-	-	-	-	-	-	-	-
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	16.000	-	-	-	-	-	-	-	-	-
FH4: *Force Health Protection - Adv Tech Dev*	-	1.606	1.691	1.268	-	1.268	1.332	1.776	1.868	1.905	-	-
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	-	-	-	-	-	-	-	-	-
MM3: *Warfighter Medical Protection & Performance*	-	11.814	17.983	19.025	-	19.025	19.148	18.935	19.201	19.582	-	-

A. Mission Description and Budget Item Justification

This program element (PE) maturates and demonstrates advanced medical technologies including drugs, vaccines, medical devices, diagnostics, and developing medical practices and procedures to effectively protect and improve the survivability of U.S. Forces across the entire spectrum of military operations. Cross DoD coordinated and cooperative efforts are focused in four principal medical areas: Combat Casualty Care, Military Operational Medicine, Militarily Relevant Infectious Diseases, and Clinical and Rehabilitative Medicine.

Promising medical technologies are refined and validated through extensive testing, which is closely monitored by the U.S. Food and Drug Administration (FDA) and Environmental Protection Agency (EPA), as part of their processes for licensing and/or approving new medical products. The FDA requires medical products to undergo extensive preclinical testing in animals and/or other models to obtain preliminary effectiveness and safety information before they can be tested in human clinical trials. Clinical trials are conducted in three phases to prove the safety of a drug, vaccine, or device for the targeted disease or medical condition, starting in Phase 1 with a small number of healthy volunteers. Following Phase 1, Phase 2 clinical trials to provide expanded safety data and evaluate the effectiveness of a drug, vaccine, or medical device in a larger population of patients having the targeted disease or medical condition. Each successive phase includes larger numbers of human subjects and requires FDA cognizance prior to proceeding. Work conducted in this PE primarily focuses on late stages of technology maturation activities required to conduct Phase 1 and 2 clinical trials. Some high-risk technologies may require additional maturation with FDA guidance prior to initiating these clinical trials. Such things as proof of product stability and purity are necessary to meet FDA standards before entering later stages of testing and prior to transitioning into a formal acquisition program

where large Phase 3 pivotal trials will be conducted for licensure. Activities in this PE may include completion of preclinical animal studies and Phase 1 and 2 clinical studies involving human subjects according to FDA and EPA requirements. Promising medical technologies that are not regulated by the FDA are modeled, prototyped, and tested in relevant environments.

Blast research and research into maturing field rations in this PE are fully coordinated with the United States Army Natick Soldier Research, Development, and Engineering Center. This coordination enables improved body armor design and rations for Soldiers. Additionally, the activities funded in this PE are externally peer reviewed and fully coordinated with all Services as well as other agencies through the Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Community of Interest (COI). The ASBREM COI, formed under the authority of the Assistant Secretary of Defense for Research and Engineering, serves to facilitate coordination and prevent unnecessary duplication of effort within the Department of Defense's biomedical research and development community, as well as its associated enabling research areas.

Project 810 maturates and demonstrates FDA-regulated medical countermeasures such as drugs, vaccines, and diagnostic systems to naturally occurring infectious diseases and wound infections of military importance, as identified by worldwide medical surveillance and military threat analysis. The project also supports testing of personal protective measures such as repellents and insecticides regulated by the EPA. This project is being coordinated with the Defense Health Program.

Project 840 validates studies on safety and effectiveness of drugs, biologics (products derived from living organisms), medical devices, and medical procedures intended to minimize immediate and long-term effects from battlefield injuries; advanced technology development and clinical studies for treatment of ocular (and visual system traumatic injury; and restoration of function and appearance by regenerating skin, muscle, and bone tissue in battle-injured casualties. Additionally, this project develops and realistically tests improved occupant protection systems through medical research to characterize mechanisms of injuries sustained by occupants of ground-combat vehicles subjected to underbody blast events, determine human tolerance limits to underbody blast forces, and develop tools to predict injuries to ground-combat vehicle occupants exposed to underbody blast forces.

Project FH4 maturates, validates, and supports enhanced Force Health Protection of Soldiers against threats in military operations and training. Health-monitoring tools are matured to rapidly identify deployment stressors that affect the health of Joint Forces. These databases and systems enhance the DoDs ability to monitor and protect against adverse changes in health, especially mental health effects caused by changes in brain function. Force Health Protection work is conducted in close coordination with the Department of Veterans Affairs. The program is maturing the development of global health monitoring (e.g., development of neuropsychological evaluation methodologies), validating clinical signs and symptoms correlating to medical records, diagnosed diseases, and mortality rates. The key databases supporting this program are the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases allow for the examination of interactions of psychological stress and other deployment and occupational stressors that affect Warfighter health behaviors.

Project MM3 supports the Medical and Survivability technology areas with laboratory validation studies and field demonstrations of biomedical products designed to counteract myriad environmental and physiological stressors, as well as materiel hazards encountered in training and operational environments to protect, sustain, and enhance Soldier performance. The key efforts are to demonstrate and transition technologies, as well as validate tools associated with Soldier survivability, injury assessment and prediction, assessments for post-concussive syndrome, and enhancing performance during continuous operations. The three main thrust areas are

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*

(1) Physiological Health and Environmental Protection, (2) Injury Prevention and Reduction, and (3) Psychological Health and Resilience. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services.

Work funded in this project PE is fully coordinated with efforts undertaken in PE 0602787A and the Defense Health Program.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this PE is performed by Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Medical Research Institute of Infectious Diseases, Ft Detrick, MD; U.S. Army Research Institute of Environ. Med. (USARIEM), Natick, MA; U.S. Army Institute of Surgical Research, Ft Sam Houston, TX; U.S. Army Aeromedical Research Laboratory (USAARL), Ft Rucker, AL; the Naval Medical Research Center (NMRC), Silver Spring, MD; U.S. Army Dental Trauma Research Detachment (USADTRD), Ft. Sam Housto

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	100.999	67.291	70.050	-	70.050
Current President's Budget	100.646	106.264	69.584	-	69.584
Total Adjustments	-0.353	38.973	-0.466	-	-0.466
• Congressional General Reductions	-	-0.027			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	39.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.197	-			
• SBIR/STTR Transfer	-1.550	-			
• Adjustments to Budget Years	-	-	-0.466	-	-0.466

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: 814: *NEUROFIBROMATOSIS*		
Congressional Add: *Neurofibromatosis Research Program*	15.000	15.000
Congressional Add Subtotals for Project: 814	15.000	15.000
Project: 945: *BREAST CANCER STAMP PROCEEDS*		
Congressional Add: *Breast Cancer Stamp Proceeds*	0.497	-
Congressional Add Subtotals for Project: 945	0.497	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: 97T: *NEUROTOXIN EXPOSURE TREATMENT*		
Congressional Add: *Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program*	16.000	16.000
Congressional Add Subtotals for Project: 97T	16.000	16.000
Project: MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Military Burn Trauma Research Program*	8.000	8.000
Congressional Add Subtotals for Project: MM2	8.000	8.000
Congressional Add Totals for all Projects	39.497	39.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) 810 / *Ind Base Id Vacc&Drug*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
810: *Ind Base Id Vacc&Drug*	-	17.096	18.269	18.719	-	18.719	16.696	17.889	18.052	18.406	-	-

A. Mission Description and Budget Item Justification

This project maturates and demonstrates U.S. Food and Drug Administration (FDA)-regulated medical countermeasures such as drugs, vaccines, and diagnostic (identification of the nature and cause of a particular disease) systems to naturally occurring infectious diseases that are threats to deployed U.S. military forces. The focus of the program is on prevention, diagnosis, and treatment of diseases that can adversely impact military mobilization, deployment, and operational effectiveness. Prior to licensure of a new drug or vaccine to treat or prevent disease, the FDA requires testing in human subjects. Studies are conducted stepwise: first to prove the product is safe in humans, second to demonstrate the desired effectiveness and optimal dosage (amount to be administered) in a small study, and third to demonstrate effectiveness in large, diverse human populations. All test results are submitted to the FDA for evaluation to ultimately obtain approval (licensure) for medical use. This project supports the studies for safety and effectiveness testing on small study groups after which they transition to the next phase of development for completion of expanded safety and initial studies for effectiveness in larger populations. If success is achieved for a product in this project, the effort will transition into Advanced Development. The project also supports testing of personal protective measures that can reduce disease transmission from arthropods to include products such as repellents and insecticides, which are regulated by the Environmental Protection Agency (EPA).

Research conducted in this project focuses on the following five areas:
(1) Drugs to Prevent/Treat Parasitic (organism living in or on another organism) Diseases
(2) Vaccines for Prevention of Malaria
(3) Bacterial Disease Threats (diseases caused by bacteria)
(4) Viral Disease Threats (diseases caused by viruses)
(5) Diagnostics and Disease Transmission Control

Research is conducted in compliance with FDA regulations for medical products for human use and EPA regulations for insect-control products that impact humans or the environment (e.g., repellents and insecticides).

Work is managed by Walter Reed Army Institute of Research (WRAIR) and the U.S. Army Medical Institute of Infectious Disease (USAMRIID) and coordinated with NMRC. The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Promising medical countermeasures identified in this project are further matured under PE 0603807A, project 808.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, MD, and its overseas laboratories; USAMRIID, Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. Significant work is conducted under a cooperative agreement with the Henry M. Jackson Foundation, Bethesda, MD.

Efforts in this project support the Soldier portfolio and the principal area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Drugs to Prevent/Treat Parasitic Diseases	2.207	2.219	1.958
Description: This effort selects promising anti-parasitic drug candidates for treating malaria and leishmaniasis (a disease transmitted by sand flies) for testing in humans, prepares data packages required for FDA approval of testing in humans, and conducts that testing. Studies have shown that the malaria parasite can become resistant to existing drugs, which makes it necessary to continually research new and more effective treatments. ***FY 2014 Accomplishments:*** Assessed effectiveness of new and refined anti-parasitic drugs through testing in human populations exposed to malaria and leishmania infections world-wide. ***FY 2015 Plans:*** Advance new generation drugs with improved therapeutic index (largest dose producing no toxic symptoms) through small animal model testing. Perform clinical testing for safety and effectiveness of new selected candidate drugs and drug combinations. ***FY 2016 Plans:*** The down-selected compounds from Triazine group showing positive results in small animal testing in FY15 will be used in clinical testing for safety and effectiveness in human volunteers. Will also conduct clinical testing to assess metabolism (break-down within human body) of 8-aminoquinoline class drugs (i.e. primaquine) to improve drug safety and effectiveness for treatment and prevention of relapsing malarias (persons getting sick second time after drug treatment). Will transition best therapeutic (treatment or drug promoting disease healing) and preventive drug candidates to advanced development.			
Title: Vaccines for Prevention of Malaria	5.306	5.123	5.503
Description: This effort selects candidate vaccines for various types of malaria, including the severe form of malaria (Plasmodium falciparum) and the less severe but relapsing form (Plasmodium vivax), prepares technical data packages required for FDA approval of testing in humans and conducts testing of promising malaria vaccine candidates in humans. A malaria vaccine would minimize the progression and impact of drug resistance and poor Warfighter compliance with taking preventive anti-malarial drugs. ***FY 2014 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Conducted human safety and effectiveness clinical trials of new formulations of vaccine candidates and assessed vaccine performance for suitability for transition to Advanced Development. ***FY 2015 Plans:*** Continue to conduct human safety and effectiveness clinical trials of new formulations of vaccine candidates supporting transition into Advanced Development. Conduct human clinical studies to assess how long malarial vaccination sustains protection levels. Down select lead P. falciparum vaccine candidates for transition into Advanced Development ***FY 2016 Plans:*** Will continue conducting human safety and effectiveness clinical trials of new formulations of vaccine candidates including weakened (so they do not produce disease) malaria sporozoites (infective stage of the parasite) in human volunteers to assess their safety and effectiveness. Will down-select the best vaccine candidate for transition to advanced development.			
Title: Bacterial Disease Threats ***Description:*** This effort selects promising candidate vaccines against each of the three main bacterial causes of diarrheas (E. coli, Campylobacter, and Shigella (a significant threat during initial deployments)) for testing in human subjects. Data packages are prepared, as required for FDA approval, and testing is conducted in human subjects. ***FY 2014 Accomplishments:*** Produced best vaccine candidates by using Good Manufacturing Practices developed by the FDA; conducted human (volunteers) safety trials of additional promising vaccine candidates against each of the three main bacterial causes of diarrhea. ***FY 2015 Plans:*** Conduct expanded vaccine candidate safety and effectiveness human clinical trials with two diarrheal pathogens, Shigella, and EnteroToxigenic E. coli (ETEC). Transition best successful down-selected vaccine candidates to Advanced Development. ***FY 2016 Plans:*** Will prepare data packages to present to the FDA for approval for human testing of vaccine candidates for bacterial diarrheal agents. Will conduct extended safety and effectiveness studies by using different escalating doses of down selected vaccine candidates against each of the three diarrheal agents (Shigella, ETEC and Campylobacter) in human volunteers. Will transition the best Shigella, ETEC & Campylobacter vaccine candidates, respectively, to Advanced Development.	5.179	4.916	4.518
Title: Viral Disease Threats ***Description:*** This effort progresses the most promising vaccine candidates against dengue fever (a severe debilitating disease caused by a virus and transmitted by a mosquito), and hantavirus (severe viral infection that causes internal bleeding and is contracted from close contact with rodents) and conducts FDA-required nonclinical safety and protection testing (laboratory-	2.703	4.886	5.116

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
based) in animals, prepare FDA investigational new drug technical data packages, and conducts clinical testing of candidate vaccines in humans. ***FY 2014 Accomplishments:*** Evaluated the alternative strategies to deliver vaccine candidates in human muscle and skin to develop a needle-free injection; explored the concept of using our DNA vaccines to produce antibodies that could be used to treat or prevent the diseases caused by hantaviruses; and further evaluated human safety and effectiveness of best vaccine candidates against all dengue types present worldwide. ***FY 2015 Plans:*** Complete clinical testing of selected hantavirus and dengue vaccine candidates for safety and initiate expanded clinical studies to test the efficacy of the candidate vaccine in human volunteers. Initiate expanded clinical testing for efficacy studies with multivalent dengue vaccine in US adults with new vaccine lots. Also initiate clinical studies for effectiveness in dengue endemic countries with best down-selected candidates. Refine the final vaccine formulation and delivery into human body. Initiate the development of a human challenge model for all four dengue viruses. Under this model, volunteers vaccinated with a dengue vaccine candidate are deliberately "challenged" with attenuated dengue viruses to assess whether or not the candidate vaccine can prevent dengue infection. ***FY 2016 Plans:*** Will conduct assessments of vaccine effectiveness and safety among human populations immunized with experimental dengue vaccines. Will continue development and testing of the experimental dengue human challenge model initiated in FY15. Will continue clinical trials with candidate DNA vaccine against hantaviruses and will continue to look for a commercial partner and a country where hantaviruses infections regularly occur, to conduct large scale clinical trials (FDA required). Will coordinate with the FDA to establish specific guidelines for the licensure of a hantavirus DNA vaccine.			
Title: Diagnostics and Disease Transmission Control ***Description:*** This effort conducts human subject testing of FDA-regulated field medical diagnostic devices and EPA-approved measures to control arthropods (i.e. insects, ticks & mites)-borne pathogens (infectious agents) that cause diseases such as Q fever, Sand fly fever, and Japanese encephalitis. ***FY 2014 Accomplishments:*** Initiated new field evaluations under the biosurveillance portion of the next-generation diagnostic system (NGDS) managed by Program Manager, Chemical Biologic Medical Systems, specifically for assays targeting vectors (organisms that transmit disease,	1.701	1.125	1.624

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
such as a mosquito) transmitting medically relevant diseases; conducted field evaluation of the new alternate repellent products in overseas field locations; and evaluated the NGDS assays (tests) for use in diagnosing pathogens (infectious agents) in humans. ***FY 2015 Plans:*** Develop Rapid Human Diagnostic Devices (RHDD) in collaboration with industry partners and transition to Advanced Development. WTest vector (organisms that transmit disease) surveillance devices in field. Test new vector control technologies with field applications and select best tools for military operations. ***FY 2016 Plans:*** Will support projects to research and develop RHDDs for priority diseases and pathogens (infectious agents) that are usable at or near the point of need. Will develop military relevant assays (i.e. panels differentiating diseases that have similar symptoms) to be transitioned for the next-generation diagnostic system (NGDS) platform. Will continue to test new vector control technologies in the field.			
Accomplishments/Planned Programs Subtotals	17.096	18.269	18.719

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 814 / *NEUROFIBROMATOSIS*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
814: *NEUROFIBROMATOSIS*	-	15.000	15.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurofibromatosis research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Neurofibromatosis Research Program	15.000	15.000
FY 2014 Accomplishments: Neurofibromatosis Research Program		
FY 2015 Plans: Neurofibromatosis Research Program		
Congressional Adds Subtotals	15.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) 840 / *Combat Injury Mgmt*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
840: *Combat Injury Mgmt*	-	30.633	29.321	30.572	-	30.572	31.189	32.247	32.798	33.448	-	-

A. Mission Description and Budget Item Justification

This project matures, demonstrates, and validates promising medical technologies and methods to include control of severe bleeding, treatment for traumatic brain injury (TBI), revival and stabilization of trauma patients, acute treatment of extremity (arms and legs) and facial injuries, treatment of severe burn wounds, treatment of single and multiple organ failures due to trauma, and predictive indicators and decision aids for life support systems. Post-evacuation medical research focuses on continued care and rehabilitative medicine for extremity, facial/maxillary (jaw bone), and ocular (eye) trauma and leveraging recent innovations in regenerative medicine and tissue engineering techniques.

Research conducted in this project focuses on the following six areas:

(1) Damage Control Resuscitation
(2) Combat Trauma Therapies
(3) Traumatic Brain Injury
(4) Combat Critical Care Engineering
(5) Clinical and Rehabilitative Medicine
(6) Underbody Blast Injury Assessment

All research is conducted in compliance with FDA requirements for licensure of medical products for human use.

Promising efforts identified through applied research conducted under PE 0602787A, project 874, are further matured under this project. Promising results identified under this project (840) are further matured under PE 0603807A, project 836.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this project is performed by the United States Army Dental & Trauma Research Detachment (USADTRD) and the U.S. Army Institute of Surgical Research (USAISR), Joint Base San Antonio-Fort Sam Houston, TX; the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.

Efforts in this project support the Soldier Portfolio and the principal areas of Combat Casualty Care and Military Operational Medicine.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Damage Control Resuscitation	6.916	6.953	7.200
Description: This effort supports work required to validate safety and effectiveness of drugs and medical procedures to control bleeding, maintain metabolism (the chemical processes that are required to maintain life) and minimize harmful inflammation after major trauma. Efforts focus on stopping bleeding, preserving tissue function and preventing or minimizing secondary organ failure (including brain and spinal cord injury). ***FY 2014 Accomplishments:*** Evaluated devices, biologics (medical products derived from living organisms), and techniques to control life-threatening internal bleeding caused by injuries to the chest and abdomen; continued studies of drugs and biologics to reduce inflammation as therapy for traumatic bleeding and developed laboratory assays and clinical practice guidelines for diagnosis of impaired blood clotting ability caused by trauma; and validated an improved blood platelet storage technology for far-forward use. ***FY 2015 Plans:*** Continue to evaluate hemostatic (acting to arrest bleeding or hemorrhage) medical products (drugs / devices) and techniques to control life threatening bleeding from areas of the body where tourniquets may not be effective such as within the chest and abdomen, and from large soft tissue (e.g. skin and muscle) injuries or injuries to the armpit or groin. Continue to evaluate drugs and biologics (medical products derived from living organisms) to reduce traumatic bleeding caused by inflammation. Conduct preliminary studies to help determine optimal conditions for extending platelet (a cell in blood that helps it clot) storage time and while also maintaining blood-clotting capability. These efforts support continued validation studies of novel blood platelet storage technologies for far-forward use. ***FY 2016 Plans:*** Will continue research from FY15 to evaluate hemostatic drugs, biologics, devices and techniques in relevant traumatic bleeding shock models. Extend FY15 work, will evaluate promising hemostatic devices designed to stop bleeding in body locations where tourniquets cannot be used; evaluations will be done in manikins and normal human volunteers. Will evaluate preclinical safety of emerging platelet storage technologies with respect to preserving platelet hemostatic function and preventing an adverse inflammation response.			
Title: Combat Trauma Therapies	5.026	4.345	3.508
Description: This effort focuses on work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from battlefield injuries. ***FY 2014 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Transitioned biofilm (an aggregate of microorganisms in which cells adhere to each other on a surface) diagnostics, drugs that disrupt biofilm formation, and biofilm treatment therapies to clinical evaluation. Evaluated an FDA-approved, point-of-care, stem cell implant device in a clinical trial to determine whether it improves muscle function following large-volume muscle loss. ***FY 2015 Plans:*** Perform analysis supporting development of a predictive model to estimate dental casualties for Soldiers entering a theater of operations. Continue research to improve repair of large volume muscle loss injuries using stem cell technologies, biological scaffolds (tissue engineered graft), and autologous (individual as both donor and recipient) muscle tissue therapies (use muscle from uninjured area of body to replace lost muscle). ***FY 2016 Plans:*** As follow on to research from FY15, will evaluate therapies to reduce fibrosis (development of excessive connective tissue after injury) during recovery from large volume muscle loss injury and improve muscle functionality. Will perform small clinical studies to characterize effects of traumatic and burn injuries on vital organ preservation, scarring, and need for pain-relieving drugs. Will field an information product on a predictive model to estimate dental casualties for Soldiers entering a theater of operations.			
Title: Traumatic Brain Injury ***Description:*** This effort supports work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from concussive penetrating brain injuries. In FY2013 and FY2014, this effort supports Technology-Enabled Capability Demonstration 7.d, Brain in Combat. ***FY 2014 Accomplishments:*** Continued clinical pivotal study to validate an assay to diagnose presence and severity of TBI at or near point of injury; continued clinical trial of candidate drug for treatment of TBI; and continued work to identify combination therapeutics that mitigate or reduce effects of TBI for Advanced Development and clinical trials. ***FY 2015 Plans:*** Continue pivotal clinical study to validate an assay to diagnose presence and severity of TBI at or near point of injury; will continue clinical trial of candidate drug for treatment of TBI; and will continue work to identify combination therapeutics that mitigate or reduce effects of TBI for advanced development and clinical trials ***FY 2016 Plans:*** Will examine promising therapies to protect brain cells following TBI using relevant animal models of penetrating and concussive TBI. Will perform studies to establish drug protocols targeting the sub-acute (within the first few days following TBI) and chronic	3.302	3.658	4.062

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
TBI recovery phases. Will continue research from FY15 to evaluate effectiveness (therapeutic effect or benefit) of different drug combinations to protect brain cells following TBI and prevent seizures.			
Title: Combat Critical Care Engineering ***Description:*** This effort supports development of diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation (to revive), stabilization and life support, and development of improved critical care nursing practices to improve care of severely injured or ill casualties during transport and in theater hospitals and development and evaluation of technologies to treat vital organ failure caused by traumatic injury. ***FY 2014 Accomplishments:*** Conducted in-human validation studies of advanced algorithms that measure tissue blood flow, metabolism, and oxygenation and evaluated ventilation strategies to improve neurologic (brain) status in casualties with TBI. ***FY 2015 Plans:*** Translate new arterial waveform (a graph obtained by monitoring the pressure in the arteries produced by the pumping of the heart) features to the development of algorithms for early identification of patients at greatest risk for developing shock. Continue research on ventilation strategies to improve brain status in casualties with TBI. Perform studies to identify means to improve critical care nursing practice in theater hospitals. ***FY 2016 Plans:*** Will evaluate militarily relevant pre-hospital care technologies used in existing civilian trauma system, including improved patient monitors with decision support algorithms to predict shock, life-saving intervention technologies and evaluation of telehealth direction of remote surgical procedure. Will conclude work on ventilation strategies and transition to advanced development. Will start clinical studies to support development of combat nursing clinical practice guidelines for en route care and for management of sepsis (potentially life-threatening complication of infection) in the burn intensive care unit. Will perform translational studies of promising technologies to treat single and multiple organ failure due to trauma.	4.227	2.948	3.692
Title: Clinical and Rehabilitative Medicine ***Description:*** This effort supports clinical studies of treatment of ocular and visual system traumatic injury, as well as restoration of function and appearance by regenerating skin, muscle, bone tissue, and soft tissue (including the genitalia and abdomen), in battle-injured casualties. Areas of interest for regenerative medicine include healing without scarring, repair of compartment syndrome (muscle and nerve damage following reduced blood flow caused by swelling), replacement skin, and facial reconstruction. ***FY 2014 Accomplishments:***	9.063	10.857	11.554

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Evaluated the preclinical safety and effectiveness of promising drug delivery, diagnostic, tissue repair, and/or treatment strategies for traumatic eye injury; continued to conduct clinical research for rehabilitation strategies for traumatic eye injury. Incrementally built upon past successes to develop novel drug delivery, diagnostic, reconstructive, and regenerative strategies; utilized and refined cell-based therapies (including stem cells[primitive cells that give rise to more specialized cell types as they develop]) and tissue scaffolds (tissue engineered grafts) to assess soft and hard tissue repair; regeneration safety and effectiveness; and also built upon promising approaches from FY2013 by continuing the clinical evaluation of candidate strategies for burn, scar-less wound healing, bone and soft tissue repair, and strategies to repair extremities, craniomaxillofacial (head, neck, face and jaw), genitalia, and abdominal regions. ***FY 2015 Plans:*** Conduct preclinical studies on drug delivery, diagnostic, tissue repair, and/or treatment strategies for traumatic eye injury and evaluate the preclinical safety and efficacy of promising strategies to facilitate clinical transition. Further develop novel drug delivery, diagnostic, reconstructive, and regenerative strategies including novel biological materials and cell-based therapies for clinical transition; utilize and refine cell-based therapies (including stem cells) and tissue scaffolds to restore soft and bone tissue form and function; perform preclinical safety and efficacy studies; build upon promising approaches from FY2014 by continuing the clinical evaluation of candidate strategies for burn, scarless wound healing, bone and soft tissue repair, and strategies to repair the tissues of the extremities, craniomaxillofacial, genital and abdominal body regions. ***FY 2016 Plans:*** Will execute preclinical studies of drug delivery, diagnostic, tissue repair, and/or treatment strategies for traumatic eye injury and assess the preclinical safety and efficacy of promising strategies to facilitate clinical translation. Will further advance novel drug delivery, diagnostic, reconstructive, and regenerative strategies including novel biological materials and cell-based therapies for clinical translation; utilize and refine cell-based therapies (including stem cells) and tissue scaffolds to restore soft and bone tissue form and function; will establish preclinical safety and efficacy studies; will enhance promising approaches from FY2015 by advancing the clinical evaluation of candidate strategies for burn, scarless wound healing, bone and soft tissue repair, and strategies to repair the tissues of the extremities, craniomaxillofacial, genitalia and abdominal body regions. Improved monitoring technologies for tissue rejection during hand and face transplant procedures and craniofacial bone grafts to advance into clinical trials.			
Title: Administrative Activities for Prior Year Clinical Trials ***Description:*** Contract law requires the government to fulfill its responsibilities for the life of the Congressional Special Interest (CSI) award as stated in the terms and conditions. Each award may have an execution and award management tail of up to 5 years post-award, which usually occurs 18 months after the start of the fiscal year. ***FY 2014 Accomplishments:***	2.099	0.560	0.556

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Continued funding for scientific expertise, legal, contracting, research protections, regulatory affairs, and resource support personnel to manage active projects in FY2014 to be closed out over the POM. ***FY 2015 Plans:*** Continue funding for scientific expertise, legal, contracting, research protections, regulatory affairs, and resource support personnel to manage active projects in FY2015 to be closed out over the POM ***FY 2016 Plans:*** Will continue funding for scientific expertise, legal, contracting, research protections, regulatory affairs, and resource support personnel to manage active projects in FY2016 to be closed out over the POM.			
Accomplishments/Planned Programs Subtotals	30.633	29.321	30.572

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 945 / *BREAST CANCER STAMP PROCEEDS*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
945: *BREAST CANCER STAMP PROCEEDS*	-	0.497	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This project receives funds as proceeds from the sale of Breast Cancer Stamps.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Breast Cancer Stamp Proceeds	0.497	-
FY 2014 Accomplishments: Breast Cancer Stamp Proceeds		
Congressional Adds Subtotals	0.497	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 97T / *NEUROTOXIN EXPOSURE TREATMENT*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	16.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurotoxin Exposure Treatment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program	16.000	16.000
FY 2014 Accomplishments: Neurotoxin Exposure Treatment Parkinsons Research Program		
FY 2015 Plans: Neurotoxin Exposure Treatment Parkinsons Research Program		
Congressional Adds Subtotals	16.000	16.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** FH4 / *Force Health Protection - Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
FH4: *Force Health Protection - Adv Tech Dev*	-	1.606	1.691	1.268	-	1.268	1.332	1.776	1.868	1.905	-	-

A. Mission Description and Budget Item Justification

This project maturates, demonstrates, and supports enhanced Force Health Protection of Soldiers against threats in military operations and training. Health-monitoring tools are matured to rapidly identify deployment stressors that affect the health of Joint Forces. The key databases supporting this program are the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases and systems enhance the DoD's ability to monitor and protect against adverse changes in health, especially psychological/ mental health effects caused by changes in brain function. Force Health Protection work is conducted in close coordination with the Department of Veterans Affairs. The program is maturing the development of holistic health monitoring (e.g., development of neuropsychological evaluation methods) and validating subclinical signs and symptoms correlating to medical records, diagnosed diseases, and mortality rates across a Soldier's career. These databases allow for the examination of interactions of psychological (mental) stress and other deployment and occupational stressors that affect Warfighter health behaviors.

This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services. The cited work is fully coordinated with Natick Soldier Research Development Engineering Command (NSRDEC), Natick, MA.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this project is performed by the U.S. Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD; USARIEM, Natick, MA; and the Naval Health Research Center (NHRC), San Diego, CA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Health Research	1.606	1.691	1.268
Description: This effort develops and validates novel tools and strategies to advance individualized operational exposure dosimetry (measures of exposure) and establish dose-response links between operational exposures and neurological (of or about the nerves and nervous system) and physical health. Dosimetry tools may include new technologies, human biomarkers (biologically derived indicator of a process, event or condition, e.g. protein), objective physiologic markers, physiological) modeling, and validated algorithms to evaluate the health effects of military service, including deployments, and methods to detect a Soldier's exposure to environmental contamination and/or toxic substances, e.g. toxic industrial chemicals (TIC).			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** FH4 / *Force Health Protection - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Assessed modifiable behaviors and emerging health concerns among Service members using survey data and other health outcome measures and assessed validity of health screening instruments/surveys and other health measures. This data led to a greater understanding of the impact of physical and mental health issues for Service members. This effort provided screening and preventive strategies to decrease negative health consequences and inform DoD polices. ***FY 2015 Plans:*** Assess modifiable behaviors and those resilience factors that protect Service Members from adverse mental or physical health outcomes. Assess the economic burden of negative coping behaviors such as alcohol and tobacco use. This effort provides screening factors to assess military Family well-being and resilience. ***FY 2016 Plans:*** Will advance and deliver innovative tools, approaches, and models for detecting and measuring a Soldier' exposure to potentially toxic substances during operations. . Will provide dose-response links between operational exposures and neurological and physical health / well-being. Will provide models for predicting the likelihood of neurological or physical injury as a result of operational exposure(s) to TICs. Will deliver evidence-based guidance to inform policy makers to refine guidelines for individualized operational exposure dosimetry linked to neurological and physical injury.			
Accomplishments/Planned Programs Subtotals	1.606	1.691	1.268

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM2 / *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Advanced Technology Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Military Burn Trauma Research Program	8.000	8.000
FY 2014 Accomplishments: Military Burn Trauma Research Program		
FY 2015 Plans: Military Burn Trauma Research Program		
Congressional Adds Subtotals	8.000	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
MM3: *Warfighter Medical Protection & Performance*	-	11.814	17.983	19.025	-	19.025	19.148	18.935	19.201	19.582	-	-

A. Mission Description and Budget Item Justification

This project supports the Medical and Survivability technology areas of the future force with laboratory validation studies and field demonstrations of biomedical products designed to protect, sustain, and enhance Soldier performance in the face of myriad environmental and physiological (human physical and biochemical functions) stressors and materiel hazards encountered in training and operational environments. This effort focuses on demonstrating and transitioning technologies as well as validated tools associated with biomechanical-based health risks, injury assessment and prediction, Soldier survivability, and performance during continuous operations. The four main thrust areas are (1) Physiological Health, (2) Environmental protection, (3) Injury Prevention and Reduction and (4) Psychological (mental) Health and Resilience.

This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services. The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this project is performed by the United States Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, and United States Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring)	1.629	1.698	2.736
Description: This effort supports and matures laboratory prototypes, nutritional interventions, and decision aids for the validation of physiological status and prediction of Soldier performance in extreme environments. This effort supports Technology-Enabled Capability Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2014-2016 and also supports capability demonstrations in the area of decreasing Soldier physical burden in FY2014-2016.			
FY 2014 Accomplishments: Demonstrated the effectiveness of nutritional interventions for facilitating wound healing and supporting immune function; demonstrated real-time physiological status monitoring systems for operational use in-theater; enhanced injury prediction			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
algorithms for incorporation into wearable sensor systems; and enabled the prediction and prevention of physical injury and health outcomes. ***FY 2015 Plans:*** Perform field-studies to demonstrate the efficacy of nutritional interventions for optimizing Warrior recovery from physical and mental injury. Validate algorithms and mathematical models capable of predicting cognitive status and monitoring recovery and healing from physical injury. ***FY 2016 Plans:*** Will verify that nutritional approaches enhance recovery of brain function after injury. Will demonstrate dining hall interventions that improve Warfighter diet quality. Will validate models that can accurately predict recovery and safe return-to-duty.			
Title: Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments. ***Description:*** This effort supports and maturates non-invasive technologies, decision-aid tools, and models to enhance Warrior protection and sustainment across the operational spectrum. This effort supports Technology-Enabled Capability Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2013-2014, and also supports capability demonstrations in the area of decreasing Soldier physical burden. ***FY 2014 Accomplishments:*** Determined the prototype noninvasive hydration sensor technologies that meet requirements for clinical precision and reliability. This technology was used to determine Warrior hydration status and inform appropriate clinical intervention and reduce the incidence of heat injuries among Warriors. ***FY 2015 Plans:*** Conduct a feasibility study to determine saliva biomarker panel to distinguish levels of dehydration in exertional exercise to prevent heat injury. Validate organ damage biomarkers correlation to clinical measures in heat stroke patients. Determine efficacy of drug treatments for heat injury and heat stroke recovery. Provide strategies for localized heating to optimize hand and finger dexterity for specific military tasks. Exploit nanomaterials (materials smaller than a one tenth of a micrometer in at least one dimension) for developing advanced focused heating approaches to prevent nonfreezing cold injury. Evaluate the efficacy of new pharmaceuticals to prevent acute mountain sickness and improve work performance at high altitude. ***FY 2016 Plans:*** Will validate biomarkers of heat injured organ damage to clinical outcome measures. Will validate effectiveness of interventions including targeted drug treatments for recovery from heat injury. Will transition altitude sickness, acclimatization and task performance models to physiological status monitoring system(s) for end-user field validation studies. Will refine localized heating	1.080	2.356	1.759

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
strategies to improve hand dexterity and develop a militarily-relevant dexterity assessment method for cold weather operations and provide policy guidance for validated intervention strategies.			
Title: Injury Prevention and Reduction (Physical Performance Enhancement) ***Description:*** This effort supports and validates injury prediction tools for brain, spine, and chest injury from blast, blunt, and ballistic impact. This effort supports Technology-Enabled Capability Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2014-2016, and also supports capability demonstrations in the area of decreasing Soldier physical burden in FY2014-2016. ***FY 2014 Accomplishments:*** Upgraded the blast, blunt trauma, and inhalation performance decrement software to incorporate extreme environmental stressors; matured musculoskeletal models for predicting physical performance injury and health outcomes for military-relevant tasks, accounting for individual variations, equipment, and environmental factors. ***FY 2015 Plans:*** Provide medical standards for protection against hearing and vestibular injuries and ensure compatibility with military operations and maintenance of Warfighter situational awareness. Develop and validate improved sensory system injury countermeasures. Develop and validate computational models to predict the effects of the primary blast wave on the face and eyes. Develop field-forward, non-invasive tools that will aid medical staff decisions regarding treatment, prognosis, and return-to-duty following muscle and/or other tissue injury. ***FY 2016 Plans:*** Will work with combat developers to provide active and passive hearing protection standards. Will refine and validate model(s) for predicting effects of hearing loss on speech intelligibility with hearing protection (FY15 6.2 work). Will refine standards for improved sensory system countermeasures to be used by aircrew in degraded visual environments. Will validate computational models that predict the effects of the primary blast wave on the face and eyes and incorporate into a decision aid for transition to commanders.	5.397	3.760	4.101
Title: Psychological Health and Resilience ***Description:*** This effort supports and validates neurocognitive (relating to or involving the central nervous system and cognitive abilities) assessment and brain injury detection methods; and validates tools and preclinical methods to treat post-traumatic stress disorder in a military population. This effort also supports validation of interventions in Warfighters for post-traumatic stress disorder (PTSD), validation of biomarkers of PTSD symptomatology, validation of methods to follow effectiveness of PTSD treatments, validation of neuroprotective (protection of nerves and nervous system) interventions and validation of strategies to prevent neurocognitive deficits (reduced ability to learn and comprehend) and symptomatology associated with brain injury. This effort supports Technology Enabled Capability Demonstration 7.d, Brain In Combat, in FY2014-2016.	3.708	10.169	10.429

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Demonstrated the utility of magnetoencephalography (technique for mapping brain activity by recording magnetic fields produced by electrical currents occurring naturally in the brain), to differentiate between PTSD and mild TBI; the utility of circulating blood biomarkers for effective assessment of acute brain injury post-concussion symptoms; and demonstrated whether neurocognitive testing can accurately inform assessment of the brain injury following a post-concussion event. These efforts led to more effective assessments of Warriors and facilitated improved strategies for appropriate care and identified better treatment modalities for brain injury following a concussion event. ***FY 2015 Plans:*** Provide guidance on the use of sleep measures to aid in the diagnosis, prognosis, and monitoring of recovery from a concussive event. Determine the utility of neurocognitive assessment tools in conjunction with physiological (human physical and biochemical functions) data from other sources, such as blood biomarkers, for assessment of post-concussive symptoms. Validate algorithms that predict concussion injury and incorporate these into currently available blast-wave concussion sensor systems. Evaluate the efficacy of bright light therapy for PTSD treatment. Determine the gender-relevant signatures of PTSD and the changes in biomarker levels associated with PTSD onset during deployment. ***FY 2016 Plans:*** Will continue to validate previously developed strategies to reduce vulnerability to concussive injury during blast and impact exposures and promote recovery from concussion. Will initiate investigation into the correlation of detailed PTSD symptomatology/ behavioral data with genomic, proteomic, and metabolic biomarkers for stratification of PTSD into subtypes. Will collect specimens pre- and post-treatment for identification of blood biomarkers associated with treatment response and identification of predictive markers associated with successful exposure therapy treatment. Will continue collaborative support for research and data analysis with the Army University Affiliated Research centers, the University of California Santa Barbara Institute for Collaborative Biotechnologies and SBE.			
Accomplishments/Planned Programs Subtotals	11.814	17.983	19.025

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	78.513	102.950	89.736	-	89.736	94.280	100.731	100.699	102.706	-	-
313: *Adv Rotarywing Veh Tech*	-	61.496	72.700	73.076	-	73.076	80.948	87.882	88.707	90.476	-	-
436: *Rotarywing MEP Integ*	-	8.987	8.000	8.444	-	8.444	8.385	6.758	5.847	5.962	-	-
447: *ACFT Demo Engines*	-	8.030	8.250	8.216	-	8.216	4.947	6.091	6.145	6.268	-	-
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	-	14.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates manned and unmanned air vehicle technologies to enable Army aviation modernization. Within this PE, aviation technologies are advanced and integrated into realistic and robust demonstrations. Project 313 matures, demonstrates and integrates enabling component, subsystems and systems in the following areas: rotors, drive trains, structures and survivability. Project 436 matures, integrates and demonstrates air launched weapons systems and mission equipment packages to enable control of unmanned systems. Project 447 matures and demonstrates affordable and efficient engines. Focus areas include: engines & drive trains; rotors & vehicle management systems; platform design & structures; aircraft & occupant survivability; aircraft weapons & sensors; maintainability & sustainability; and unmanned & optionally manned systems. A major effort in this PE is the Joint Multi-Role (JMR) Technology Demonstrator.

Work in this PE contributes to the Army S&T Air Systems portfolio and is related to and fully coordinated with PE 0602211A (Aviation Technology), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603710A (Night Vision Advanced technology), and PE 0603270A (Electronic Warfare Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this PE is performed by the U.S. Army Aviation and Missile Research, Development, and Engineering Center(AMRDEC) with facilities located at Redstone Arsenal, AL; Joint Base Langley-Eustis, VA; and Moffett Field, CA.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*

B. Program Change Summary ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**
Previous President's Budget	81.037	88.990	90.394	-	90.394
Current President's Budget	78.513	102.950	89.736	-	89.736
Total Adjustments	-2.524	13.960	-0.658	-	-0.658
• Congressional General Reductions	-	-0.040			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	14.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.524	-			
• Adjustments to Budget Years	-	-	-0.658	-	-0.658

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Future Vertical Lift Research*	-	14.000
Congressional Add Subtotals for Project: BA7	-	14.000
Congressional Add Totals for all Projects	-	14.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
313: *Adv Rotarywing Veh Tech*	-	61.496	72.700	73.076	-	73.076	80.948	87.882	88.707	90.476	-	-

A. Mission Description and Budget Item Justification

This project matures, demonstrates and integrates components, subsystems and systems for vertical lift and unmanned air systems that provide improved aircraft and occupant survivability, reduced maintenance and sustainment costs, and greater performance through improved rotors, drives, vehicle management systems and platform design and structures. Systems demonstrated include rotors, drive trains, robust airframe structures and integrated threat protection systems. A major effort in this project is the Joint Multi-Role (JMR) Technology Demonstrator in support of the Future Vertical Lift (FVL) family of aircraft.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation Development Directorate of the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Joint Base Langley-Eustis, VA, and the System Simulation Development Directorate, AMRDEC, Redstone Arsenal, AL. Work in this project is coordinated with Program Manager Aircraft Survivability Equipment (PM-ASE).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Aircraft & Occupant Survivability Systems	11.082	9.118	6.371

Description: This effort increases rotorcraft survivability by reducing platform signatures, providing the means to more efficiently counter enemy detection and tracking systems, and also increases protection to the aircraft and aircrew against ballistic munitions, crash landings, and post-crash fire events. This effort enhances air crew situational awareness, allowing manned/ unmanned aircraft to avoid enemy air threats.

FY 2014 Accomplishments:
Generated real-time threat lethality prediction algorithms and 3-D route planning optimization algorithms which include consideration of aircraft flight dynamics limits, and demonstrated in the AMRDEC Aviation Integration System Facility; demonstrated modular integrated survivability architecture using aircraft survivability equipment components, and Future Airborne Common Environment conforming software; and began full scale fabrication of a combat tempered airframe sub-section designed to meet damage tolerance criteria.

FY 2015 Plans:
Integrate for flight demonstration purposes route planner software, common processing hardware, displays, and sensors onto a relevant aircraft platform; conduct system ground testing and a series of flight tests that will quantify the capability of the hardware/ software to process data from threat sensors and display appropriate adjustments to the route plan; complete development and demonstration of a common software/hardware interface to rapidly integrate survivability technologies into aviation platforms; and

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
demonstrate increased operational durability and total survivability through full-scale tests of combat tempered airframe, zero-vibration helicopter, durable main rotor, integrated crash protection system, and adaptive flight control laws. ***FY 2016 Plans:*** Complete full scale demonstration of Combat Tempered Platform Technology. Will initiate platform system trades of vehicle hardening and aircraft / occupant protection technologies with threat detection and route optimization for complex environments to optimize the total survivability of future vertical lift concepts; and will begin to mature integrated technology solution through analysis and incremental tests.			
Title: Rotors & Vehicle Management Systems ***Description:*** This effort demonstrates the performance benefits of advanced rotors through the evaluation of alternative designs aimed to satisfy future force capability needs for increased system durability, speed, range and payload. This effort also integrates advanced flight controls with real-time aircraft state information into vehicle management systems to enable safe, low-effort maneuvering and real-time adaptation to aircraft state changes (degradation, damage, mission, etc.) ***FY 2014 Accomplishments:*** Demonstrated scalable and portable vehicle management system techniques to more efficiently use available data to improve performance and reduce pilot workload using advanced flight controls across a wide range of Army rotorcraft sized vehicles and missions (cargo, assault, scout, attack and recon); and demonstrated an integrated reconfigurable rotor, at full scale in component tests and scaled wind tunnel tests, and demonstrated capability to adapt during operation to maximize performance, reduce vibrations, and reduce acoustic signatures. ***FY 2015 Plans:*** Mature advanced Vehicle Management System (VMS) technologies and demonstrate via flight test a system which more efficiently utilizes available vehicle data to improve system performance and reduce pilot workload across the range of Army rotorcraft with applicability to both the legacy fleet and the Future Vertical Lift (FVL) fleet. ***FY 2016 Plans:*** Will demonstrate integrated Rotors and Vehicle Management Technologies developed in PE 0602211A to reduce rotor loads, reduce hub and airframe drag and improve performance and will validate high-fidelity computational models of complete rotorcraft for the aerodynamics and dynamics in whirl stands and wind tunnels. Will conduct flight test demonstration of dual-lift control.	7.061	4.455	1.505
Title: Platform Design & Structures Systems ***Description:*** Design, fabricate, evaluate and demonstrate advanced vertical lift aircraft system configurations that address Future Vertical Lift (FVL) capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed, range, payload, and reduced operating costs. Conduct preliminary and detailed system design of multiple	32.001	48.768	57.810

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
candidate systems. Flight demonstrate operational capability of FVL technology demonstrators. Demonstrate an architecture standard and toolset that enables robust, effective, affordable and enduring mission system solutions for the FVL family of systems. ***FY 2014 Accomplishments:*** Conducted preliminary design of multiple technology demonstrator aircraft, considering higher speed rotor/prop-rotor configurations, lightweight airframe structures, and low drag fuselages to support medium lift utility and attack/recon missions; conducted design support testing to establish performance expectations for vehicle subsystem concepts and enablers; refined a model development specification; matured technology development plans for the selected vehicle concepts; and conducted configuration and architecture concept evaluations with analyses and demonstrations performed to mature tools, processes and technologies required for mission systems development. ***FY 2015 Plans:*** Complete detailed design of Joint Multi-Role technology demonstrator concepts; mature final design drawings; provide cost/weight analyses; conduct critical system design review; begin component and subsystem fabrication and test; update analytical tools; conduct the Joint Common Architecture demonstration; refine the objective Mission Equipment Package (MEP) definition; define an Architecture Centric Virtual Integration process for avionics architecture development; and complete version 1 of the Joint Common Architecture standard. ***FY 2016 Plans:*** In FY16, the JMR TD program will continue execution of the Air Vehicle demo efforts, Joint Common Architecture (JCA) standard validation and implementation demonstrations, and the Mission System Architecture Demo (MSAD) efforts. Specific tasks for the Air Vehicle effort includes: for both flight vehicles - complete fabrication of major air vehicle components; initiate flight vehicle assembly; complete scaled wind tunnel tests and continue data reduction activities; develop and submit subsystem test plans, air vehicle ground test plan, and critical analytical results in support of the on-going airworthiness evaluation; complete fabrication of full scale subsystem test fixtures; initiate tests to reduce risks and develop airworthiness data; and develop and exercise flight control software in simulations and system integration labs (SILs). Specific tasks for the MSAD effort include: issuance of Requests for Information to refine the scope of the implementation demonstrations; continued development of the JCA standard including the functional decomposition of subsystem modules using both government and industry experts and government laboratory facilities; support the development of the model-based software tool with the System Architecture Virtual Integration effort; and conduct mission systems architecture implementation process demonstrations designed to mature tools, processes and technologies required for affordable and effective mission systems.			
Title: Rotorcraft Drive Systems	6.003	6.954	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort demonstrates advanced rotorcraft drive technologies with the potential to: increase the horsepower-to-weight ratio; reduce drive system noise; reduce production, operating and support costs; and provide automatic component impending failure detection. The drive system demonstrators for this effort will be applicable to current platforms and future Vertical Lift platforms. ***FY 2014 Accomplishments:*** Matured designs of full-scale demonstrator transmissions and tail rotor drive shaft system; initiated fabrication of full-scale demonstrator hardware for aircraft configurations such as Blackhawk; assessed and validated reliability and maintainability algorithms; and assessed progress towards meeting power/weight goals as well as production and operational cost goals. ***FY 2015 Plans:*** Complete final assembly of the full-scale drive system demonstrator hardware for Blackhawk configurations; conduct full-scale testing to include endurance testing for reliability and over torque testing to validate material design parameters; and evaluate loss of lubrication capabilities through testing.			
Title: Maintainability & Sustainability Systems ***Description:*** Mature and demonstrate technologies that improve the operational availability of rotorcraft while reducing operating and support (maintenance) costs. Efforts include component sensing, diagnostics, prognostics, and control systems. Far-term objective is to enable transition to an ultra-reliable, low maintenance design approach that significantly reduces unscheduled maintenance, inspections and operating and sustainment costs. ***FY 2014 Accomplishments:*** Matured advanced prognostic algorithms for more chaotic, non-linear dynamic failure modes for engines, structures, rotor systems and drives; matured the interfaces for health monitoring systems to communicate with Joint Common Architecture standards; and evaluated the integration of system health monitoring with electronic controls to enable adaptive control systems. ***FY 2015 Plans:*** Mature engine adaptive controls to optimize performance, component life and maintenance schedule based on engine health; mature planetary gear failure detection technology, multifunctional aircraft sensor technology to reduce number of sensors and system weight, and a drive system intermediate rating methodology; demonstrate technologies for assessment of the structural integrity of a primarily composite airframe; verify the integrity of composite repairs, and predict the remaining useful life; and demonstrate in-flight real-time, automated methods to sense rotor system track and balance and make adjustments. ***FY 2016 Plans:***	1.962	3.405	3.378

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will mature wireless sensors for on-component processing of part health and usage history; will demonstrate methodologies to allow for probability of failure predictions based on vehicle current state and anticipated mission; will mature technologies to enable lighter weight designs through loads monitoring of critical components; will mature and demonstrate technologies for component self assessment, usage tracking and embedded history; and will mature embedded multifunctional sensors with built-in processing and communications. Will conduct developmental testing of system health and fault recognition algorithms, sensors and structural global health models.			
Title: Crew Decision Aid System ***Description:*** Demonstrate intelligent algorithms that aid decisions and actions in order to increase situation awareness, maximize use of on-board and off-board sensors, efficiently manage a team of manned and unmanned vehicles and their mission systems, and develop and execute effective and appropriate offensive and defensive responses. This work continues in FY15 and FY16 in PE 0603003A Project 436 under the Unmanned / Optionally Manned Systems effort. ***FY 2014 Accomplishments:*** Demonstrated an intelligent search and screen function to sort actionable priority data from onboard and off-board sources and evaluate Joint Common Architecture-like protocols for algorithm integration.	3.387	-	-
Title: Survivability for DVE Operations ***Description:*** Develop and mature advanced sensor and cockpit display technologies to provide ability to maintain terrain and obstacle situational awareness during all degraded visual environments both aircraft induced(brown-out & white-out) and environmentally induced (fog, rain, snow etc.). Flight testing on fleet aircraft is an integral component of the demonstration. Work in this area is being done in coordination with efforts at U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC), PE 603710A, Night Vision Advanced Technology. The program presents an opportunity to North Atlantic Treaty Organization (NATO) nations, global industry, and academia to participate with their own assets in order to foster information exchange and collaboration. ***FY 2016 Plans:*** Will conduct the first major milestone event of the DVE Mitigation Demonstration Program, the NATO DVE Flight Trials at Yuma Proving Ground, AZ. The demonstration will be executed with a UH-60 aircraft that will host program developed modernized control laws (MCLAWS version 3), multi-modality sensor suites (two) and advanced cueing elements. All modes of flight will be tested (landing, take-off, enroute) and numerous obstacle fields will be presented to the flight crew in order to assess overall DVE System performance, system capability and pilot workload.	-	-	4.012
Accomplishments/Planned Programs Subtotals	61.496	72.700	73.076

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 436 / *Rotarywing MEP Integ*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
436: *Rotarywing MEP Integ*	-	8.987	8.000	8.444	-	8.444	8.385	6.758	5.847	5.962	-	-

A. Mission Description and Budget Item Justification

This project matures and validates man-machine integration and mission equipment software and hardware technologies for unmanned and optionally manned aircraft systems. Efforts focus on artificial intelligence, intelligent agents, cognitive decision aiding, sensors, avionics, communications, and pilot vehicle interfaces. This project improves the overall mission execution by demonstrating manned and unmanned system teaming, enhanced aircraft pilotage capability, improved crew workload distribution, and new capabilities for both manned and unmanned aircraft. This project supports Army transformation by providing mature technology to greatly expand the capabilities of unmanned aircraft, in current operating roles and future unmanned wingman roles. This project also develops, demonstrates and integrates manned and unmanned sensor and weaponization technologies such as advanced missiles, guns, fire controls, advanced target acquisition and pilotage sensors into Army aviation platforms. Efforts are directed toward reducing the integrated weight of weapons, increasing engagement ranges, providing selectable effects on a variety of threats, and enabling cost-effective integration across multiple aviation platforms.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation Development Directorate of the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC), Joint Base Langley-Eustis, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Unmanned and Optionally Manned Systems	7.045	8.000	8.444
Description: Mature and apply tactical behavior algorithms and safe-flight technologies to enable unmanned and optionally manned aircraft to maintain safe, responsive, flexible and tactical formation flight with manned helicopters for unmanned wingman applications in re-supply, reconnaissance, surveillance and attack missions. Develop, mature, apply, and integrate advanced decision aiding, autonomy, and human-machine interface technologies to enable the helicopter flight crew to make full use of the capabilities of an unmanned aerial system (UAS) without requiring continuous attention. Efforts include development of intelligent algorithms that aid decisions and actions in order to increase situation awareness, maximize use of on-board and off-board sensors, efficiently manage a team of manned and unmanned vehicles and their mission systems, and develop and execute effective and appropriate offensive and defensive responses.			
FY 2014 Accomplishments: Matured and integrated autonomous retrograde capability on rotary-wing cargo UAS; conducted flight testing and system-level demonstration of all technologies integrated on the cargo unmanned aerial demonstrator system; determined highest-			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 436 / *Rotarywing MEP Integ*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
value unmanned wingman functions for decision aiding and autonomy; and selected and began algorithm implementation and integration approach. ***FY 2015 Plans:*** Complete implementation of aiding and autonomy algorithms into simulation; demonstrate task and mission effectiveness of interface devices and concepts, and aiding and autonomy algorithms; optimize approach for full integration of selected devices, concepts, and algorithms; and demonstrate a hierarchical structure of nested crew aiding and autonomy functions and evaluate the structure and functionality set for application across multiple Army aircraft, both current and future, and for suitability as the aiding/autonomy domain of the Joint Common Architecture (JCA). ***FY 2016 Plans:*** Will design, develop and demonstrate advanced autonomous behaviors in a virtual battle space to be integrated into a simulation facility to evaluate Manned/Unmanned Teaming (MUM-T). Will integrate close proximity flight in a simulated environment and mature technology in preparation for a simulation demonstration. Will mature and demonstrate data fusion technologies of both on and off board sensors in a simulation environment. Will demonstrate advanced decision aiding technologies to aid an airborne mission commander to control both own ship and a team of unmanned system. Will implement Future Airborne Capability Environment (FACE) conformance requirements to allow for ease of portability.			
Title: Aircraft Weapon & Sensor Systems ***Description:*** Mature and integrate sensors, weapons, and networked technologies into manned and unmanned air systems for enhanced reconnaissance, attack, utility, and cargo missions. ***FY 2014 Accomplishments:*** Matured advanced fire control systems and demonstrated an integrated weapon system through ground firings, including: sensors, proximity/point detonation airburst ammunition and sensor targeting algorithms, for use against ground and air targets. This effort completed at the end of FY14.	1.942	-	-
Accomplishments/Planned Programs Subtotals	8.987	8.000	8.444

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 436 / *Rotarywing MEP Integ*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 447 / *ACFT Demo Engines*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
447: *ACFT Demo Engines*	-	8.030	8.250	8.216	-	8.216	4.947	6.091	6.145	6.268	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates power system technologies through design, fabrication, and evaluation of advanced engine components in order to improve the performance of turbine engines for vertical lift aircraft. This project supports Army modernization by demonstrating mature technologies for lighter turbine engines that provide increased power, increased fuel efficiency, improved sustainability and reduced maintenance. These advanced engine designs will significantly improve the overall aircraft performance characteristics and reduce the logistical footprint of vertical lift aircraft.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation Development Directorate of the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC), at Joint Base Langley-Eustis, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Future Affordable Turbine Engine (FATE)	8.030	8.250	8.216

Description: Demonstrate an advanced, innovative 7000 horsepower class gas turbine engine that provides significant improvement in operational capability for current and future rotorcraft. FATE uses sequential design and fabrication iterations to mature engine design and demonstrate significant reduction in specific fuel consumption (SFC), significant improvement in horsepower-to-weight ratio, and significant reduction in production and maintenance cost compared to year 2000 state-of-the-art engine technology. The sequential design and fabrication process will begin with the compressor subsystem, then the combustor subsystem, then the turbine subsystem, and finally the mechanical systems. Work in this project is coordinated with efforts in PE 0602211A, project 47A.

FY 2014 Accomplishments:
Completed majority of remaining component tests in support of first engine build; used results from these initial component level tests to complete/refine hardware fabrication efforts as appropriate for the first engine build and redesigned component tests; initiated FATE engine hardware fabrication and assembly/instrumentation for first engine test; and identified design improvements for goal demonstration testing.

FY 2015 Plans:
Will complete assembly/instrumentation for first engine test; this initial, full engine, system level test will validate the mechanical integrity of the advanced FATE architecture and provide data for an initial integrated performance assessment; begin redesigned

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 447 / *ACFT Demo Engines*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
component tests in support of final goal engine build; and use results from first engine test to establish optimized component flow areas and variable geometry schedules. ***FY 2016 Plans:*** Will complete fabrication of redesigned engine components and complete assembly, instrumentation, and testing of the final performance demonstration engine; this full engine system level test will validate the horsepower to weight ratio and specific fuel consumption goals of the advanced FATE architecture.			
Accomplishments/Planned Programs Subtotals	8.030	8.250	8.216

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** BA7 / *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	-	14.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Aviation advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Future Vertical Lift Research ***FY 2015 Plans:*** This Congressional Add will support research for Future Vertical Lift technologies and concepts in support of the Joint Multi-Role Tech Demo Program.	-	14.000
Congressional Adds Subtotals	-	14.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	72.934	72.908	57.663	-	57.663	63.457	74.739	72.337	65.412	-	-
232: *Advanced Lethality & Survivability Demo*	-	45.488	39.808	40.797	-	40.797	40.794	45.658	41.086	42.144	-	-
43A: *ADV WEAPONRY TECH DEMO*	-	10.000	15.000	-	-	-	-	-	-	-	-	-
L96: *High Energy Laser Technology Demo*	-	14.277	14.375	12.526	-	12.526	17.728	24.075	26.226	18.143	-	-
L97: *Smoke And Obscurants Advanced Technology*	-	3.169	3.725	4.340	-	4.340	4.935	5.006	5.025	5.125	-	-

Note

FY 16 decrease attributed to early completion of 40mm munition efforts and shirt ofefforts from 6.3 to 6.2 weapons and munitions technology

A. Mission Description and Budget Item Justification

This program element (PE) matures weapons and munitions components/subsystems and demonstrates lethal and non-lethal weapons and munitions with potential to increase force application and force protection capabilities across the spectrum of operations. Project 232 focuses on affordable delivery of scalable (lethal to non-lethal) effects for weapons and munitions including: artillery, mortars, medium caliber, tank fired, Soldier weapons and shoulder fired weapons. Project L96 matures and integrates critical high energy laser subsystems into a mobile demonstrator to explore and validate system performance in relevant environments. Project L97 demonstrates performance of advanced obscurants and delivery of mechanisms and conducts forensic analysis of explosives and hazardous materials to enable detection.

Work in this PE is related to, and fully coordinated with, PE 0602120A (Sensors and Electronic Survivability), PE 0602307A (Advanced Weapons Technology), PE 0602618A (Ballistics Technology), PE 0602622A (Chemical, Smoke, and Equipment Defeating Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603313A (Missile and Rocket Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ; Edgewood Chemical Biological Center (ECBC), Edgewood, MD; and the U.S. Army Space and Missile Defense Center (SMDC), Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	73.885	57.931	65.886	-	65.886
Current President's Budget	72.934	72.908	57.663	-	57.663
Total Adjustments	-0.951	14.977	-8.223	-	-8.223
• Congressional General Reductions	-	-0.023			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.700	-			
• SBIR/STTR Transfer	-1.651	-			
• Adjustments to Budget Years	-	-	-8.223	-	-8.223

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: 43A: *ADV WEAPONRY TECH DEMO*		
Congressional Add: *Program Increase*	10.000	15.000
Congressional Add Subtotals for Project: 43A	10.000	15.000
Congressional Add Totals for all Projects	10.000	15.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
232: *Advanced Lethality & Survivability Demo*	-	45.488	39.808	40.797	-	40.797	40.794	45.658	41.086	42.144	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies for affordable precision lethal and non-lethal weapons and munitions. Technologies include advanced energetic materials, insensitive munitions, novel fuze designs, penetrators, scalable effects and millimeter wave sources for high power microwave (HPM) systems.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Efforts in this project support the Lethality and Ground Maneuver portfolios.

Work in this project is performed by the Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Ground Based Networked Munitions Technologies ***Description:*** This effort matures and demonstrates technology for improved capability remotely delivered area denial munition systems to include: networked munition architecture, low hazard effects, delivery mechanisms, and non-lethal response to tampering. ***FY 2014 Accomplishments:*** Matured autonomous Non-Lethal Alert technology for personnel detection/discrimination that was previously developed with improved communications and decreased size and weight to better support the base protection mission; optimized non-lethal effects package for Autonomous Non-Lethal Alert to provide enhanced force protection. ***FY 2015 Plans:*** Integrate and demonstrate technologies for multi-purpose networked munitions. ***FY 2016 Plans:*** Will develop area denial munition technologies including networked munition level architecture and advanced methods for precision delivery/location of remote effects.	1.388	0.992	1.004
Title: Extended Area Protection and Survivability (EAPS) ***Description:*** This effort demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery, and mortar rounds (RAM) and unmanned aerial systems (UAS).	3.519	3.113	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Demonstrated integrated system of radar, command guided interceptors and auto cannon by a defeat of a statically placed threat munition; demonstrated performance requirements. ***FY 2015 Plans:*** Optimize and demonstrate an integrated Counter Unmanned Aerial Systems (C-UAS) capability, comprised of algorithms, fire control and command guided interceptor munitions.			
Title: Advanced Lethality Demonstration ***Description:*** This effort matures and demonstrates novel penetrator designs (without using depleted uranium (DU)), as well as alternative lethal mechanisms to maintain or exceed tank main gun performance against multiple target types into the future. ***FY 2014 Accomplishments:*** Fabricated hardware components, assemble cartridges, and conducted functional and armor tests leading to technology demonstration; conducted technology demonstration (120 mm ballistic testing through all temperatures); analyzed test data; and provided test results to PEO Ammunition.	4.009	-	-
Title: Cluster Munitions Replacement Acceleration ***Description:*** This effort matures and demonstrates ultra high reliability fuzing, advanced kill mechanisms, and alternative dispensing technologies for 155mm artillery to provide increased battlefield lethality with reduced unexploded ordnance (UXO) compliant with the DoD cluster munitions policy. ***FY 2014 Accomplishments:*** Performed TRL6 demonstration on complete system which consisted of two major tests - a static arena test on the warhead and a ballistic demonstration test; the static arena test provided data on the effectiveness of the round which was then used to validate that the system meet the lethality requirements; the ballistic demonstration test showed the performance of the system in a representative environment and showed the improvement in reliability over traditional Dual-Purpose Improved Conventional Munitions. ***FY 2015 Plans:*** Mature the design and demonstrate performance against the expanded target set that now includes tracked and light wheeled tactical vehicles; exploit emerging breakthroughs in warhead technologies that enable defeat of the expanded target sets at a reduced cost (e.g. number of rounds fired to service a target). ***FY 2016 Plans:***	3.875	3.000	3.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will continue maturation of a novel cluster munition policy compliant warhead for 155mm artillery; conduct arena testing of multi-explosive formed penetration optimized for effects against armored targets integrated into a 155mm artillery projectile compliant with DoD cluster munition policy; conduct static and ballistic testing on an integrated projectile, culminating in a TRL6 demonstration.			
Title: Medium Caliber Weapon Systems ***Description:*** This effort matures and demonstrates advanced medium caliber ammunition, weapon, fire control, and ammunition handling systems optimized for remote operation. This effort demonstrates cannon-super high elevation engagement, high performance stabilization, remote ammunition loading, weapon safety and reliability, improved lethality, accuracy, and the ability to fire a suite of ammunition from non-lethal to lethal, to provide escalation of force capability in one system. ***FY 2014 Accomplishments:*** Demonstrated and matured the turret control system in preparation for the integration of the weapon, ammunition handling system and fire control sensor enhancements within a Bradley fighting vehicle; demonstrated system level optimized performance capabilities of a 30mm weapon platform; optimized and down selected the appropriate air bursting fuze technologies for the integration within the 50mm air bursting cartridge; continued to mature and improve the fire control-target based user interface software as well as continued to develop and optimize the design of the 50mm Bushmaster III gun. ***FY 2015 Plans:*** Focus is to optimize technologies from Weapon, Fire Control and Turret functional areas together in preparation of demonstrating a system level platform integration with an advanced medium caliber weapon system within a Bradley Fighting Vehicle (BFV) variant. In support of this effort, finalize and optimize a prototype turret and drive system to support the XM813 30mm weapon system; optimize and mature the advanced sensors (down range wind sensor, dynamic metrology sensor and improved laser range finder) and the scenario based fire control system supporting the XM813 30mm weapon system, 30mm armor piercing (AP) munition and the Mk310 30mm programmable air bursting munitions (PABM); perform the integration of these technologies within the BFV and demonstrate improved accuracy and lethality performance at a system level. Additionally, finalize 50mm fuze improvements and perform a fuze shoot off and demonstration to down select and optimize the burst point accuracy of the 50mm PABM munition. ***FY 2016 Plans:*** Will continue to mature and optimize weapon, ammunition, fire control, and turret technologies for 50mm cannon; refine the ammunition fuzing approach to improve accuracy and lethality; analyze data collected from integration, test and demonstration to apply to system level improvements; upgrade fire control to meet system level requirements and design turret for integration into a prototype platform.	10.612	10.000	9.967
Title: Advanced Remote/Robotic Armament System (ARAS)	1.006	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort provides advanced remote armaments with scalable effects from non-lethal to lethal engagements. In FY 2014 this effort supports Technology Enabled Capability Demonstration 1.a, Force Protection – Basing. Note: Prior to FY14, this effort was combined with Medium Caliber Weapon Systems above. ***FY 2014 Accomplishments:*** Matured and demonstrated ARAS software/electronics controls and validated/improved mechanical subsystems to ensure they met all design specifications to mitigate risks associated with obtaining an Army Test and Evaluation Command (ATEC) limited safety release which was essential for the capstone demonstration; also, in preparation of ATEC testing, performed generation of a Safety Assessment Report (SAR) and other pre-ATEC activities.			
Title: Advanced Power and Energy Management for Munitions ***Description:*** This effort demonstrates the technology options available to provide the next generation of gun fired smart munitions, with advanced fuzing and power components for improved performance. ***FY 2014 Accomplishments:*** For multi-point initiation, demonstrated a distributed four point initiation system in a future warhead application that is capable of achieving simultaneity between points and selectable control; for proximity sensor, demonstrated improved range extraction and enhanced countermeasure protections through ballistic testing; for impact switch, matured and demonstrated a micro electrical mechanical system (MEMS) based impact switch that has multi-level sensing capability against varying targets; for thin film thermal batteries, matured and demonstrated a thin film heat source integrated into existing thin film battery; for super capacitor, demonstrated robustness of design through environmental and ballistic testing. ***FY 2015 Plans:*** Optimize next generation proximity sensor (NGPS) sub-system to meet improved performance requirements; demonstrate and validate NGPS design in an artillery platform to achieve a TRL 6.	3.118	0.600	-
Title: Scale-up of Energetic Materials ***Description:*** This effort matures and demonstrates the performance and insensitivity of energetic materials ranging from 25mm medium caliber (direct fire) through 155mm large cal (indirect fire) weapons. ***FY 2014 Accomplishments:*** Scaled-up and formulated newly synthesized ingredients for lethality and insensitive munition (IM) benefits; optimized propellant formulations for various applications of interest for extended range; prototyped novel propulsion system concepts; performed live	1.747	2.927	2.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
fire and performance testing for nano pressed explosives; conducted IM insult testing on XM1128 projectile; performed IM testing on compatible IM detonation trains. ***FY 2015 Plans:*** Perform appropriate test series on mature propellant and explosive formulations to facilitate certification at the Energetic Material Qualification Board (EMQB) level and enable transition of new materials to munitions qualification programs. ***FY 2016 Plans:*** Will begin the transition of insensitive energetic materials of interest to the Army; and down-select and evaluate energetic materials to be scaled up to production levels to verify they meet the Army needs and can be produced in large quantity.			
Title: Force Protection and Tactical Overmatch Armament Systems ***Description:*** This effort demonstrates improved ability to deliver decisive effects by providing hemispherical protection to semi-fixed and mobile sites against personnel, vehicle, and materiel targets to enable tactical overmatch to the Tactical Small Unit. ***FY 2014 Accomplishments:*** Integrated mature component technologies that have demonstrated effects against threat UAS; demonstrated direct and indirect fired munitions providing hemispherical protection system of systems approach to accurately sense, warn, and respond to threats by delivering decisive effects timely and accurately.	0.966	-	-
Title: Active Protection Armament Technologies ***Description:*** This effort supports the Army's Active Protection System (APS) program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. This effort is done in coordination with efforts in PE 0602601A, PE 0602618A, PE 0603004A, PE 0603005A, PE 0603270A, and PE 0603313A. ***FY 2015 Plans:*** Mature and integrate hard kill related technologies such as fire control, target detection device and hard kill countermeasures into the Army's APS common architecture. ***FY 2016 Plans:*** Will develop hard-kill countermeasure system requirements to ensure proper interface with the Modular APS; continue to mature and merge key hard-kill technologies including fire control, launcher, munition, and warhead for seamless integration with the Army's MAPS controller.	-	3.110	5.967
Title: Remote Armament System Integration	1.836	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort integrates and demonstrates weapon systems on a semi-autonomous and autonomous unmanned platform while maintaining positive control of weapon system. ***FY 2014 Accomplishments:*** Integrated mature component technologies of a medium caliber weapon mounted on a 1+ ton unmanned vehicle and controlled via secure distributed communications operating up to 5 km from a command and control entity.			
Title: Networked Effects Decision Suite ***Description:*** This effort provides sensor-to-shooter capabilities to deliver desired effects on target, specifically addressing accurate target location and target hand-off, improving accuracy and lethality at the small combat level. ***FY 2014 Accomplishments:*** Implemented fire support execution matrix; improved target prioritization; improved 3D de-conflictions of fires application; demonstrated target data/track management and effects planning; demonstrated weapon placement coordination; demonstrated effects planning component.	2.511	-	-
Title: Precision Non-Line-of-Sight (NLOS) Munition for Light Forces ***Description:*** This effort will provide a precision technology capability for an 81mm mortar cartridge for light forces for base defense. ***FY 2014 Accomplishments:*** Improved and optimized down selected 81mm mortar GPS precision design candidate; matured design and integrated into 81mm mortar round system taking into account warhead and propulsion system; validated the 81mm precision mortar design integration. ***FY 2015 Plans:*** Mature components, build hardware and verify 81mm precision design via a live system test: verify GPS and fuze setter technology and candidate designs with tests. ***FY 2016 Plans:*** Will fabricate and demonstrate 81mm precision mortar design through a series of inert system flight tests culminating in a capability demonstration at the end of FY16.	1.080	1.507	1.004
Title: Solid State Active Denial Technology (SS-ADT) ***Description:*** This effort demonstrates non-lethal counter-personnel directed energy (DE) technology for crowd control up to 100 meters.	1.510	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Improved the azimuth and elevation steering capability and develop a Fire Control Suite for Target Tracking; performed demonstration of human target effects.			
Title: Integrated Base Defense Hostile Protection System ***Description:*** This effort demonstrates technology to locate unmanned aircraft systems (UAS) in bearing via acoustic sensor arrays as well as the point of origin of mortars and rocket propelled grenades (RPGs) fires. ***FY 2014 Accomplishments:*** Demonstrated and optimized acoustic detection and tracking in bearing of UAS; matured multi node system level fusion to improve performance; repackaged components to reduce logistic burden and optimized power usage for extended mission life and maintenance cycles.	1.510	-	-
Title: Extended Range/Guided 40mm Munition ***Description:*** This effort develops a 40mm guided, low cost, extended range projectile for use in the M320 launcher. This projectile will be capable of defeating beyond line-of-sight targets. ***FY 2014 Accomplishments:*** Matured and demonstrated optimized components for a guidance, navigation and control system for extended range 40mm low velocity grenades; performed improvements and demonstrated extended range technologies to include airframe and Guidance, Navigation and Control; optimized design and demonstrated a mature warhead integrated into the projectile. ***FY 2015 Plans:*** Mature, integrate and demonstrate component technologies in an extended range guided 40mm projectile to 600 meters (threshold)/ 1000 meters (objective); demonstrate improved probability of hit at an increased range; provide a low cost integrated guidance navigation and control system with optimized airframe, canards, tail fin, and propulsion system; optimize fuze and warhead design for enhanced lethality; demonstrate the ability of the projectile to guide to hit targets at ranges between 600 to 1000 meters.	2.313	3.016	-
Title: Automated Direct/Indirect Fire Mortar (ADIM) ***Description:*** This effort develops a line-of-sight/non-line-of-sight remotely operated mortar system for use in base protection and mobile fire support. ***FY 2014 Accomplishments:***	3.039	2.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Improved and optimized the baseline, ground-up designed system; demonstrated its capabilities in a controlled environment in order to validate expected increases in performance. ***FY 2015 Plans:*** Adapt the system to be compatible with the 81mm precision mortar cartridge; prepare for an integrated demonstration.			
Title: Explosive Hazard Predetonation System ***Description:*** This effort demonstrates a system to neutralize improvised explosive devices (IEDs) by leveraging emerging detection, geo-location, and classification technologies mounted on a ground vehicle. It provides an integrated system approach to enhanced neutralization / pre-detonation that utilizes data from sensor networks. It integrates technologies transitioned from the IED Neutralization Technology effort in PE 0602642A/Proj H19 in FY2014/15. ***FY 2014 Accomplishments:*** Demonstrated an improved IED neutralization capability that interoperated with standard communications networks and databases to provide historical and real time IED emplacement data; matured the neutralization system to utilize beam steering algorithms for convoy operations as well as integrated emerging waveforms to defeat a wider class of IEDs; demonstrated reduced Size, Weight and Power (SWaP) requirements for legacy neutralization systems utilizing emplacement data and RF generation enhancements.	0.966	-	-
Title: Enhanced Sniper Technologies ***Description:*** This effort investigates advanced projectile designs such as long rod penetrator technologies that will provide snipers with the capability for increased range effectiveness (up to 1500m, possibly greater), hit probability, and armor penetration, for use in man-portable sniper weapons. ***FY 2014 Accomplishments:*** Optimized the performance of the long rod sabot design, notably the slip obturator and discard; demonstrated accuracy improvements associated with design modifications to existing projectiles; investigated the technological advances and viability of guided munitions in small caliber applications. ***FY 2015 Plans:*** Validate the technology matured through this program by demonstrating improved sniper cartridges fired in common calibers weapons that increase a sniper's probability of hit in non-ideal/combat relevant conditions at extended ranges. ***FY 2016 Plans:***	0.483	1.507	3.011

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will optimize demonstrated advanced sniper ammunition concepts through modeling and simulation and design veirfication; and demonstrate selected fully integrated ammunition-weapon designs in relevant operational environments.			
Title: Long Range Gun Technology ***Description:*** This effort matures and demonstrates extended range artillery weapon system and projectile technologies that increase the range by 25% without an increase in platform weight. ***FY 2015 Plans:*** Mature component technologies associated with longer range artillery capabilities to include weapon system components like cannon tube, breech and mount. ***FY 2016 Plans:*** Will continue to mature designs of component technologies associated with longer range artillery capabilities - including cannon tube, breech and mount; conduct initial component verification; and conduct prototype testing of weapon sub-systems.	-	2.036	7.015
Title: Soldier Fired Advanced Effect Air Burst Munition ***Description:*** This effort demonstrates technologies for improved lethality of current air bursting munitions which address emerging requirements from the warfighter. ***FY 2015 Plans:*** Mature technologies for neutralization of targets in defilade; mature and demonstrate advanced explosives/fragmentation warhead designs that increase lethal zone for air burst munitions.	-	1.800	-
Title: Affordable Precision Technologies ***Description:*** This effort integrates complementing navigation sensors, actuators and subsystems in order to demonstrate precision delivery capability on an indirect fire munition system in a global positioning system (GPS) denied environment. ***FY 2015 Plans:*** Integrate and optimize critical guidance subsystems; demonstrate airframe and actuator performance through flight testing in order to verify the maneuverability of the projectile. ***FY 2016 Plans:*** Will demonstrate image navigation guidance technology with algorithms and associated optics integrated in a projectile through a series of captive flight tests; and demonstrate guidance and control system in a dynamic test to verify the ability to maneuver in flight.	-	2.000	2.500
Title: Guided Enhanced Fragmentation Mortar Munition	-	2.200	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort will develop and demonstrate a 120mm precision guided mortar with improved capabilities with respect to the currently fielded 120mm precision guided mortar. ***FY 2015 Plans:*** Build and test fully integrated 120mm precision guided mortar systems to verify designs and demonstrate functionality at nominal and environmental extreme conditions.			
Title: Counter-Unmanned Aviation System (C-UAS) Technology ***Description:*** This effort matures and demonstrates modular Counter UAS technologies designed to encompass the entire kill chain including detection, tracking, classification, and defeat of UAS for point defense and mobile applications. ***FY 2016 Plans:*** Will mature and integrate technologies for UAS tracking and defeat; evaluate and select weapon systems and munitions for defeat of UAS and integrate into current system of systems for mobile and area defense; integrate precision fire control mechanisms and demonstrate the system of systems defeat of UASs; evaluate results of demonstrated UAS defeat mechanisms.	-	-	2.000
Title: Extended Range Munition Integration ***Description:*** This effort matures and demonstrates extended range artillery technologies including rocket and base bleed propulsion, hybrid lifting surfaces and guidance technologies which increase range and accuracy. ***FY 2016 Plans:*** Will mature and integrate projectile technologies for next generation extended range rocket-assisted projectiles including integrated munition designs involving novel rocket motor formulations, advanced flight controls, and precision guidance components that can survive launch conditons in an extended range cannon environment.	-	-	3.329
Accomplishments/Planned Programs Subtotals	45.488	39.808	40.797

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 43A / *ADV WEAPONRY TECH DEMO*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
43A: *ADV WEAPONRY TECH DEMO*	-	10.000	15.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Advanced Weaponry Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	10.000	15.000
FY 2014 Accomplishments: Matured and demonstrated lethal and non-lethal weapons and munitions with potential to increase force application and force protection capabilities across the spectrum of operations.		
FY 2015 Plans: Advanced weaponry technology demonstrations		
Congressional Adds Subtotals	10.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L96 / *High Energy Laser Technology Demo*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
L96: *High Energy Laser Technology Demo*	-	14.277	14.375	12.526	-	12.526	17.728	24.075	26.226	18.143	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced technologies for future High Energy Laser (HEL) weapons technology. The major effort under this project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations that are traceable to the form, fit, and function requirements for a HEL weapon. At entry level weapon power of around 10 kW, SSL technology has the potential to engage and defeat small caliber mortars, unmanned aerial vehicles (UAVs), surface mines, sensors, and optics. At full weapon system power levels of around 100 kW, SSL technology has the potential to engage and defeat rockets, artillery and mortars (RAM), UAVs, cruise missiles, and anti-tank guided missiles (ATGMs), as well as surface mines, sensors, and optics at tactically relevant ranges. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems and without the need to strategically, operationally, or tactically stockpile ordnance. This effort utilizes a modular building block approach with open systems architecture to ensure growth, interoperability, and opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power and thermal management subsystems, as well as Battle Management Command, Control, and Computers (BMC3).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work is performed by the US Army Space and Missile Defense Command/Army Forces Strategic Command, Technical Center, Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Laser System Ruggedization	11.944	5.679	5.059
Description: This effort ruggedizes laser systems for integration on tactical platforms. Ruggedization includes modifications of the laser system to withstand vibration, temperature, and contamination environments expected on the High Energy Laser Mobile Demonstrator (HEL MD) platform, and other selected tactical platforms, while ensuring platform volume, weight, and interface specifications are met. The laser system consists of laser devices, such as the laboratory laser devices developed under PE 0602307A, Project 042, and the prime power (PE 0603005A, Project 441), command and control and thermal management subsystems required for the laser device operation.			
FY 2014 Accomplishments: Completed ruggedization efforts for available programmable pulsed power technology to provide prime power for the 50 kW laser device; began ruggedization of available thermal management technology that can cool the 50 kW laser device; provided additional ruggedization of the 50 kW laser device to enable integration into the HEL MD platform; corrected beam control system			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L96 / *High Energy Laser Technology Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
deficiencies discovered during the 10 kW demonstration, identified additional enhancements required for 50 kW demonstrations during propagation events. ***FY 2015 Plans:*** Continue additional ruggedization of a 50kW class laser device for integration on the HEL MD platform; continue ruggedization of thermal management technology that can cool the 50 kW laser device; and initiate power generation function ruggedization for recharging the power storage modules. ***FY 2016 Plans:*** Will continue ruggedization of thermal management subsystem and power management subsystem; ruggedize available power storage hardware received from the Tank-Automotive Research Development and Engineering Center (TARDEC) in preparation for integration; continue ruggedization of 50 kW class solid state laser subsystem components; and begin ruggedization of the BMC3 subsystem for the 100 kW laser system.			
Title: High Energy Laser Mobile Demonstrations (HEL MD) ***Description:*** This effort initially integrates a commercial-off-the-shelf (COTS) 10kW laser subsystem (then later a ruggedized ~50kW laser subsystem) into the existing mobile laser demonstrator platform that includes the ruggedized BCS built under the HEL TD effort and other required subsystems to demonstrate weapon system performance. The goal is to demonstrate and evaluate performance of a complete mobile high energy laser weapon in a relevant environment. ***FY 2014 Accomplishments:*** Completed the 10 kW laser demonstration integrated with the HEL MD platform; finished assessment of 10 kW integrated subsystem performance against selected targets; conducted two propagation data collections with the 10 kW laser on the HEL MD, one at Eglin AFB and one at WSMR, to begin anchoring the models at the 1060 nm wavelength; began integration of power subsystem for future 50kW demonstration. ***FY 2015 Plans:*** Begin subsystem demonstration and performance validation for the ruggedized thermal management technology that cools the 50 kW laser device; begin subsystem demonstration and performance validation for the ruggedized battle management function that provides controls for the 50kW laser and other subsystems; and begin planning for the integrated 50kW class demonstration, to include objective definition, demonstration reference missions, and long-lead purchases. ***FY 2016 Plans:*** Will procure targets and continue coordination activities for 50kW class laser demonstration and data collection events with range, Laser Clearing House, and Federal Aviation Authority (FAA) organizations; begin fabrication of interfaces and integration of thermal management and power management subsystems; begin performance validation of integrated thermal management and	2.333	8.696	7.467

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L96 / *High Energy Laser Technology Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
power management subsystems for the 50 kW class demonstration; and begin fabrication of interfaces and integration of laser subsystem components.			
Accomplishments/Planned Programs Subtotals	14.277	14.375	12.526

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L97 / *Smoke And Obscurants Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
L97: *Smoke And Obscurants Advanced Technology*	-	3.169	3.725	4.340	-	4.340	4.935	5.006	5.025	5.125	-	-

A. Mission Description and Budget Item Justification

The project matures and demonstrates obscurant technologies with potential to enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces. This project also matures and demonstrates improved detection of explosives and hazardous materials by Soldiers and Small Units.

Work in this PE is related to, and fully coordinated with, PE 0602622A (Chemical, Smoke and Equipment Defeating Technology) and PE 0603606A, project 608 (Countermine & Barrier Development).

This project sustains Army science and technology efforts supporting the Ground Maneuver portfolio.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed and managed by the Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Obscurant Enabling Technologies ***Description:*** This effort demonstrates the dissemination of new and advanced obscurants. ***FY 2014 Accomplishments:*** Conducted toxicology studies of optimized grenades; further characterize performance of low hazard visual obscurant grenade. ***FY 2015 Plans:*** Conduct initial dissemination studies on artillery/mortar delivered low hazard visual obscurant. Demonstrate low hazard visual smoke grenade. ***FY 2016 Plans:*** Will continue dissemination studies of artillery/mortar delivered low hazard visual obscurant.	0.637	0.697	0.836
Title: Forensic Analysis of Explosives	1.017	1.378	1.577

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L97 / *Smoke And Obscurants Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort demonstrates improved point and stand-off detection of explosives and home made explosive (HME) precursors. ***FY 2014 Accomplishments:*** Integrated and demonstrated Colorimetric Reconnaissance Explosive Sensor System (CRESS) HME detection kit for dismounted Soldiers; fabricated the Chemical Fingerprint Identification System (CFIS) device for unambiguous biometric identification detection of explosives in latent fingerprints; developed a prototype forensic optical imager that will generate digital fingerprints compatible with law enforcement databases and simultaneously determine the chemical composition of trace residue using Raman chemical imaging and fluorescence imaging. ***FY 2015 Plans:*** Integrate and demonstrate Chemical Fingerprint Identification System (CFIS) device for unambiguous biometric identification of an individual linking explosive residue identified and found in latent fingerprints using Raman Chemical Imaging. ***FY 2016 Plans:*** Will optimize and mature the Chemical Fingerprint Identification System (CFIS) device for unambiguous biometric identification of an individual linking explosive residue identified and found in latent fingerprints using Raman Chemical Imaging.			
Title: Detection Mechanisms for Contaminants ***Description:*** This effort demonstrates improved point and standoff detection of a wide range of hazardous materials. ***FY 2014 Accomplishments:*** Optimized and matured unified ion mobility based sensing of explosives and chemical agents in the Joint Chemical Detector (JCD) system; demonstrated standoff detection of trace homemade explosives with laser based systems. ***FY 2015 Plans:*** Demonstrate unambiguous detection of explosives and chemical agents in a unified and integrated system based on ion mobility spectrometry. ***FY 2016 Plans:*** Will expand number of explosive materials detected in the Chemical Explosives Detector (CED) variant of the Joint Chemical Detector (JCD) while retaining CWA and TIC detection capabilities; integrate software and algorithms supporting the detection of explosive materials in the CED; optimize and mature the inlet system for particulate and vapor detection, as well as integrated on-board vapor generators (OVGs) for dopant and calibrant delivery.	1.515	1.650	1.927
Accomplishments/Planned Programs Subtotals	3.169	3.725	4.340

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L97 / *Smoke And Obscurants Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	146.486	147.485	113.071	-	113.071	118.252	124.969	124.973	127.363	-	-
221: *Combat Veh Survivablty*	-	48.311	53.744	55.476	-	55.476	60.567	64.465	63.389	64.553	-	-
441: *Combat Vehicle Mobilty*	-	32.723	42.032	43.381	-	43.381	43.681	43.297	43.799	44.669	-	-
497: *Combat Vehicle Electro*	-	7.152	7.143	6.660	-	6.660	7.118	7.153	7.202	7.345	-	-
515: *Robotic Ground Systems*	-	8.300	7.066	7.554	-	7.554	6.886	10.054	10.583	10.796	-	-
533: *Ground Vehicle Demonstrations*	-	25.000	17.500	-	-	-	-	-	-	-	-	-
53D: *NAC Demonstration Initiatives (CA)*	-	25.000	20.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures, integrates and demonstrates combat and tactical vehicle automotive technologies that enable a lighter, more mobile and more survivable force. This PE executes the Army's Combat Vehicle Prototyping (CVP) program to mature, integrate and demonstrate ground vehicle leap ahead technologies in support of future combat vehicles. Project 221 matures, integrates and demonstrates protection and survivability technologies such as active protection systems (APS), advanced vehicle armors, blast mitigation and occupant safety devices to address both current and emerging advanced threats to ground vehicles. Project 441 matures and demonstrates advanced ground vehicle power and mobility technologies such as powertrains, power generation and storage, water and fuel logistics, and running gear subsystems for military ground vehicles to enable a more efficient, mobile and deployable force. Project 497 matures, integrates, and demonstrates vehicle electronics hardware (computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms) and software that result in increased crew efficiencies, vehicle performance, reduced size, weight, and power (SWaP) burdens and vehicle maintenance costs. Project 515 matures and demonstrates unmanned ground vehicle (UGV) technologies with a focus on sensors, perception hardware and software, and robotic control algorithms that enable UGV systems to maneuver on- and off-road at speeds which meet mission requirements with minimal human intervention.

Work in this PE is coordinated with, PEs 0602105A (Materials), 0602120A (Sensors and Electronic Survivability, Robotics Technology), 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology), 0602624A (Weapons and Munitions Technology), 0602705A (Electronics and Electronic Devices), 0603004A (Weapons and Munitions Advanced Technology), 0603125A (Combating Terrorism Technology Development), 0603270A (Electronic Warfare Technology), 0603313A (Missile and Rocket Advanced Technology), and 0708045A (Manufacturing Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*

B. Program Change Summary ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**
Previous President's Budget	146.992	110.031	114.799	-	114.799
Current President's Budget	146.486	147.485	113.071	-	113.071
Total Adjustments	-0.506	37.454	-1.728	-	-1.728
• Congressional General Reductions	-	-0.046			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	37.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.951	-			
• SBIR/STTR Transfer	-2.457	-			
• Adjustments to Budget Years	-	-	-1.728	-	-1.728

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: 533: *Ground Vehicle Demonstrations*		
Congressional Add: *Program Increase*	25.000	17.500
Congressional Add Subtotals for Project: 533	25.000	17.500
Project: 53D: *NAC Demonstration Initiatives (CA)*		
Congressional Add: *Alternative Energy Research*	25.000	20.000
Congressional Add Subtotals for Project: 53D	25.000	20.000
Congressional Add Totals for all Projects	50.000	37.500

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
221: *Combat Veh Survivablty*	-	48.311	53.744	55.476	-	55.476	60.567	64.465	63.389	64.553	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures, integrates and demonstrates protection and survivability technologies such as active protection systems (APS), advanced vehicle armors, blast mitigation and occupant safety devices to address both current and emerging advanced threats to ground vehicles. This project integrates complimentary survivability technologies to enable advanced protection suites, providing greater survivability and protection against emerging threats. This project executes the Army's APS program to mature and demonstrate APS technologies in order to increase protection against current and emerging advanced threats while maintaining or reducing vehicle weight by reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection and active countermeasures. This project develops an APS Common Architecture that defines the component interface standards and component specifications enabling adaptable APS solutions that can be integrated across Army vehicle platforms as required.

Work in this project supports the Army S&T Ground Maneuver Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan in collaboration with the Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Grounds, MD, Armament Research, Development and Engineering Center (ARDEC), Picatinny, NJ, Aviation and Missile Research, Development and Engineering Center (AMRDEC), Huntsville, AL and Communications-Electronics Research, Development and Engineering Center (CERDEC), Aberdeen Proving Grounds, MD and Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Vision Protection:	3.760	4.120	2.959
Description: This effort matures and integrates devices to protect occupant's eyes, vehicle cameras and electro-optic fire control systems against anti-sensor laser devices as well as reduce the sensor's optical signature. Anti-sensor laser devices can deny vision either temporarily by flooding the sensor with too much light (jamming) or permanently by damaging the sensor. These jamming or damaging effects can slow our battle tempo, disrupt fire control solutions, or prevent vehicles from completing their mission. This effort focuses on demonstrating the effectiveness of optical systems that protect sensors and Warfighter vision from pulsed, continuous wave and future laser threats to maintain fire control capability and situational awareness. Coordinated work is also being performed in PEs 0602120A, 0602705A, 0602712A, and 0602786A.			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Conducted vulnerability studies of electro-optical (day-camera) sensors against pulsed-laser energy threats to determine the laser energy required to render individual pixels, full pixel columns and the entire focal plane array of the sensor ineffective or damaged; and refined the integration technique required to apply the laser protection technology to electro-optical (day-camera) sensors. ***FY 2015 Plans:*** Continue vulnerability studies to determine the energy levels required to make pixels, columns and the entire focal plane of an electro-optical (day-camera) ineffective. Mature concepts for integrating protection materials into the optical path of electro-optical (day-camera) sensors, and evaluate the effects of sensor exposure to pulsed-laser threats on the survivability of the sensors to continue the fire control mission. ***FY 2016 Plans:*** Will mature optical power-limiting materials to improve protection of camera sensors from laser energy. Will evaluate the power-limiting materials protection capability against low-powered continuous wave and short-pulsed laser threats. Will integrate the power-limiting material onto a current fire-control sensor and determine the improved survivability of the sensor against near term laser threats.			
Title: Armor Technologies: ***Description:*** This effort matures, fabricates, integrates and evaluates advanced ground vehicle armor systems such as emerging base armor, appliqué armor, multifunctional armor systems (embedded antennas and health monitoring devices); matures scalable / modular / common armor system integration design standards; creates armor system test & evaluation standards; refines armor modeling and simulation system engineering process. This effort is done in coordination with efforts in PEs 0602105A, 0602601A, 0602618A, and 0708045A. ***FY 2014 Accomplishments:*** Matured and integrated advanced tactical and combat vehicle armor technologies by performing environmental, armor attachment durability and ballistic testing; explored new integration techniques for armor systems and prepared for their future integrated armor attachment durability performance testing. ***FY 2015 Plans:*** Evaluate the performance differences between different transparent armor solutions and determine if additional testing is required to ensure consistent performance.	0.956	0.952	-
Title: Advanced Armor Technologies: ***Description:*** This effort matures, fabricates, integrates and evaluates advanced ground vehicle armor systems such as advanced passive kinetic energy armor, explosive reactive armor, electromagnetic armor, and adaptive armor. The goal is to optimize armor	-	-	8.673

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
system technologies and integration methodologies to reduce overall armor system weight; create and mature scalable / modular / common armor system integration standards for the advanced armor technologies; create armor system test & evaluation standards for advanced armor technologies and leverages the standards for armor component and armor system maturation; refines armor modeling and simulation system engineering process to incorporate advances in armor technologies. This effort is done in coordination with efforts in PEs 0602105A, 0602601A, 0602618A, and 0708045A. ***FY 2016 Plans:*** Will begin armor integration approaches to help achieve an overall ground vehicle armor subsystem weight reduction of 10-15%. Will demonstrate advanced passive and explosive reactive armor technologies and design approaches for defeat of kinetic energy threats, chemical energy threats, and improvised explosive devices. Demonstrations will include environmental testing followed by ballistic testing of advanced armor components. Will mature advanced passive armor system design for integration of the armor technology components and attachment schemes. Will mature advanced explosive reactive armor system design for integration of the armor component technologies. Will mature weight optimization methods for holistic vehicle lightweighting that supports and complements the vehicle armor systems.			
Title: Occupant Centric Protection (OCP) Technologies: ***Description:*** This effort matures and validates design philosophies, guidelines, military standards, handbooks, etc. that embody a focused, systems engineering approach to occupant-centric protection in vehicle design. This is accomplished using tools such as modeling and simulation (M&S), full vehicle and subsystem demonstrators, evaluations and component optimizations. This effort addresses and validates the products from requirements generation through design and build to incorporate occupant-centric philosophies. This effort is done in coordination with efforts in PE 0602601A. ***FY 2014 Accomplishments:*** Integrated occupant protection technologies such as seats, restraints and energy absorbing materials onto demonstrators using an approach that focuses on protecting the occupants by designing from the inside out; matured processes for establishing occupant-centric standards and guidelines developed in PE 0602601A; conducted assessments using physical models and proofs of concepts of occupant protection technologies such as seats, restraints and energy absorbing materials to validate M&S and to reduce risk for sub-system and integrated vehicle underbody blast OCP test events; conducted underbody blast tests on subsystem demonstrators of vehicles and hull structures; and matured and integrated solutions into vehicle demonstrators to reduce injuries from secondary effects such as loose cargo becoming flying hazards in blast, crash and rollover events. ***FY 2015 Plans:*** Continue integration and demonstration of occupant protection components such as seats, restraints and energy absorbing materials into subsystem demonstrators and OCP vehicle demonstrators. Continue analysis of performance of OCP subsystems and demonstrators; begin subsystem and integrated OCP vehicle live-fire testing to simulate under-body blast events and	8.103	13.315	9.957

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
identify and document a rigorous analytical approach to balance protection with mobility/weight goals; continue development and refinement of occupant-centric standards, guidelines and procedures/processes. ***FY 2016 Plans:*** Will mature passive and active levels of occupant-centric protection technologies for combat vehicle survivability. Will optimize combat vehicle survivability demonstrator designs using modeling and simulation to include the integration of a lightweight structure design, and occupant protection component technologies. Will conduct optimization to balance weight, mobility and performance goals. Will verify occupant-centric design guidelines and procedures/processes. Will evaluate the performance of the initial Warrior Injury Assessment Manikin Project (WIAMan) test device in a simulated test environment.			
Title: Blast Mitigation: ***Description:*** This effort fabricates and matures advanced survivability and protection components, tools and subsystems for enhanced protection against vehicle mines, improvised explosive devices (IEDs) and other underbody blast threats, and vehicle collision and rollover events that result from blast events. This effort also integrates and improves occupant protection technologies such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious performance evaluation through modeling and simulation (M&S), experimentation and instrumented test of blast-mitigating technologies in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, and sensors for active blast mitigating technologies. This effort is done in coordination with efforts in PE 0602601A. ***FY 2014 Accomplishments:*** Continued to mature and demonstrate interior and exterior technologies such as energy absorbing materials in structural design, hull shaping and floor designs to mitigate injuries due to underbody blast events, vehicle collisions and rollovers. Conducted subsystem-level testing to improve: test methods to validate existing M&S models, designed methodologies and assessments of blast mitigation products, and lab and instrumentation capabilities to assess components, sub-system and system level blast mitigation capabilities. Created and maintained standards, guidelines and methodologies for specific blast mitigation technologies. ***FY 2015 Plans:*** Integrate advanced passive and active technologies such as active blast countermeasures, energy absorbing materials and floor designs to mitigate the effects of underbody blast threats; conduct impact and blast tests to evaluate the integration methods for exterior and interior blast mitigation technologies onto components, and sub-systems; characterize performance to build greater knowledge for occupant-centric blast mitigation design guidelines/standards, M&S tools, test procedures, laboratory processes, experimentation capabilities. ***FY 2016 Plans:*** Will mature and integrate the next generation of seats, restraints, and flooring technologies to mitigate underbody blast effects to the occupant in Combat Vehicle Prototyping (CVP) program concepts. Will demonstrate the CVP concepts' performance using	12.207	1.799	4.312

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
modeling and simulation along with sub-system level blast tests. Will validate integration methods for blast mitigation technologies onto a combat vehicle platform. Will exploit technologies to increase neutralization effectiveness rates against anti-tank mines while maintaining host platform mobility and reliability characteristics.			
Title: Vehicle Fire Protection: ***Description:*** This effort matures, integrates and demonstrates technologies to minimize vehicle and crew vulnerabilities to fires in current and future military ground vehicles. Supporting technologies include modeling and simulation (M&S), sensor systems, software, chemical agents, fire-resistant materials and hardware components. This effort is done in coordination with efforts in 0602601A. ***FY 2014 Accomplishments:*** Continued to demonstrate enhanced fire protection technologies for military platforms; evaluated and verified optimized common crew Automated Fire Extinguishing System (AFES) components to establish compliance to the crew AFES requirements; integrated design of the common crew AFES into a vehicle platform demonstrator to validate integration, test, safety, and fielding requirements for common crew AFES on vehicle demonstrators designed for Occupant Centric Platforms; validated and improved common crew AFES M&S based on test results; and enhanced in-house laboratory capabilities to improve assessment and demonstration of vehicle fire protection technologies. ***FY 2015 Plans:*** Conduct system-level evaluation of common crew AFES technologies and utilize the analysis to develop component specifications for common crew AFES; continue to investigate integration opportunities of common crew AFES to enable AFES commonality across vehicle fleet; and demonstrate technologies to mitigate injuries and improve damage mitigation due to thermal events. ***FY 2016 Plans:*** Will improve designs and technologies to minimize vehicle and crew vulnerabilities to fires. Will evaluate next generation materials, components and system level technologies to address emerging military ground vehicle thermal threats. Will validate AFES designs using modeling and simulation (M&S) and testing to improve integration for current and new vehicle configurations.	4.468	2.063	2.643
Title: Hit Avoidance Architecture: ***Description:*** This effort matures and demonstrates the Army's Active Protection System (APS) Common Architecture that defines the component interface standards and component specifications enabling adaptable APS solutions that can be integrated into multiple Army vehicle platforms. This effort matures an evaluation test-bed to enable maturation of the APS Common Architecture. This effort helps inform requirements of fielding APS including to: develop safety release criteria, identify vehicle integration constraints and engage potential operators to determine how hit avoidance will impact techniques, tactics and procedures. This effort is done in coordination with efforts in PEs 0602601A, 0602618A, 0603004A, 0603270A, and 0603313A.	18.817	4.500	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Conducted evaluation of existing APS sensors, countermeasures and controllers and utilized the analysis to develop component specifications for the Army's future APS efforts; developed fuze board-compliant common APS command and control processor and fire control module to enable APS commonality across vehicle fleet; developed and provided bus protocols, common interface specifications and standards to industry for APS Common Architecture; conducted hardware in the loop analyses of APS components during development and integration of APS component technologies with the common processor; incorporated a laser decoy countermeasure (CM) capability into an existing infrared soft-kill CM; tested and matured soft-kill countermeasure. ***FY 2015 Plans:*** Continue APS Common Architecture maturation to include an APS common controller. Integrate and fabricate software and hardware for the common controller, enabling integration of active protection components that accommodate varying performance and vehicle needs. Begin integration with Hit Avoidance Technologies and conduct hardware-in-the-loop analyses to validate common controller meets APS interface requirements. Will conduct soft-kill countermeasure environmental and live-fire assessments.			
Title: Hit Avoidance Technologies: ***Description:*** This effort matures, integrates and demonstrates hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) Active Protection System (APS) components and integrated systems to verify the APS Common Architecture. In demonstrating hard-kill and soft kill-active protection technologies, requirements and specifications will be matured for future integration onto tactical and combat vehicle platforms. This effort is coordinated with efforts in PEs 0602601A, 0602618A, 0603004A, 0603270A, and 0603313A. ***FY 2015 Plans:*** Mature and integrate the soft-kill countermeasure with the APS Common Architecture and modular APS common controller to demonstrate soft-kill defeat of anti-tank guided missiles on a combat vehicle. Verify the soft-kill countermeasure is compliant with the APS Common Architecture interface standards. Mature and integrate a hard-kill active protection system demonstrator using the APS Common Architecture and APS common controller and hard-kill tracking sensors and countermeasures that are matured and compliant with the architecture interfaces and protocols. Enhance hard-kill and soft-kill simulation and hardware-in-the-loop evaluation capability to exercise and test software and hardware components to inform requirements and determine trade space for hit avoidance technologies. ***FY 2016 Plans:*** Will continue maturation of the modular active protection systems (APS) common architecture, and maturation of the modular APS common controller. Will continue software and hardware maturation for the APS common controller, enabling integration of active protection components that accommodate varying performance and vehicle needs. Will enhance soft-kill and hard-kill simulation	-	26.995	26.932

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and laboratory capability to exercise and test software and hardware components against design requirements and determine trade space for APS configurations. Will continue to mature a modular architecture APS configuration with soft-kill and hard-kill capabilities by integrating sensors and countermeasures that are matured and compliant with the APS common architecture interfaces and protocols. Will conduct virtual and physical demonstrations of a modular architecture APS soft-kill configuration defeat capability against anti-tank guided missiles at the subsystem level.			
Accomplishments/Planned Programs Subtotals	48.311	53.744	55.476

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
441: *Combat Vehicle Mobilty*	-	32.723	42.032	43.381	-	43.381	43.681	43.297	43.799	44.669	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced mobility and electric technologies for combat and tactical vehicles to enable lightweight, agile, deployable, fuel efficient and survivable ground vehicles. Technologies include advanced propulsion, engines, transmissions, power, and electrical components and subsystems. This project will also mature and demonstrate advanced mechanical and electrical power generation systems to increase available onboard electrical power to enable future capabilities such as next generation communications and networking, improvised explosive device (IED) jamming systems and next generation sensor devices can be supported on combat and tactical vehicles. This project also matures and demonstrates water and fuel logistics technologies.

Work in this project supports the Army S&T Ground Maneuver Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in conjunction with Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Onboard Vehicle Electric Power Component Development:	4.742	4.278	4.401
Description: This effort focuses on meeting the Army's demand for more onboard vehicle electric power to enable technologies such as advanced survivability systems, situational awareness systems and the Army network. This effort matures, integrates and demonstrates onboard vehicle power (OBVP) components to include electrical power generation machines and associated power converters such as high temperature inverters and converters, advanced control algorithms, and high efficiency power conversion (mechanical to electrical) components. Additionally, it matures and integrates advanced electric machines such as Integrated Starter Generator (ISG) and their controls for mild hybrid (system that integrates electric machines to assist internal combustions engines for propulsion) electric propulsion and high power electric generation. Coordinated work is also being conducted under PEs 0602601A and 0603005A.			
FY 2014 Accomplishments: Integrated onboard vehicle power (OBVP) components onto the vehicles to demonstrate increased vehicle power generation capabilities; evaluated performance of vehicle with OBVP against baseline vehicle performance; evaluated reliability of hybrid			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
vehicle components, including electric motors and controllers; and demonstrated bidirectional vehicle-to-grid power flow and mobile microgrid capability. ***FY 2015 Plans:*** Evaluate combat vehicle performance with integrated onboard vehicle power (OBVP) technologies that verify they provide adequate onboard electrical power to enable future communications, networking, IED jamming and sensors; implement OBVP and hybrid component control approaches to minimize vehicle performance impacts while generating significant electrical power. ***FY 2016 Plans:*** Will mature and demonstrate onboard vehicle power (OBVP) technologies to include inverters and generators for high temperature operation capability, power quality and the ability to provide more compact, power dense electrical power generation. Will demonstrate power technologies to enable application of advanced technologies to vehicles including electromagnetic armor, communications and other technologies enhancing combat vehicle lethality, survivability and situational awareness.			
Title: Advanced Running Gear: ***Description:*** This effort matures and demonstrates running gear components and advanced suspension technologies to increase vehicle mobility and durability in response to increased ground vehicle platform weights. Components and subsystems include new elastomer compounds, lightweight, survivable track systems and road wheels, advanced compensating track tensioners, advanced damping suspension technologies, Electronic Stability Control (ESC) systems, and preview sensing technologies linked to advanced suspension designs. Coordinated work is also being conducted under PEs 0602601A and 0603005A. ***FY 2014 Accomplishments:*** Fabricated, evaluated and qualified lightweight track technology improvements for the Bradley Fighting Vehicle in direct support of improving vehicle occupant survivability; investigated, baselined and characterized low rolling resistance tire compounds for tactical military applications with the goal of increased fuel efficiency; matured, fabricated and laboratory tested track width adjusting suspension systems to improve vehicle stability; and assessed flush backed track designs to establish baseline data on design improvements. ***FY 2015 Plans:*** Fabricate, install and test an external suspension system for a 60-70 ton combat application to evaluate system durability and reliability as well as vehicle performance characteristics; mold high capacity, lightweight track compounds for heavy (60-70 ton) combat vehicle systems and perform vehicle testing to demonstrate the durability and rolling resistance reductions of these compounds; model suspension control architectures for system control of vehicle dynamics, ride and handling. ***FY 2016 Plans:***	5.465	2.672	5.004

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will improve elastomer materials and road wheels to demonstrate improved combat vehicle track system durability. Will continue fabrication, integration and optimization of external suspension unit system for 60-70 ton combat vehicle application. Will mature suspension control architectures for system control of vehicle dynamics, ride height and handling. Will characterize combat vehicle external suspension unit functionality, durability and system performance relative to performance metrics. Will execute track and suspension maturation efforts in support of the Combat Vehicle Prototyping program.			
Title: Combat Vehicle Subsystem Demonstrations	-	15.022	15.031
Description: This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, vehicle architecture and systems integration. The primary focus of this activity is to mature and demonstrate a series of subsystem demonstrators building off of previous investment in ground combat acquisition and technology programs with the purpose of maturing key technologies to refine and inform future platform requirements and reduce risks in critical ground combat vehicle technology areas. Specifically, this effort focuses on maturing and demonstrating ground combat vehicle mobility technologies such as powertrain subsystems and systems integration technologies such as vehicle structures and concept demonstrators. This effort seeks to optimize platform efficiency and growth potential to ensure the combat fleet is able to accept new technologies as they are developed to bring advanced capability for the Warfighter. This effort is executed in coordination with PEs 0602601A, 0602618A, 0603004A, and 0603125A. ***FY 2015 Plans:*** Mature, integrate and evaluate emerging ground vehicle subsystem and component technologies for mobility, survivability and systems integration such as advanced transmission, flooring and vehicle structures to establish subsystem and component performance baselines. Analyze the influence of emerging ground vehicle subsystem technologies on future integrated combat vehicle designs and concepts. Conduct modeling, analysis and trade studies for next-generation ground vehicle subsystems. Assess developmental and existing critical technology areas such as mobility, survivability and vehicle structures for optimal platform configuration. Conduct laboratory assessment of multiple vehicle powertrain subsystems and configurations such as engines and transmissions including both conventional and hybrid powertrain approaches. ***FY 2016 Plans:*** Will mature the design of a unique high power density, low heat rejection, fuel efficient opposed piston engine concept through the use of advanced lightweight materials and optimization of in-cylinder combustion performance and efficiency to inform future combat vehicle concept development and analyses and its future powertrain subsystem demonstrator. Will optimize engine fuel efficiency and increase commonality of engine components to reduce engine logistical and life cycle costs. Will develop novel future combat vehicle concepts for the Combat Vehicle Prototyping (CVP) program leveraging leap-ahead technologies			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and technology concepts. Will conduct capability analyses and trade studies on the integration of vehicle mobility and occupant protection technologies into the CVP concepts, in order to optimize the platform configuration.			
Title: Energy Storage Systems Development: ***Description:*** The goal of this work is to mature energy storage systems to both enable silent watch capability and increased survivability through power brick energy storage components for pulse power electromagnetic armor. This is accomplished through the maturation and demonstration of advanced ground vehicle energy storage devices such as advanced chemistry batteries, high energy density capacitors and power brick batteries for pulse power. This effort leverages commercial industry battery development efforts to reduce battery volume and weight while improving their energy and power densities. This effort also matures and optimizes a common specification for battery management systems to improve the battery state of charge indicator accuracy and battery state of health information to reduce the frequency of battery replacement and optimize starting, lighting, and ignition functions. Coordinated work is also being conducted under PEs 0602601A and 0602705A. ***FY 2014 Accomplishments:*** Matured and optimized an advanced vehicle battery system with improved energy and power density; validated the battery system's performance in military mission scenarios to evaluate reduction on logistics footprint; tested the system to military specifications; integrated battery system onto a vehicle platform; conducted performance characterization; and integrated second generation power brick battery into pulse power electromagnetic armor system. ***FY 2015 Plans:*** Optimize the improved second generation power brick battery for pulse power electro-magnetic armor system to evaluate power brick battery performance and ensure it meets military specifications; leverage power brick battery design and testing to create concepts for modular, standardized new high energy, high voltage advanced batteries for mobility applications; and generate common performance specifications for power brick and standardized high voltage battery systems. ***FY 2016 Plans:*** Will mature standardized low voltage battery systems to improve fuel efficiency and support vehicle lightweighting. Will mature control electronics and battery management system for advanced, standardized, military specific batteries to improve durability and reliability. Will optimize advanced, standardized, military specific battery system for increased energy density and reliability.	2.735	3.627	2.926
Title: Pulse Power: ***Description:*** This effort matures and demonstrates high energy, compact pulse power components, subsystems and systems that enable significantly improved survivability and lethality applications components to include Direct Current (DC) to DC chargers, high energy batteries, pulse chargers, high density capacitors, solid state-switches, control systems and electromagnetic armor panels. Coordinated work is also being conducted under PEs 0602601A, 0602618A, and 0602705A.	-	3.500	3.823

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2015 Plans: Demonstrate a second generation power brick and mission module based electromagnetic armor module. Demonstrate multi-hit defeat with fast re-charge time capabilities in a lab environment with an electrical surrogate load. Conduct follow-on ballistic testing of the electromagnetic armor module to demonstrate multi-hit defeat capabilities enabled by the integrated power brick and mission module. ***FY 2016 Plans:*** Will integrate energy storage and high-voltage power electronic components into a power system to support electromagnetic armor development weight reduction goals of 10% to 15%. Will demonstrate and validate pulse power system and electromagnetic armor module in relevant environments. Will begin integrated demonstration of pulse power and electromagnetic armor systems, including durability and environmental testing, Will validate ballistic performance of the integrated pulse power and electro-magnetic armor system.			
Title: Non-Primary Power Systems:	3.356	2.646	3.096
Description: This effort exploits, matures, and demonstrates Auxiliary Power Unit (APU) technologies such as a small modular/scalable engine-based APUs, a fuel cell reformer system to convert JP-8 to hydrogen, a sulfur tolerant JP-8 fuel cell APU, and novel engine-based APUs for military ground vehicles and unmanned ground systems. This effort also establishes interface control documents for simplified integration of current and future APUs, improves reliability to reduce logistic burdens, as well as reduces acoustic signature for silent operation. Additionally, this effort exploits JP-8 fuel cell and engine APUs to optimize prime power in unmanned ground systems. Coordinated work is also being conducted under PE 0602601A.			
FY 2014 Accomplishments: Demonstrated a small engine-based APU on an unmanned ground system; evaluated and selected a modular/scalable small engine for use in a high power APU (25-45kW); integrated and evaluated active noise control hardware on an engine-based APU; and evaluated performance of various APU technologies for higher power applications.			
FY 2015 Plans: Demonstrate a JP-8 fueled small power system integrated onto an unmanned ground system. Integrate and demonstrate acoustic improvements of high power rotary engines for APU use. Perform testing on high power small engines for rotary APU use. Demonstrate the improvements of an integrated APU and Battery system to meet engine off power needs, such as power demands for silent watch, vehicle starting and communications and surveillance equipment. Integrate a fuel cell power system onto a mobile platform to demonstrate silent mobility.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will mature power dense, heavy fuel engine, such as JP-8, rotary engine and electrical generator technologies to significantly increase under armor power generation capability for combat vehicles. Will integrate and optimize rotary engine-based auxiliary power unit system for increased fuel efficiency and improve packaging of rotary engine, electrical generator and other components to decrease acoustic signature.			
Title: Propulsion and Thermal Systems: ***Description:*** This effort matures and evaluates high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), increased electrical power generation needs (onboard communications, surveillance and exportable power), improved fuel economy (fuel cost & range), enhanced mobility (survivability), and reduced cooling system burden (size, heat dissipation). This effort also matures thermal management technologies and systems including heat energy recovery, propulsion and cabin thermal management sub-systems to utilize waste heat energy and meet objective power and mobility requirements on combat and tactical vehicles. Lastly, this effort maximizes efficiencies within propulsion and thermal systems to reduce thermal burden on the vehicle while providing the same or greater performance capability. ***FY 2014 Accomplishments:*** Performed advanced powertrain sub-systems integration and validation testing to include energy efficiencies and performance capabilities by utilizing highly efficient transmissions and engines incorporating advanced algorithms and control strategies, low heat rejection and high power density systems; evaluated waste heat recovery technologies at a system level in a laboratory environment for performance validation; completed the power take off (PTO) system and fan control strategies for increased efficiency in engine cooling performance. ***FY 2015 Plans:*** Mature and model an advanced powertrain system utilizing a highly efficient transmission and engine and incorporating advanced algorithms and control strategies to enhance energy efficiencies and performance capabilities for future combat vehicles. ***FY 2016 Plans:*** Will mature combat vehicle mechanical automatic transmission design and increase transmission efficiency by targeting the optimal efficiency through all vehicle operating ranges. Will optimize powertrain system mobility and steering performance by delivering increased engine power to the vehicle track system while reducing heat rejection. Will validate model of advanced powertrain system. Will mature transmission quality, reliability and durability to reduce lifecycle costs.	9.241	5.607	5.000
Title: Force Projection: ***Description:*** This effort focuses on reducing the logistics footprint, improving fuel efficiency, and ensuring mobility by maturing and demonstrating technologies in areas such as water purification, generation, quality monitoring, storage and distribution and	5.184	4.680	4.100

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
wastewater treatment and reuse; petroleum quality monitoring, filtration, storage and distribution, hydraulic fluids; alternative fuels and fuel additives; lubricants, oil, powertrain fluids and coolants. This effort is done in coordination with efforts in PE 0602601A. ***FY 2014 Accomplishments:*** Conducted performance assessments of waste water treatment and recycling technologies; further matured and demonstrated in-line water quality and process monitoring capability equivalent to the Water Quality Analysis Set - Purification; characterized selected alternative fuels and fuel additives to improve performance and diversify energy sources; assessed the suitability of candidate alternative fuels in military ground systems; evaluated lower viscosity gear oils and hydraulic fluids that increase fuel efficiency through a reduction in hydro-dynamic friction; and continued evaluation of candidate Petroleum, Oil, Lubricants and coolants to meet new military technology requirements. ***FY 2015 Plans:*** Conduct demonstrations of waste water treatment and recycling technologies in a field environment. Demonstrate expanded in-line water quality and process monitoring capability to address pathogens and toxins such as giardia, cryptosporidium, and pesticides. Characterize selected alternative fuels and fuel additives to improve performance and diversify energy sources; evaluate candidate long life coolants designed to reduce the overall logistics burden and meet emerging requirements of military ground systems; and evaluate fluid distribution composite hose technologies to improve logistical burdens of deploying fuel and water pipeline systems. ***FY 2016 Plans:*** Will perform modeling and analysis of waste water treatment and recycling technologies to assess the scalability of technologies and optimize system designs. Will evaluate and qualify synthetic fuels made from non-petroleum sources against performance requirements for use in military ground systems. Will mature and demonstrate fuel sensor technologies and a portable fuel analyzer for contaminate detection. Will validate performance of gear oils and hydraulic fluids using a new test methodology and performance based specification, demonstrating increased vehicle fuel efficiency with limited equipment/hardware modifications.			
Title: Flood damage assessment and repair of mission equipment ***Description:*** Flood damage assessment and repair of mission equipment ***FY 2014 Accomplishments:*** In August 2014 heavy rains caused flooding at TARDEC. Funding was reprogrammed to assess and repair mission equipment.	2.000	-	-
Accomplishments/Planned Programs Subtotals	32.723	42.032	43.381

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 497 / *Combat Vehicle Electro*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
497: *Combat Vehicle Electro*	-	7.152	7.143	6.660	-	6.660	7.118	7.153	7.202	7.345	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures, integrates, and demonstrates vehicle electronics hardware such as computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms as well as vehicle software to enhance crew performance, increase vehicle fuel efficiency, reduced Size, Weight, and Power (SWAP) burdens and reduce vehicle maintenance costs. This project also advances open system architectures (power and data) for military ground vehicles to enable common interfaces, standards and hardware implementations. The overall vehicle system architecture is known as VICTORY (Vehicle Integration for C4ISR/EW Interoperability), which is a long term technology effort that provides an open architecture that will allow platforms to accept future technologies without the need for significant re-design as new technologies are developed and integrated. Additionally this project matures integrated condition based maintenance technologies that reduce the operation and sustainment costs of vehicle electronics and electrical power devices. Technical challenges include: software and algorithm development for increased levels of automation for both manned and unmanned systems, secure vehicle data networks, interoperability of intra-vehicle systems, and implementation of advanced user interfaces. Overcoming these technical challenges enables improved and increased span of collaborative vehicle operations, efficient workload management, commander's decision aids, embedded simulation for battlefield visualization and fully integrated virtual test/evaluation.

Work in this project supports the Army S&T Ground Maneuver Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Vehicle Electronics Integration Technologies:	4.226	3.503	4.508
Description: This effort matures, demonstrates and implements next generation military ground vehicle electronics and electrical power open architectures for future ground combat and tactical vehicle systems. Mature and demonstrate technologies to include: next generation video/data networking and computing equipment, Silicon Carbide (SiC) high voltage power electronics and low voltage smart power distribution. Technologies will reduce currently fielded vehicle overall space, weight and power (SWaP) concerns for vehicle electronics. This effort is coordinated with efforts in PE 0602601A.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 497 / *Combat Vehicle Electro*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Completed preliminary power and data maturation activities; continued to mature the architecture design such as activity and sequence diagrams, use cases, and mission scenarios, as well as produce system operation descriptions and defined both physical and data component interfaces for the network and power hardware and software subsystems; beginning optimization activities for electronics and electrical power component selection and/or fabrication for reconfigurable combat vehicle cab simulation. ***FY 2015 Plans:*** Further mature and begin implementation of next generation military ground vehicle electronics and electrical power open architectures; conduct market/trade analysis and integrate applicable high and low voltage vehicle power components, command, control, communications, and combat vehicle computing hardware and software necessary for full architecture system functionality into a reconfigurable combat vehicle cab simulation. ***FY 2016 Plans:*** Will mature and demonstrate vehicle electronics architecture to facilitate rapid integration of card-based communication equipment into combat and tactical systems. Will continue all maturation and integration activities of the next generation power and data architecture and corresponding system design in a System Integration Laboratory (SIL). Will verify and validate the next generation power and data architecture through testing traced to power, network and SIL designs and requirements. Will enhance the data transport mechanism for VICTORY, leveraging the next generation power and data architecture and incorporating electronics and electrical power open architecture requirements for future combat vehicles. Will exploit the existing VICTORY (Vehicular Integration for C4ISR/EW Interoperability) data architecture to demonstrate future combat vehicle functions and components.			
Title: Vehicle Electronics Architecture and Standards:	2.926	3.640	2.152
Description: This effort matures technologies and standards for existing and future combat and tactical ground vehicles. Open commercial standards will be evaluated and modified for use in military ground vehicles and possible inclusion in the Army's open, non-proprietary intra-vehicle data network e.g., VICTORY (Vehicular Integration for C4ISR/EW Interoperability). This effort will also evaluate standards and components for suitability of integration into vehicle platforms. This effort also supplements the design of electronic architectures to support the efficient integration of electronic components into vehicle systems through the use of open standards. Additionally, this effort matures and expands the VICTORY effort to interface with the Modular Active Protection System (APS) Architecture. This effort is coordinated with PEs 0602601A and 0603005. ***FY 2014 Accomplishments:*** Continued to mature and refine the VICTORY standards and open architecture; began improvement of the VICTORY SIL for compatibility with VICTORY standard version 1.6 to support component compliance testing to the latest VICTORY standard			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 497 / *Combat Vehicle Electro*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
release; matured next generation open vehicle architecture by performing analysis of current VICTORY standards for application to combat vehicle architectures. ***FY 2015 Plans:*** Complete update of VICTORY SIL to version 1.6 and begin update of VICTORY SIL to VICTORY standard version 1.7 to demonstrate component compliance testing to latest VICTORY release. Mature and demonstrate current VICTORY interfaces (1.6 vs. 1.7) to support next generation open vehicle architectures in preparation for a data and computing architecture demonstration in FY16. ***FY 2016 Plans:*** Will continue to mature and validate the VICTORY specification through demonstration in the VICTORY SIL. Will complete the VICTORY SIL update to standard version 1.7, which adds capabilities for Logistics and Training systems and demonstrate component compliance to standard version 1.7. Will begin the VICTORY SIL update to VICTORY standard version 1.8, providing the capability to demonstrate component compliance to the VICTORY standard version 1.8, which adds capabilities for weapons and sensor systems.			
Accomplishments/Planned Programs Subtotals	7.152	7.143	6.660

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 515 / *Robotic Ground Systems*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
515: *Robotic Ground Systems*	-	8.300	7.066	7.554	-	7.554	6.886	10.054	10.583	10.796	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies to enable Unmanned Ground Vehicles (UGV) including sensor technologies, perception hardware and software, and control technologies that allow the Soldier to perform mission tasks more efficiently. Challenges addressed include: obstacle avoidance, overcoming perception limitations, intelligent situational behaviors, command and control by Soldier operators, frequency of human intervention, operations in adverse weather, and autonomy enabled vehicles protecting themselves and their surroundings from intruders. Mature technologies are incorporated onto existing, Army-owned UGV technology demonstrators so that performance of the enabling technologies can be evaluated.

The approach builds upon, complements, and does not duplicate previous and ongoing investments conducted under the Joint Robotics Program Office.

Work in this project supports the Army S&T Ground Maneuver Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Unmanned Ground Systems Technology:	8.300	7.066	7.554
Description: This project matures, integrates and demonstrates advanced robotic and autonomous technologies for the tactical and combat vehicle fleets. Unmanned ground systems technologies can be employed to overcome critical Army challenges to include automated resupply and sustainment, improved tactical intelligence, and reduced physical and cognitive burden. Challenges can be met by utilizing relevant technologies such as maneuver and tactical behavior algorithms, autonomy kits, sensor and weapons integration, advanced navigation and planning, vehicle self-protection, object and local environment manipulation, local situational awareness, advanced perception, vehicle and pedestrian safety, and robotic command and control. This effort is coordinated with efforts in PEs 0602120A, 0602601A and 0603005.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 515 / *Robotic Ground Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Matured and integrated advanced autonomous maneuver, active safety and Soldier load reduction hardware, software, algorithms, control interfaces, and sensor payloads onto demonstrator vehicles to substantiate optionally manned/unmanned vehicle missions and validate emerging safety methodology and tactics, techniques and procedures; expanded integration of scalable autonomy kits and control interfaces onto representative tactical wheeled vehicles to increase Soldier safety, operational efficiency and effectiveness and culminate with technical demonstrations and robust data analysis in a relevant operational environment; began integration of interoperability standards-compliant components and systems onto manned/unmanned robotic platforms to increase re-use and reduce costs of current/future systems. ***FY 2015 Plans:*** Mature and integrate autonomy-enabling technologies to include: drive-by-wire systems, vehicle active safety technologies, mission packages, and related software, algorithms and control interfaces. Validate emerging safety methodologies and tactics, techniques and procedures. Mature and integrate higher level intelligent behaviors to increase Soldier safety, operational efficiency, effectiveness, and manned/unmanned teaming. Further integrate components and systems compliant with interoperability standards onto manned/unmanned platforms to increase re-use and reduce costs of current/future systems. ***FY 2016 Plans:*** Will mature, integrate and demonstrate advanced scalable autonomous technologies onto tactical vehicles to automate driving tasks and reduce logistics support requirements. Will mature and integrate software and behavior algorithms to enable autonomous convoy and autonomous vehicle loading/unloading operations to improve the effectiveness of unit resupply and sustainment operations. Will mature and demonstrate platform autonomy in increasingly complex environments and mission applications ranging from urban terrain to cross country maneuvers.			
Accomplishments/Planned Programs Subtotals	8.300	7.066	7.554

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 533 / *Ground Vehicle Demonstrations*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
533: *Ground Vehicle Demonstrations*	-	25.000	17.500	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	25.000	17.500
FY 2014 Accomplishments: Matured and demonstrated decreased chemical agent resistant coating (CARC) curing time, nano-composite materials and modeling capabilities, transparent armor with improved resistance to rock strike and delamination, fastener coating systems with reduced cost and complexity, military specific efficient powertrain, technologies to support an autonomy enabled brigade, ground vehicle coating system with improved shelf life, and a ground systems advanced reliability capability to identify reliability cost drivers and improve cost analysis. Matured and optimized capabilities to evaluate modular active protection components, matured vehicle concepts for the Combat Vehicle Prototyping (CVP) program and the architecture and standards to enable reduction of the logistics burden using autonomy. ***FY 2015 Plans:*** Program increase		
Congressional Adds Subtotals	25.000	17.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 53D / *NAC Demonstration Initiatives (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
53D: *NAC Demonstration Initiatives (CA)*	-	25.000	20.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Alternative Energy Research	25.000	20.000
FY 2014 Accomplishments: Matured and demonstrated multiple technologies with the Department of Energy through the Advanced Vehicle Power Technology Alliance (AVPTA), including Thermoelectric Enabled Engine, Lightweight Vehicle Structures, Multi-Material Joining, Computer Aided Engineering for Electric Batteries, Lubricant Formulations to Enhance Fuel Efficiency, and Non Rare Earth Material Motors. Matured and demonstrated water treatment and water generation technologies, vehicle electrification technologies and modeling and simulation capabilities to determine fuel efficiency and water generation capabilities logistical impacts.		
FY 2015 Plans: Program increase for alternative energy research		
Congressional Adds Subtotals	25.000	20.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	10.706	6.880	5.554	-	5.554	3.904	4.026	5.160	5.262	-	-
257: *DIGITAL BATTLEFLD COMM*	-	5.000	-	-	-	-	-	-	-	-	-	-
592: *Space Application Tech*	-	5.706	6.880	5.554	-	5.554	3.904	4.026	5.160	5.262	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates advanced space technologies that support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, DoD, and Army space policies. This PE provides applications for enhanced intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, ground-to-space surveillance, and command and control capabilities. Project 592 matures and demonstrates networked and integrated surveillance, communications, and command and control capabilities for high altitude and tactically responsive space payloads to enable information superiority, enhanced situational awareness, and support global assured access enabling distributed tactical operations.

Work in this PE complements the work in PE 0602120A (Sensors and Electronic Survivability), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603794A (Command, Control, and Communications Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	5.862	6.883	5.592	-	5.592
Current President's Budget	10.706	6.880	5.554	-	5.554
Total Adjustments	4.844	-0.003	-0.038	-	-0.038
• Congressional General Reductions	-	-0.003			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	5.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.156	-			
• Adjustments to Budget Years	-	-	-0.038	-	-0.038

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: 257: *DIGITAL BATTLEFLD COMM*		
Congressional Add: *Space applications advanced technology program increase*	5.000	-
Congressional Add Subtotals for Project: 257	5.000	-
Congressional Add Totals for all Projects	5.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*	**Project (Number/Name)** 257 / *DIGITAL BATTLEFLD COMM*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
257: *DIGITAL BATTLEFLD COMM*	-	5.000	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for digital battlefield advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Space applications advanced technology program increase	5.000	-
FY 2014 Accomplishments: Space applications advanced technology program increase		
Congressional Adds Subtotals	5.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*	**Project (Number/Name)** 592 / *Space Application Tech*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
592: *Space Application Tech*	-	5.706	6.880	5.554	-	5.554	3.904	4.026	5.160	5.262	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates payloads, sensors, and data down link systems for tactically responsive space and high altitude platforms supporting Army ground forces. This project matures, demonstrates, and integrates light weight materials, hardware components with reduced power consumption, and advanced data collection, processing, and dissemination capabilities. This project also develops algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems. These efforts support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, DoD, and Army space policies.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL. This program is designated as a DoD Space Program.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Payload Technology Development	5.706	6.880	5.554

Description: This effort matures technologies for smaller, Warfighter-responsive sensor and communication small satellite constellations. Work related to standard Army networks is done in coordination with the Communications-Electronics Research Development and Engineering Center (CERDEC).

FY 2014 Accomplishments:
Matured low cost launch vehicle engine capable of lifting small satellite class payloads into low earth orbit; matured and demonstrated on-orbit deployment and positioning system for small satellites; evaluated and demonstrated algorithms and software to enable tactical dissemination of space-based digital sensor data.

FY 2015 Plans:
Conduct low cost launch vehicle engine and rocket stage performance validation; demonstrate suborbital launch, to include rocket and supporting range equipment; validate functionality of space-based mission command for imaging spacecraft architecture, affordable launch technical control, and affordable launch fire control.

FY 2016 Plans:
Will demonstrate proof-of-concept small satellite control using standard Army networks; integrate small satellite communications and imagery payload software onto standard Army network platforms and assess ability to control on-orbit small satellites and

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*	**Project (Number/Name)** 592 / *Space Application Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
onboard payloads; and mature Software Defined Radio (SDR) and imagery payloads based on lessons learned from earlier on-orbit demonstrations.			
Accomplishments/Planned Programs Subtotals	5.706	6.880	5.554

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	6.145	13.574	12.636	-	12.636	14.417	14.695	15.123	15.422	-	-
792: *Personnel Performance & Training*	-	6.145	13.574	12.636	-	12.636	14.417	14.695	15.123	15.422	-	-

Note

FY 14 decrease attributed to below threshold reprogrammings (-1500 thousand) for high priority educational opportunities for under represented populations (-750 thousand) and Engineered Resilient Systems (ERS) (-750 thousand)

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates advanced behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., culture of dignity, respect, and inclusion). These technologies provide advanced personnel measures that more fully assess potential and predict performance, behavior, attitudes, and resilience. These technologies also provide innovative and effective training and mentoring methods to ensure Soldiers, leaders, and units have the knowledge, skills, and abilities to sustain positive unit climates and meet mission requirements in uncertain and complex environments. This PE validates new selection measures and performance metrics, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Research in this PE will result in effective non-materiel solutions to help the Army adjust to changes in force size and structure, a variety of mission demands and contexts, challenges in human relations, and budgetary constraints.

Efforts in this program element support the Army Science and Technology Soldier portfolio.

Work in this project complements and is fully coordinated with and PE 0602785A (Manpower/Personnel/Training Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Human Capital Strategy.

Work in this PE is performed by the US Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	7.796	13.580	12.719	-	12.719
Current President's Budget	6.145	13.574	12.636	-	12.636
Total Adjustments	-1.651	-0.006	-0.083	-	-0.083
• Congressional General Reductions	-	-0.006			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.500	-			
• SBIR/STTR Transfer	-0.151	-			
• Adjustments to Budget Years	-	-	-0.083	-	-0.083

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	**Project (Number/Name)** 792 / *Personnel Performance & Training*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
792: *Personnel Performance & Training*	-	6.145	13.574	12.636	-	12.636	14.417	14.695	15.123	15.422	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates advanced behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., culture of dignity, respect, and inclusion). These technologies provide advanced personnel measures that more fully assess potential and predict performance, behavior, attitudes, and resilience. These technologies also provide innovative and effective training and mentoring methods to ensure Soldiers, leaders, and units have the knowledge, skills, and abilities to sustain positive unit climates and meet mission requirements in uncertain and complex environments. This PE validates new selection measures and performance metrics, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Research in this PE will result in effective non-materiel solutions to help the Army adjust to changes in force size and structure, a variety of mission demands and contexts, challenges in human relations, and budgetary constraints.

Efforts in this program element support the Army Science and Technology Soldier portfolio.

Work in this project complements and is fully coordinated with and PE 0602785A (Manpower/Personnel/Training Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Human Capital Strategy.

Work in this PE is performed by the US Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Personnel Assessment	2.590	3.397	5.348
Description: This effort, previously titled "Personnel Technology," matures and assesses Soldier selection measures, techniques and tools to better predict behavior and performance to provide the Army the flexibility to adapt to changing recruiting environments. The Army's current selection measures primarily focus on a candidate's cognitive (e.g., technical and analytical) ability which does not predict attrition, discipline, and motivation.)			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	**Project (Number/Name)** 792 / *Personnel Performance & Training*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Initiated validation of non-cognitive measures (e.g., temperament) to better match enlisted Soldiers to jobs (involves large-scale data collection and analysis, job/task analysis, and predictive modeling) across multiple job types. ***FY 2015 Plans:*** Will validate non-cognitive measures as predictors of success (e.g., attrition, performance, attitudes) for enlisted Soldiers as well as non-commissioned officers (NCOs) in special assignments; will identify strategies for conducting classification analyses. Will initiate research to develop enhanced suitability screening for military positions of trust (e.g., Sexual Harassment/Assault Response and Prevention Coordinators, Drill Sergeants. ***FY 2016 Plans:*** Will continue validation and refinement of non-cognitive predictors of success (e.g., attrition, performance, attitudes) for enlisted Soldiers and non-commissioned officers at accession and selection for special assignments; will conduct classification analyses to aid person-job match.			
Title: Personnel Readiness, Performance, and Conduct ***Description:*** This effort, previously titled, "Training and Leader Development," matures methods to assess, enhance, and sustain individual and unit readiness, resilience, and effectiveness to improve Soldier and unit performance. This effort also develops efficient and empirically valid measures to assess command climate and associated outcomes, and matures methods to enable leaders and units to maintain or create climates of respect, dignity and inclusion. ***FY 2014 Accomplishments:*** Developed adaptive instructional model that captures task type, training domain, level of expertise, and training method to improve training efficiency for cognitive/decision-making tactical skills and tasks; expanded training approaches for operational units using live/virtual/constructive environments to train a broad range of military operations. ***FY 2015 Plans:*** Will initiate research to prevent sexual harassment and assault through more effective training and mentoring methods. Will initiate research on valid measures of command climates of dignity, respect, and inclusion. Will validate Army instructor methods and techniques to improve instructor skills. ***FY 2016 Plans:*** Will develop measures of conduct and performance as indicators of unit climate of dignity, respect, and inclusion; will design and develop measures of collective performance; will develop methods and measures to identify and develop high quality Army instructors; will develop training methods that allow Soldiers to better use and control highly automated training systems.	3.555	10.177	7.288
Accomplishments/Planned Programs Subtotals	6.145	13.574	12.636

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	**Project (Number/Name)** 792 / *Personnel Performance & Training*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	40.345	44.851	-	-	-	-	-	-	-	-	-
TR1: *TAC C4 Technology Int*	-	29.287	29.788	-	-	-	-	-	-	-	-	-
TR2: *Secure Tactical Information Integration*	-	11.058	15.063	-	-	-	-	-	-	-	-	-

Note

In the FY15 PB a $5M Congressional add appropriated to PE 0603006A in FY14 appeared in this PE due to a database error. That has been corrected.

Efforts in this PE were transferred to PE 0603794A beginning in FY16 for the purposes of correctly identifying the efforts as Command, Control and Communications Advanced Technology.

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates technologies to address the seamless integrated tactical communications challenge with distributed, secure, mobile, wireless, and self-organizing communications networks and networked transceivers that will operate reliably in diverse and complex terrains, in all environments. Efforts demonstrate seamlessly integrated communications and information security technologies across all network tiers, ranging from unattended networks and sensors through maneuver elements using airborne and space assets. Project TR1 investigates and leverages antennas; wireless networking devices, protocols, and software; network operations tools and techniques; and combines these and other technology options in a series of command, control, communications, and computers, intelligence, surveillance, and reconnaissance (C4ISR) on-the-move (OTM) network modernization demonstrations to measure their potential battlefield effectiveness. Project TR2 researches information security devices, techniques, services, software and algorithms to protect tactical wired and wireless networks against modern network attacks; generate and distribute tactical cyber situational awareness; and focuses on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions.

Work in this PE is complimentary of PE 0602782A (Command, Control, Communications Technology), and fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602783A (Computer and Software Technology), PE 0603001A (Warfighter Advanced Technology), PE0603270A (Electronic Warfare Technology) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	45.394	44.871	46.431	-	46.431
Current President's Budget	40.345	44.851	-	-	-
Total Adjustments	-5.049	-0.020	-46.431	-	-46.431
• Congressional General Reductions	-	-0.020			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.049	-			
• Adjustments to Budget Years	-	-	-46.431	-	-46.431
• Other Adjustments 2	-5.000	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR1 / *TAC C4 Technology Int*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
TR1: *TAC C4 Technology Int*	-	29.287	29.788	-	-	-	-	-	-	-	-	-

Note

Efforts in this project were transferred to PE 0603794A Project EL4 beginning in FY16.

A. Mission Description and Budget Item Justification

This project matures and demonstrates key communications and mobile networking technologies, such as antennas, transceivers, transceiver components, networking software and novel techniques to provide secure, reliable, mobile network solutions that function in complex and diverse terrains. This project concentrates on four major goals: to provide a series of technology demonstrations of new and emerging command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) technology enabled capabilities to significantly reduce risk associated with the network-of-networks concept; to lower the size, weight power and cost of wireless networking systems deployed on Army platforms through hardware and software convergence; to provide critical improvements in the ability to communicate and move large amounts of information in radio frequency (RF) contested environments, in a seamless, integrated manner across the Army's highly mobile manned and unmanned force structure; and to assess the technology readiness level (TRL) of emerging network technologies in an operationally relevant environment.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground Maneuver, Air and Soldier/Squad portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Antenna and Hardware Technologies (Formerly named Antenna Technologies)	2.615	1.845	-
Description: This effort matures and demonstrates low cost, power efficient, communications and electronic warfare (EW) antenna technologies for terrestrial and tactical satellite ground terminals. The focus is to reduce the visual signature and cost of antennas and reduce the number of antennas required on platforms by proving the capability to transmit and receive on multiple frequency bands, such as X/K/KA/Q for satellite communication (SATCOM) and ultra-high frequency/very-high frequency (UHF/VHF) and L Band for terrestrial communications on the same antennas. This effort also develops small form factor interference mitigation hardware for compatibility between communications and electronic warfare (EW) systems. Work accomplished under PE 0602782A/project H92 compliments this effort. This effort transitioned to PE 0603794A Project EL4 in FY16.			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR1 / *TAC C4 Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Demonstrated conformal antenna (including antenna feed system) integrated into Army ground platform; developed and fabricated EW antennas for non-tactical vehicles; developed radio frequency (RF) multiplexers to enable multiple communications systems to use a single antenna simultaneously within the same frequency bands. ***FY 2015 Plans:*** Design, fabricate and evaluate distributed On-the-Move (OTM) SATCOM antenna arrays to enable extension of high throughput satellite connectivity to tactical combat vehicles without interfering with weapons and targeting systems; develop a Government standard architecture for distributed SATCOM arrays to enable interoperability between various transceivers and antenna arrays.			
Title: RF Interoperability Through Convergence ***Description:*** This effort designs transceiver hardware and software standard and proof of concept that will reduce size, weight, power and cost of multiple communications and EW systems on tactical platforms. The standard and proof of concept demonstration takes advantage of common components within the communications and EW systems to define the internal and external interfaces to communications and EW devices. The effort includes implementing and publishing a reference architecture and associated specifications for a modular, open systems approach for integrating military communications and EW devices. Work being accomplished under PE 603270A/project K16 compliments this effort. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2015 Plans:*** Mature the radio reference architecture, specification and application program interfaces (API) to standardize radio modules and minimize life cycle cost of Army tactical communications devices on tactical vehicles; demonstrate, in a lab environment, a subset of communication systems components in an integrated package using the matured specification and API; investigate expansion of the reference architecture to include EW systems.	-	3.000	-
Title: C4ISR On-The-Move (OTM) ***Description:*** This effort provides a venue for the demonstration of new and emerging C4ISR technologies. This venue performs risk mitigation and technology assessments by evaluating the Technology Readiness Levels (TRLs) of candidate Army science and technology (S&T) and best of Industry efforts to support tactical network modernization. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2014 Accomplishments:*** Assessed the capability, functionality, and performance of network integrated architectures and emerging capabilities that support the Army Brigade Combat Team Modernization Plan and Network Modernization Strategy; finalized the evaluation of hybrid/ bridging architectures for Capability Sets 14/15 and conduct initial assessments of Capability Sets 16/17 architectures to support	8.956	8.939	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR1 / *TAC C4 Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
the associated programmed increments of Warfighter Information Network-Tactical (WIN-T) and Nett Warrior; provided a system of systems environment/venue to evaluate technical progress, assess the next generation of Army technologies and facilitate transition of S&T efforts; performed risk mitigation and TRL assessment of Army S&T programs and best of Industry efforts maturing in the FY14 timeframe for selection/inclusion as systems under evaluation for future Army Network Integration Events; and continued to support research and development of enabling Future Force capabilities and accelerate capabilities to enhance the current force. ***FY 2015 Plans:*** Assess the capability, functionality, and performance of network integrated architectures and emerging capabilities that support the Army Brigade Combat Team Modernization Plan and Network Modernization Strategy; conduct red team assessment of network technologies and architectures, assess the next generation of Army technologies and facilitate transition of S&T efforts with particular emphasis on enhancing field robustness and simplifying network set up and maintenance processes; perform risk mitigation and TRL assessment of Army S&T programs and best of industry efforts maturing in the FY15 timeframe; support the associated programmed increments of WIN-T and Nett Warrior Programs of Record.			
Title: Communication Networking Technologies (Formerly named Wireless Mobile Networking)	8.942	8.254	-
Description: This effort matures and demonstrates components, software, algorithms and services that enable Army tactical wireless networks to operate more efficiently in both the use of RF spectrum and network resources for terrestrial and Satellite Communication (SATCOM) systems. This effort matures and demonstrates software to improve performance of wireless tactical networks in austere and hostile RF spectrum environments by composing and coding algorithms and protocols that sense network and spectrum conditions, to automatically adapt network node behaviors to make more efficient use of available resources. Efforts target improving RF communications performance in complex terrain, enabling communications while simultaneously operating electronic protection devices. Efforts also include adapting commercial wireless technology for use in the tactical environment. Work accomplished under PE 0602782A/project H92 and 0603008A TR2 compliments this effort. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2014 Accomplishments:*** Matured all-digital strategic SATCOM terminal components to increase SATCOM channel capacity and reduce vulnerability to interference; for Army tactical ground communications, adapted and matured directional radio networking protocols and routing algorithms to improve spectral efficiency, network robustness and resistance to RF interference; adapted and integrated spatial diversity signal processing to improve wireless communications performance in complex (e.g. urban, forested) terrain; designed modular waveform components and matured algorithms that support simultaneous communications and blue force jamming; designed radio reference architecture, specification and application program interface (API) to standardize radio modules and			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR1 / *TAC C4 Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
minimize life cycle cost of Army tactical communications devices; investigated, adapted and developed techniques to allow use of commercial cellular and smart devices in Army communications bands and environments. ***FY 2015 Plans:*** Complete integration of all digital strategic ground terminal components and demonstrate improved bandwidth utilization at reduced size, weight and power; using the all digital strategic ground terminal, demonstrate SATCOM spectrum monitoring and control, and integrate RF signal modulation techniques to enable improved SATCOM performance against jamming; complete implementation of signals management module software; complete modifications to Soldier Radio Waveform (SRW) and radio operating environment to support frequency hopping at timeslot boundaries using parameters chosen by the software; integrate, test, and demonstrate signal management software with SRW modifications to support simultaneous communications and blue force jamming.			
Title: Network Operations (NetOps) ***Description:*** This effort matures network operations tools (network management, information dissemination management and cyber security) to simplify the planning, management and troubleshooting of complex tactical communications networks. Focus is on network visualization, incident correlation and decision aids that assist soldiers with managing the complexity inherent with wireless, On-the-Move communications networks. ***FY 2014 Accomplishments:*** Developed and demonstrated software for automating the decision and implementation processes for configuring and re-configuring network components; developed a collaborative execution environment in an effort to provide a decision enhancing capability enabling unit signal officers to collaborate when managing tactical communication resources. ***FY 2015 Plans:*** Complete integration of decision software tools and processes for configuring tactical network components with existing network monitoring tools and demonstrate the capability to visualize the function and health of the multi-tiered network; demonstrate reduced cycle times to automatically generate network configurations and anomaly corrections.	3.921	2.750	-
Title: Networking technologies for Wireless Personal Area Networks (WPAN) ***Description:*** This effort develops and matures wireless personal area network (WPAN) technology for the Soldier in a manner approved by the National Security Agency (NSA) for up to Secret data traffic. This effort is coordinated with PE 0603001A/Project J50. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2014 Accomplishments:*** Designed and analyze networking architectures, frameworks and protocols to link devices into individual WPANs while allowing multiple WPANs to operate concurrently without interference; designed and coded a tactical standard waveform and protocols	4.853	5.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR1 / *TAC C4 Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
for up to Secret short range wireless communication between WPAN nodes that meet NSA security requirements; matured, integrated and demonstrated wireless hardware components for integration onto Soldier-borne equipment such as hand held computing platforms, radios, weapon sites, information displays and Soldier-borne sensors to develop a WPAN without impacting the size, weight power and cost of these devices. ***FY 2015 Plans:*** Conduct evaluation of multiple WPAN design solutions for performance, reliability and security; develop specification and architecture of WPAN hardware interfaces and software; establish studies for WPAN standards for security and interface development; perform lab, RF chamber, and field electromagnetic compatibility, low probability of intercept and low probability of detection validation; conduct field evaluations of selected design(s) on multiple Soldier Systems.			
Accomplishments/Planned Programs Subtotals	29.287	29.788	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR2 / *Secure Tactical Information Integration*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
TR2: *Secure Tactical Information Integration*	-	11.058	15.063	-	-	-	-	-	-	-	-	-

Note

Efforts in this project were transferred to PE 0603794A Project EL5 beginning in FY16.

A. Mission Description and Budget Item Justification

This project matures and demonstrates software, algorithms and services that focus on tactical cyber situational awareness, autonomous network defense, cross domain security and encryption solutions to secure the Army's tactical network. Efforts focus on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions. This project codes, optimizes, and demonstrates software based technologies for intrusion detection, high assurance internet protocol (IP) encryption, seamless communications across security boundaries, as well as information sharing across operations and intelligence functions. These capabilities to automate, protect, monitor, report and access cyber elements of the tactical network are intended to greatly reduce Soldier burden and protect the Army's tactical network by building upon enterprise solutions from commercial, Department of Defense, Department of the Army and other government agencies. This project cumulatively builds science and technology capabilities in accordance with Army Cyber Material Development Strategy and the Office of the Secretary of Defense Cyber Community of Interest.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground Maneuver, Air and Soldier/Squad portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications Electronics Research Development and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Tactical Defensive Cyber (formerly named Information Assurance)	11.058	15.063	-
Description: This effort matures and demonstrates technologies that create new methods for proactively defending resource constrained tactical wireless networks against cyber attack using nontraditional methodologies. Work being performed under PE / projects 0602782/H92, 0602783/Y10 and 0603008A/TR1 complement this effort. This effort transitioned to PE 0603794A Project EL5 in FY16.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR2 / *Secure Tactical Information Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Matured dynamic moving target defense internet protocol (IP) and ported network hopping techniques; designed and coded software to dynamically modify operating systems and applications to increase an adversary's work factor to exploit Army networks; designed and coded moving target defense capability management software tools; demonstrated integration of IP and port hopping, with protection capabilities within the Army's communications network devices (CND) common operating environment; developed cyber attack prediction techniques to include associated consequences to help reason on adversarial intent and motivation to predict cyber related attacks on Army networks and associated consequences; utilized polymorphic and metamorphic transformation engines to develop new techniques to detect malware variants; designed and coded algorithms to assess software at the binary code level to detect malicious intent; demonstrated software assurance capability to seamlessly integrate Army software assurance tools with those developed by other DoD laboratories; designed and coded protection software tools for server components and design and code network security controls for the tactical cloud computing environment. ***FY 2015 Plans:*** Mature and code software algorithms to differentiate between stealthy attacks and software coding errors to reduce the vulnerability in software applications; demonstrate dynamic moving target defense internet protocol (IP) and port network hopping techniques; demonstrate software to dynamically modify operating systems and applications to make it more difficult for an adversary to exploit Army networks; demonstrate moving target defense capability management software tools; demonstrate integration of IP and port hopping with existing protection capabilities; encode and demonstrate user behavior and operating system anomaly sensors, and anomaly based learning algorithms to provide protection against zero day malware; demonstrate ability to leverage tactical systems to augment local cyber situational awareness; demonstrate dissemination and correlation of offensive and defensive cyber data within the intelligence enterprise to enable tactical defensive cyber operations; investigate cloud based security architectures to enable self monitoring and healing of cloud security services that can perform rapid battle damage assessment and rapidly apply security services against threats; mature, fabricate and demonstrate an anti-tamper key loader for devices that use subscriber identity modules and smart cards; design and instantiate security architectures for multi-functional waveforms and converged communications and electronic warfare transceivers.			
Accomplishments/Planned Programs Subtotals	11.058	15.063	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603008A / *Electronic Warfare Advanced Technology*	**Project (Number/Name)** TR2 / *Secure Tactical Information Integration*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603009A / *TRACTOR HIKE*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	9.161	7.492	7.502	-	7.502	8.074	8.650	8.686	8.858	-	-
B18: *DB18*	-	4.323	7.492	7.502	-	7.502	8.074	8.650	8.686	8.858	-	-
B31: *DB31*	-	4.838	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	9.161	7.492	7.557	-	7.557
Current President's Budget	9.161	7.492	7.502	-	7.502
Total Adjustments	-	-	-0.055	-	-0.055
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.055	-	-0.055

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) B18 / *DB18*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
B18: *DB18*	-	4.323	7.492	7.502	-	7.502	8.074	8.650	8.686	8.858	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1)

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) B31 / *DB31*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
B31: *DB31*	-	4.838	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1)

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	13.168	16.740	17.425	-	17.425	17.719	17.803	20.927	21.345	-	-
S28: *Immersive Learning Environments*	-	2.485	2.736	3.121	-	3.121	3.254	3.100	4.153	4.236	-	-
S29: *Modeling & Simulation - Adv Tech Dev*	-	6.227	8.881	9.213	-	9.213	6.922	7.024	8.052	8.213	-	-
S31: *Modeling And Simulation Infrastructure Technology*	-	4.456	5.123	5.091	-	5.091	7.543	7.679	8.722	8.896	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates tools to enable effective training capability for the Warfighter. Project S28 matures and demonstrates simulation technologies developed by the Institute for Creative Technologies (ICT) at the University of Southern California. Project S29 incorporates advanced modeling and simulation (M&S), training, and leader development technology into immersive training demonstrations as well as demonstrates a framework for future embedded training and simulation systems for future force combat and tactical vehicles, and dismounted Soldier systems. Project S31 develops, integrates and demonstrates an overarching M&S architecture that incorporates multi-resolution, entity-based models, simulations, and tools to enable Network-Centric Warfare M&S capability.

Work in this PE complements and is fully coordinated with efforts in PE 0602308A (Advanced Concepts and Simulation), PE 0602785A (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology) and PE 0603007A (Manpower, Personnel and Training Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy

Work in this PE is performed by the U.S. Army Research Laboratory, Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, FL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	13.620	16.749	17.553	-	17.553
Current President's Budget	13.168	16.740	17.425	-	17.425
Total Adjustments	-0.452	-0.009	-0.128	-	-0.128
• Congressional General Reductions	-	-0.009			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.452	-			
• Adjustments to Budget Years	-	-	-0.128	-	-0.128

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S28 / *Immersive Learning Environments*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
S28: *Immersive Learning Environments*	-	2.485	2.736	3.121	-	3.121	3.254	3.100	4.153	4.236	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates immersive technologies that include the application of photorealistic synthetic environments, multi-sensory interfaces, virtual humans, and training applications on low-cost game platforms for Soldier training applications using simulation technologies. This project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies that are created at the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California to develop training demonstrators. These demonstrators focus on urban operations, asymmetric warfare, resilience and rehabilitation to support Warfighting units and Army Institutions (U. S. Army Training and Doctrine Command (TRADOC) and U.S. Army Medical Command (MEDCOM)). Resilience and rehabilitation research will focus on Post Traumatic Stress Disorder (PTSD). The ICT's collaboration with its entertainment partners creates a true synthesis of creativity and technology that harnesses the capabilities of industry, and the research and development community to advance the Army's capabilities.

Efforts in this program element (PE) support the Army science and technology Soldier portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Immersive Techniques for Training Applications	2.485	2.736	3.121
Description: This effort demonstrates and matures technological advancements from PE 0602308A/Project D02 into complex state-of-the-art simulation environments in support of multi-student and team training applications.			
FY 2014 Accomplishments: Matured the tools and technologies required to create prototype simulations, games, and virtual environments focused on training commanders on the decision making, planning, and leadership for institutional and Warfighting units; and explored advanced display technologies to prototype new low cost immersive displays for virtual training environments.			
FY 2015 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S28 / *Immersive Learning Environments*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Investigate visual perception technologies and effects and use findings to incorporate more natural human perception/ performance in virtual training environments; and demonstrate how technologies that capture the essence of high performing instructors can be used to improve virtual classroom instruction. ***FY 2016 Plans:*** Will mature collaborative virtual environments through the incorporation of live objects to enhance user's immersion experience and improve user's performance; optimize simulation techniques such as redirected walking (creates real time virtual environment adjustments to allow user to walk through large scale environment while remaining in a smaller physical space) by expanding capability to support multiple users moving within a single virtual reality training environment.			
Accomplishments/Planned Programs Subtotals	2.485	2.736	3.121

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
S29: *Modeling & Simulation - Adv Tech Dev*	-	6.227	8.881	9.213	-	9.213	6.922	7.024	8.052	8.213	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates next generation training and simulation systems that integrate virtual threats, asymmetric warfare concepts, network-centric operations, and embedding training capabilities as well as technologies into operational go-to-war future force systems to include dismounted warrior systems. The synergy between these embedded training capabilities and the immersive training advanced technology development in Project S28 provides Army units with a set of complementary embedded as well as deploy-on-demand systems that provide just-in-time, dynamic, realistic training, and mission rehearsal capabilities. Demonstrations include technologies that form a framework for future training applications for the range of future force operations such as robotic control and other sensor operations; mission planning and rehearsal; maneuver; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network analysis to support distributed simulations; and vehicle system interface requirements. This project creates a joint environment by synchronizing virtual and constructive simulated forces with the next generation and current training systems from the Army, Navy, Air Force, and Marine Corps forces.

Efforts in this program element (PE) support the Army science and technology Soldier portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Embedded Techniques	6.227	7.881	8.013
Description: This effort matures and demonstrates capabilities (most provided from PE 0602308A/project C90) built into or added onto operational systems, subsystems, or equipment, to enhance as well as maintain the skill proficiency of Soldiers, and maximizes component commonality among combat vehicles and Soldier computer systems.			
FY 2014 Accomplishments: Designed embedded training components (e.g. predictive simulation) for current and future Command and Control systems for both mounted and dismounted Soldiers; designed components for advance sensor technology for locomotion and gesturing; advanced and matured technology for developing artificial intelligence behaviors for interactive characters in a mixed kinetic/non-			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
kinetic training scenario within a dismounted squad virtual game environment; and advanced and conducted experimentation with tactile feedback technology. ***FY 2015 Plans:*** Mature component design of algorithms for course of action embedded training on current and future command and control systems; mature component design of advanced sensor technology for locomotion and gesturing, tactile feedback technology, and artificial intelligence behaviors for computer generated forces to simulate dismounted squads; and validate component technology maturity in relevant simulation environments. This effort develops virtual, mixed and augmented technologies for dismounted Soldier training. ***FY 2016 Plans:*** Will complete FY15 component designs for embedded training on current and future command and control systems; develop prototype systems of advanced sensor technology for locomotion, gesturing and tactile feedback technologies for computer generated forces to simulate dismounted squads; mature, demonstrate and assess effectiveness of augmented reality training systems for dismounted Soldier training.			
Title: Training Effectiveness ***Description:*** This research addresses the effectiveness of training Soldiers and teams in immersive environments. This effort will research and develop simulations to determine the interaction of realism, immersion, acceptance, and training effectiveness. A baseline of the key dimensions of realism and immersion for current training systems will be developed and will be extended to generate guidelines for the development of future training technologies. Cost effectiveness of these training components will also be considered. ***FY 2015 Plans:*** Identify impacts and tradeoffs associated with training effectiveness using current (training) simulation architectures and the expected training effectiveness associated with using future virtual, mixed, and augmented reality training technologies. ***FY 2016 Plans:*** Will provide a baseline of measures and methods for use in assessing training effectiveness for a subset of technologies used in various training environments (simulated and live); and begin to develop comparative assessment strategies needed to measure effectiveness of future virtual, mixed, and augmented reality training technologies and identify gaps in measurement techniques.	-	1.000	1.200
Accomplishments/Planned Programs Subtotals	6.227	8.881	9.213

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
S31: *Modeling And Simulation Infrastructure Technology*	-	4.456	5.123	5.091	-	5.091	7.543	7.679	8.722	8.896	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project matures and demonstrates a distributed modeling and simulation (M&S) environment that integrates a collection of multi-fidelity models and simulations and tools that map to an evolving architecture and M&S activities to support decisions throughout the acquisition life-cycle. This provides a unifying M&S architecture that synchronizes and integrates multi-resolution modeling applications such as Live, Virtual, and Constructive (LVC) experimentation. This effort focuses on researching cutting-edge M&S methods to enable the Army and DoD to perform critical System of Systems (SoS) analysis, experimentation, technology tradeoffs, capability assessments, concept development, and training that saves time and resources while increasing the effectiveness of acquisition and training activities.

Efforts in this program element (PE) support the Army science and technology Soldier portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Advanced Distributed Simulation Environments	4.456	5.123	5.091
Description: In FY14, this effort was renamed from Modeling Architecture for Technology, Research, and Experimentation (MATRIX) to Advanced Distributed Simulation Environments to reflect this effort's evolution of simulation technologies. This effort matures and demonstrates modeling and simulation (M&S) technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and System of Systems (SoS) architecture, technology tradeoffs, etc.			
FY 2014 Accomplishments: Refined and matured SoS architecture for integration and use in Army and DoD simulation and training programs; matured a generalized interface for the systems engineering architecture and M&S tools for transition to DoD programs with existing M&S systems engineering capabilities; matured and refined Distributed Soldier Representation to demonstrate a Soldiers-as-a-Service			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
simulation (illustrating relevance of human factors data to training); identified hardware and software solutions that decreased dependence on third party solutions; formalized M&S in a cloud environment (M&S as a service tool for training and mission rehearsal simulations across geographically distributed areas); provided a tool to rapidly configure and run training simulations by maturing and translating simulations from complex scenario definitions and databases; matured and refined M&S tools targeted towards Program Executive Office for Simulation, Training and Instrumentation (PEO STRI) simulation needs. ***FY 2015 Plans:*** Mature and demonstrate SoS simulation architecture technologies for integrating Army and DoD simulation and training programs; demonstrate an initial distributed Soldier simulation providing a more complete representation of the Soldier by including effects such as culture, individual stress, resilience, social and family relationships, individual and unit decision making, and effects on performance; mature and demonstrate M&S as a cloud-based service that supports training and mission rehearsal simulations across geographically distributed areas; advance and refine simulation and training technologies in support of the Army next generation training initiatives; and mature and transition M&S hardware and software solutions targeted towards PEO STRI simulation needs. ***FY 2016 Plans:*** Will exploit current simulation architecture technologies to demonstrate utility for use in a future robust, single simulation architecture (Future Holistic Training Environment-Live/Synthetic (FHTE-LS)) and identify associated technology gaps; refine and demonstrate distributed Soldier simulation for use in training and analysis applications; mature and demonstrate M&S as a cloud-based service that supports experimentation and testing across geographically distributed areas; Demonstrate potential of current training simulation technologies for use in areas such as cyber training in support of PEO STRI simulation technology gaps.			
Accomplishments/Planned Programs Subtotals	4.456	5.123	5.091

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603020A / *TRACTOR ROSE*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	10.662	14.483	11.912	-	11.912	11.910	11.911	11.930	12.167	-	-
B84: *DB84*	-	2.499	2.540	-	-	-	-	-	-	-	-	-
DB1: *DDB1*	-	8.163	11.943	11.912	-	11.912	11.910	11.911	11.930	12.167	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	10.662	14.483	12.000	-	12.000
Current President's Budget	10.662	14.483	11.912	-	11.912
Total Adjustments	-	-	-0.088	-	-0.088
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.088	-	-0.088

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603020A / *TRACTOR ROSE*				Project (Number/Name) B84 / *DB84*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
B84: *DB84*	-	2.499	2.540	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603020A / *TRACTOR ROSE*				Project (Number/Name) DB1 / *DDB1*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
DB1: *DDB1*	-	8.163	11.943	11.912	-	11.912	11.910	11.911	11.930	12.167	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(l).

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	14.546	24.257	27.520	-	27.520	27.686	24.906	25.199	25.701	-	-
DF5: *Agile Integration & Demonstration*	-	14.546	24.257	27.520	-	27.520	27.686	24.906	25.199	25.701	-	-

A. Mission Description and Budget Item Justification

This Program Element demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include: hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the U.S. Department of Energy to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; experimentation and red teaming of rapidly deployable technologies that enable troops at small, remote bases or integrated within local communities to detect, assess, and defend against a range of enemy threats; and red-teaming to stress and assess emerging systems earlier in the life-cycle, providing a more holistic understanding of employment risks in operationally-representative environments and against potential threats.

This Program Element supports the Command, Control, Communications and Intelligence (C3I), Ground, and Innovation Enablers Portfolios.

Work in this project is complementary to and is fully coordinated with PE 0602105A (Materials Technology), PE 0602270A (Electronic Warfare Technology), PE 0602303A (Missile Technology), PE 0602618A (Ballistics Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602784A (Military Engineering Technology), 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603270A (Electronic Warfare Technology), PE 0603710A (Night Vision Advanced Technology), and PE 0603734A (Military Engineering Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this Program Element is performed by the Army Research, Development, and Engineering Command (RDECOM) and the Army Engineer Research and Development Center (ERDC).

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	15.046	24.270	27.722	-	27.722
Current President's Budget	14.546	24.257	27.520	-	27.520
Total Adjustments	-0.500	-0.013	-0.202	-	-0.202
• Congressional General Reductions	-	-0.013			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.500	-			
• Adjustments to Budget Years	-	-	-0.202	-	-0.202

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
DF5: *Agile Integration & Demonstration*	-	14.546	24.257	27.520	-	27.520	27.686	24.906	25.199	25.701	-	-

A. Mission Description and Budget Item Justification

This project demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include: hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the U.S. Department of Energy to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; experimentation and red teaming of rapidly deployable technologies that enable troops at small, remote bases or integrated within local communities to detect, assess, and defend against a range of enemy threats; and red-teaming to stress and assess emerging systems earlier in the life-cycle, providing a more holistic understanding of employment risks in operationally-representative environments and against potential threats.

This project supports the Command, Control, Communications and Intelligence (C3I), Ground, and Innovation Enablers Portfolios.

Work in this project is complementary to and is fully coordinated with PE 0602105A (Materials Technology), PE 0602270A (Electronic Warfare Technology), PE 0602303A (Missile Technology), PE 0602618A (Ballistics Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602784A (Military Engineering Technology), 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603270A (Electronic Warfare Technology), PE 0603710A (Night Vision Advanced Technology), and PE 0603734A (Military Engineering Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM) and the Army Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Hybrid Intelligent Power (HI Power)	4.828	-	-
Description: This effort matures and demonstrates intelligent power management hardware and software to reduce the use of fossil fuel in tactical generators while increasing energy security. The intelligent power management technologies are plug-and-play to enable faster power grid setup times and to eliminate human error as well as to reduce soldier planning burden.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Continued to define and demonstrate standards and protocols for tactical microgrids; developed a universal device controller able to monitor and manage power sources and loads; continued to advance technologies that enable the use of renewable power sources and energy storage systems for storing any excess grid power; demonstrated a grid power manager that can utilize all power assets on the battlefield to insure optimum power utilization based on mission requirements.			
Title: Rapidly Deployable Technologies	4.887	5.060	5.060
Description: This effort conducts live, virtual, and mixed-scenario experiments to stress and assess emerging technology systems that are targeted to support troops operating in forward areas, improving technology design, development, and ultimate employment. These technologies must be readily transportable; require minimal set up, take down, and operational effort; and easily adaptable across a variety of missions, environments, and threats. This effort is coordinated with PE 0602784A, PE 0602786A, and PE 0603734A. ***FY 2014 Accomplishments:*** Analyzed and selected emerging threats that expeditionary units operating at remote bases or integrated with local communities may face in the future. Developed and conducted a set of five experiments using live, virtual, and mixed scenarios in representative operational environments to stress deployable force protection developing technologies; integrated and assessed over 20 technology systems in experiments at Camp Roberts, CA, Stennis, MS, Marine Corps Base Quantico, VA and Fort Harrison, MT. Incorporated technologists, capability developers and Soldiers from a variety of military occupations and specialties as part of experiments and demonstrations; added interagency operators into Warfighter-executed scenarios; integrated and assessed Army S&T products from logistics basing and other force protection basing development efforts. Introduced PACOM scenarios into experiments, adding to CENTCOM, SOUTHCOM and AFRICOM scenarios; expanded challenge events to identify potential technology and employment vulnerabilities during denial of service attacks/conditions. Expanded and automated the Warfighter Technology Tradespace Methodology to identify and characterize potential system employment vulnerabilities; provided feedback to developers for systems improvement and needed research areas. ***FY 2015 Plans:*** Increase focus on active defense measures for small expeditionary units based on critical threats associated with one or two high-priority operational environments; develop and integrate critical measures of success into the Warfighter Technology Tradespace Methodology to include assessing systems' means to adapt, as well as new measures specific to one or two select new theaters; expand quantitative protocols for field-based experiments; implement narrative-based modeling and assessment tool for Warfighter feedback on technologies to expose and eliminate barriers affecting technology acceptance and use; conduct a series of experiments using live and virtual scenarios and coordinated demonstrations to identify, expose, and mitigate system			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
vulnerabilities; leverage ongoing activities with units such as Special Operations Teams where possible to conduct in-country assessments and garner feedback on performance of high-priority systems. ***FY 2016 Plans:*** Will incorporate Army G-2 and TRADOC-provided threat information, as well as the expertise of Special Forces Soldiers, to develop a series of operationally relevant experiments that stress the performance limits of emerging and fielded systems geared for small unit expeditionary forces. Will integrate PACOM, AFRICOM, SOUTHCOM and/or CENTCOM-based scenarios into experiments and target specific environments of interest (e.g., wooded, marine, urban, contested and congested radio frequency (RF)). Will replicate relevant threat/overmatch capabilities (e.g., commercially available computer network, RF, and electromagnetic (EM) attack methodologies) and integrate, train, and operate technology systems in increasingly complex blue/red team scenarios. Will expand and refine quantitative measures of success for the Warfighter Technology Tradespace Methodology, and assess systems' performance across technical, user, supportability, and adaptability factors. Will uncover technology system vulnerabilities, including risks to user acceptance, and recommend mitigation options and/or areas for additional development.			
Title: Technology Systems Adaptive Red Teaming ***Description:*** This effort seeks to challenge conventional approaches to technology and systems development and insertion, and increase the awareness of risks and opportunities earlier in the lifecycle in order to improve system design, development and employment. It builds on the concepts and methodology developed under the Deployable Force Protection Adaptive Red Teaming effort and applies them to other high-priority areas for the Army. It designs and conducts a series of live, virtual and mixed scenarios and demonstrations to evaluate the most promising technologies. It stresses and assesses developing technology systems for both individual and system-of-system performance across a representation of operational environments, realistic scenarios and emerging threats. Activities include: identifying, integrating and examining system performance at live demonstration venues with experienced operators; emulating emerging threats and alternative futures to challenge assumptions regarding scenarios and system employment; and identifying and informing of potential vulnerabilities in systems and systems-of-systems, including but not limited to, performance degradation in congested/contested environments, interoperability, and adaptability. This effort is coordinated with program element 0602618A, 0602270A and 0603270A. ***FY 2014 Accomplishments:*** Selected developing electronic warfare technology systems for demonstration and evaluation; analyzed and selected current and emerging operationally relevant scenarios and threats for use in system experimentation, developed a set of experiments to stress system and operator performance and identified potential user acceptance risks when employed. Incorporated Soldiers from a variety of Military Occupation Specialties to acquire user feedback; applied and expanded the Warfighter Technology Tradespace	4.831	9.121	12.298

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Methodology and analysis to address system-specific factors of success; and provided systems assessment to inform technology development, systems integration, training, logistics and employment. ***FY 2015 Plans:*** Utilize stakeholder analysis, operational scenarios and findings from technology vulnerability assessments to identify three to four high-priority developmental systems that support Army acquisition programs within areas such as intelligence, surveillance, and reconnaissance (ISR), electronic warfare, and/or communications. Conduct in-depth, phased assessments that incorporate near-peer threats and live experiments with Warfighters to stress the systems under different scenarios and uncover vulnerabilities pertaining to systems integration, interoperability, adaptability and technology employment. Recommend means to harden systems against vulnerabilities and reduce risks arising from operational and logistics contexts. ***FY 2016 Plans:*** Will incorporate intelligence, requirements, acquisition, and science and technology community stakeholder input to identify developmental systems that support key Army acquisition programs, either current or planned. System areas of interest include: Positioning, Navigation and Timing; Weapons Systems Guidance and Control; Threat Detection/Hostile Fire Detection; Counter-Rocket, Artillery and Mortar (C-RAM), Counter-Precision Guided Munitions (C-PGM), and/or Counter-Unmanned Aerial Systems (C-UAS); Platform Common Architectures; Sensor Protection Technologies; Robotics and Autonomous/Semi-Autonomous Systems; and Denial and Deception Technologies. Will design and conduct a series of in-depth, phased assessments that incorporate near-peer threats and field experiments with experienced Warfighters; will stress the systems under various, operationally-relevant scenarios and uncover potential risks pertaining to systems integration, interoperability, adaptability, user technology acceptance, and performance in contested environments. Will recommend means to mitigate or reduce systems' vulnerabilities, with the goal of informing current or future acquisition programs early in the development lifecycle.			
Title: Ground Platform Subsystem Demonstrations ***Description:*** This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, vehicle architecture and systems integration. Specifically, this effort focuses on maturing and demonstrating integrated vehicle power management, generation and distribution technologies to increase ground vehicle energy efficiencies and ensure ground platforms have enough power to enable future capabilities such as electromagnetic armor, active protections systems, IED detect and defeat technologies, advanced situational awareness and future network integration technologies. This effort is coordinated with PE 0603005A. ***FY 2015 Plans:*** Conduct analysis of vehicle architecture and power systems. Evaluate Government and contractor developed platform architectures and conduct trades studies, analysis and interface testing to ensure common power architecture designs meet known future vehicle power requirements. Update VICTORY architecture standards to drive next generation combat platform data	-	5.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and electrical architectures to enable affordable future upgrade capability for the combat fleet. Investigate advanced capability in integrated platform power management and electrical power generation and distribution while reducing parasitic thermal burdens on the vehicle system. ***FY 2016 Plans:*** Will analyze the next generation power and data architecture and the corresponding system design's interface with vehicle subsystems, specifically powertrain subsystems. Will demonstrate electronic control communication between powertrain system components. Will mature the engine controls architecture to optimize engine power density, fuel efficiency and heat rejection. Will finalize requirements for demonstrating a system design of the next generation power and data architecture integrated on a combat vehicle, in order to validate the open architecture and power and data capabilities required for the Combat Vehicle Prototyping program and future vehicle modernization efforts.			
Title: Ground Vehicle Power and Energy ***Description:*** This effort matures and demonstrates advanced technologies that enable military ground vehicles to become significantly more energy efficient. It collaborates with the U.S. Department of Energy to demonstrate technologies in: advanced combustion engines and transmissions; lightweight structures and materials; energy recovery and thermal management; alternative fuels and lubricants; hybrid propulsion systems; batteries and energy storage; and analytical tools (e.g., modeling and simulation). This effort is coordinated with program element 0602601A. ***FY 2015 Plans:*** Support the Advanced Vehicle Power Technology Alliance (AVPTA) to mature advanced modeling tools to understand the behavior of batteries at the component, cell and module/pack levels and aid future efforts to develop new energy storage systems; conduct reliability studies utilizing military form factor advanced chemistry batteries to drive military standards into the commercial sectors, with the intent to reduce the Army cost of advanced batteries; investigate advanced lightweight materials and demonstrate advanced manufacturing techniques to reduce platform structural weight and drive down associated costs; and leverage significant investments in commercial trucking industry to demonstrate fuel efficient and active safety technologies for Army tactical vehicles. ***FY 2016 Plans:*** Will continue to support the Advanced Vehicle Power Technology Alliance (AVPTA) with the Department of Energy (DOE) to mature and demonstrate technologies within the alliance technology focus areas. Will complete demonstration of lightweight structures and materials using advanced manufacturing techniques. Will develop advanced lubricants to help mitigate frictional losses in powertrain to increase vehicle efficiency. Will develop the capability to model advanced chemistry batteries and	-	5.076	5.162

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
batteries in extreme temperature conditions. Will investigate autonomy-enabled technologies and vehicle electrification to leverage common military and industry investments.			
Accomplishments/Planned Programs Subtotals	14.546	24.257	27.520

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603130A / *TRACTOR NAIL*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	3.192	3.440	2.381	-	2.381	2.340	2.381	2.397	2.445	-	-
DS8: *Tractor Nail*	-	3.192	3.440	2.381	-	2.381	2.340	2.381	2.397	2.445	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1)

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	3.192	3.440	2.398	-	2.398
Current President's Budget	3.192	3.440	2.381	-	2.381
Total Adjustments	-	-	-0.017	-	-0.017
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.017	-	-0.017

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603131A / *TRACTOR EGGS*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	2.366	2.406	2.431	-	2.431	2.470	2.515	2.529	2.580	-	-
DS9: *Tractor Eggs*	-	2.366	2.406	2.431	-	2.431	2.470	2.515	2.529	2.580	-	-

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1)

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	2.366	2.406	2.447	-	2.447
Current President's Budget	2.366	2.406	2.431	-	2.431
Total Adjustments	-	-	-0.016	-	-0.016
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.016	-	-0.016

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	24.652	26.046	26.874	-	26.874	27.393	25.767	26.203	26.725	-	-
K15: *Advanced Comm Ecm Demo*	-	9.709	8.603	7.435	-	7.435	7.603	9.769	9.897	10.094	-	-
K16: *Non-Commo Ecm Tech Dem*	-	14.943	17.443	19.439	-	19.439	19.790	15.998	16.306	16.631	-	-

Note

FY16 decrease to support higher priority Army research areas.

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates electronic warfare (EW) sensors and software intended to deny, disrupt, locate or destroy the enemy's command, control and communications (C3) systems and intelligence, surveillance and reconnaissance assets. This PE matures both countermeasures (CM) and counter-countermeasures (CCM) to deny the enemy the use of their systems while protecting US assets from enemy deception and jamming. Project K15 matures and demonstrates capabilities to locate and exploit enemy communication systems including computer networks. Project K16 matures and demonstrates multifunctional EW capabilities (jamming) to enhance platform survivability and provide near real-time situational awareness to the Commander through the detection, identification and geo-location of emitters of interest.

Work in this PE is complimentary of PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602270A (Electronic Warfare Technology), PE 0603008A (Command, Control, Communications Advanced Technology), PE 0603772A (Advanced Tactical Computer Science) and PE 0603794A (Command, Control and Communications Advanced Technology), and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Ballistics Technology), PE 0603003A (Aviation Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603794A (Command, Control and Communications Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	25.335	26.057	31.652	-	31.652
Current President's Budget	24.652	26.046	26.874	-	26.874
Total Adjustments	-0.683	-0.011	-4.778	-	-4.778
• Congressional General Reductions	-	-0.011			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.683	-			
• Adjustments to Budget Years	-	-	-4.778	-	-4.778

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K15 / *Advanced Comm Ecm Demo*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K15: *Advanced Comm Ecm Demo*	-	9.709	8.603	7.435	-	7.435	7.603	9.769	9.897	10.094	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates electronic warfare (EW) sensors and software intended to deny, disrupt, locate or destroy the enemy's command, control and communications (C3) systems and intelligence, surveillance and reconnaissance assets. This PE matures both countermeasures (CM) and counter-countermeasures (CCM) to deny the enemy the use of their systems while protecting US assets from enemy deception and jamming. Project K15 matures and demonstrates capabilities to locate and exploit enemy communication systems including computer networks. Project K16 matures and demonstrates multifunctional EW capabilities (jamming) to enhance platform survivability and provide near real-time situational awareness to the Commander through the detection, identification and geo-location of emitters of interest.

Work in this PE is complimentary of PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602270A (Electronic Warfare Technology), PE 0603008A (Command, Control, Communications Advanced Technology), PE 0603772A (Advanced Tactical Computer Science) and PE 0603794A (Command, Control and Communications Advanced Technology), and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Ballistics Technology), PE 0603003A (Aviation Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603794A (Command, Control and Communications Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Offensive Operations	4.734	4.905	5.000
Description: This effort matures and demonstrates integrated electronic attack (EA) and computer network operations (CNO) hardware and software to execute force protection (FP), EA, electronic surveillance (ES), signals intelligence (SIGINT) and electronic warfare (EW) missions in a dynamic, distributed and coordinated fashion. This results in the capability to engage a multitude of diverse multi-node, multi-waveform, multi-platform and cyber (internetworked computers) targets while maximizing overall network efficiency and effectiveness, and preserving blue force/non-combatant communications. Work being accomplished under PE 0603270A/project K16 and PE 0602270/project 906 compliment this effort.			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K15 / *Advanced Comm Ecm Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Coded and demonstrated protocol exploitation software and techniques that allow users to remotely coordinate, plan, control and manage tactical EW and cyber assets; developed techniques to exploit protocols of threat devices not conventionally viewed as cyber to expand total situational awareness by providing access to and control of adversary electronic devices in an area of operations. ***FY 2015 Plans:*** Mature techniques to enable tagging, tracking and locating missions for combined cyber/EW signals and entities of interest; mature and demonstrate joint cyber/EW architecture for combined mission operation; integrate and mature cyber/EW and signals intelligence capability into an airborne platform and assess utility of conducting missions with all three capabilities simultaneously. ***FY 2016 Plans:*** Will use representative blue force systems to conduct exploitation of emerging signals of interest (SOI) to determine potential cyber/EW/collection applications for each signal; mature and integrate advanced techniques to enable new mission capabilities to exploit emerging target SOI; utilize emerging software defined radios as platforms to implement and demonstrate these techniques in an open and modular framework for potential porting into candidate existing and emerging Programs of Record.			
Title: Stand-off Non-Cooperative Multi-Intelligence (Multi-INT) Technologies ***Description:*** This effort matures and demonstrates hardware and software to conduct standoff intelligence, surveillance and reconnaissance in a three dimensional urban battlespace. The goal is to detect, identify, map and display personnel, RF devices and other anomalies located within structures and complex terrain to provide dismounted and remote users with real-time, immediate-area situational awareness. ***FY 2014 Accomplishments:*** Integrated Measurement and signature intelligence (MASINT)/Multi-INT vehicle mounted detection capability with soldier and airborne sensors (electro- optic/infrared/full motion video) to support higher fidelity standoff detection and targeting of threat emitters for small units; matured multi-platform cross cueing techniques and tested multi-int detection and geolocation in a laboratory environment; matured algorithms to fuse multi source detection, geolocation and targeting data into a high fidelity common display and design and code a mechanism to ingest this data into Distributed Common Ground Station-Army (DCGS-A) program of record for greater area situational awareness. ***FY 2015 Plans:*** Develop methods to efficiently cue collocated Electro Optical (EO) /Infrared (IR) sensors with an RF direction finding capability; mature hardware platform that enables an RF direction finding cueing of a collocated EO/IR sensor and conduct validation	4.975	3.698	2.435

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K15 / *Advanced Comm Ecm Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
assessments of system performance; finalize methods to export data to DCGS-A; demonstrate capability to supply data to the intel enterprise in a relevant environment to provide tactically relevant data to the Soldier. ***FY 2016 Plans:*** Will mature, assess and demonstrate multi-intelligence and EW techniques and effects on emerging threats such as unmanned aerial systems (UAS) to identify potential vulnerabilities; integrate, assess and demonstrate advanced EW techniques and effects to use against identified target UAS to determine their effectiveness and potential portability to address other threats.			
Accomplishments/Planned Programs Subtotals	9.709	8.603	7.435

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K16: *Non-Commo Ecm Tech Dem*	-	14.943	17.443	19.439	-	19.439	19.790	15.998	16.306	16.631	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates non-communication, multi-functional electronic warfare (EW) capabilities that enhance the survivability of Army air and ground platforms and dismounted Soldiers. This project matures and demonstrates radio frequency (RF), infrared (IR) and electro-optical (EO) sensors and jamming sources to detect, locate, deceive, and neutralize (jam) booby traps, radar-directed target acquisition systems, target-tracking sensors, surface-to-air missiles (SAMs), air-to-air missiles (AAMs), and top-attack and electronically-fuzed munitions. This project also enables electronic support (ES) hardware and software to detect, identify and geolocate emitters of interest from an effective standoff distance to provide near real-time situational awareness.

This project supports Army science and technology efforts in the Command Control, Communications and Intelligence, Ground Maneuver, Air and Soldier/Squad portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronic Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Distributed Aperture Infrared Countermeasures (DAIRCM) Technologies	3.863	4.233	3.278
Description: This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against EO, IR and RF guided threats.			
FY 2014 Accomplishments: Modified IR jam/receive deconfliction algorithms and interrogation techniques to develop cooperative countermeasures to protect multiple aircraft; integrated air threat detection and geo-location data with ground situational awareness to cooperatively defeat threats to both air and ground platforms; integrated miniature waveform generators, efficient high power amplifiers, and optical fiber signal distribution to add a low weight/power RF jammer to Army rotorcraft; matured and leveraged EO, IR and RF jammers for an integrated aircraft survivability architecture for more efficient jamming and reduced observable signature of the aircraft.			
FY 2015 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Mature and fabricate a brassboard wideband RF warning sensor capable of detecting and identifying modern radar threat systems to airborne platforms; conduct lab testing of brassboard RF warning sensor to evaluate sensor capabilities using RF simulation hardware and software to determine effectiveness against emerging threats and document limitations in performance to enable the development of additionally required functionality. ***FY 2016 Plans:*** Will continue to mature wideband RF warning sensor and integrate RF warning sensor into representative hardware suite; conduct sensor performance assessment to demonstrate the performance and readiness of the RF warning system.			
Title: Advanced Tactical Radio Frequency Countermeasures (ATRFCM) Technologies ***Description:*** This effort matures and demonstrates integrated EW/direction finding technologies that provide protection of air, ground and dismounts from emerging RF threats at standoff distances. Work accomplished under PE 0602120A/project H15, PE 0602270A/project 906, and PE 0603270A/project K15 complements this effort. ***FY 2014 Accomplishments:*** Modified and integrated previously matured techniques and developed new techniques, algorithms and waveforms for the detection, location and neutralization of RF threat devices; matured techniques to provide an integrated situational awareness picture and countermeasures against identified threats; improved interoperability between detection and neutralization systems with other systems on the platform such as communications, networking and Global Positioning System/position, navigation and timing. ***FY 2015 Plans:*** Mature techniques and architecture design to further improve interoperability between RF threat detection and neutralization systems with other systems on the platform such as communications, networking and Global Positioning System/navigation; design, encode and mature algorithms and architecture elements to allow for the sharing of RF and computational resources between various systems that are collocated on a platform. ***FY 2016 Plans:*** Will integrate and demonstrate signals intelligence (SIGINT) and cyber enabling capabilities into a common chassis utilizing a set of standards-based hardware and software open modular architectures to improve capability and interoperability, and reduce platform size, weight, power and costs; demonstrate the maturity of a multi-function architecture that integrates defensive electronic attack, active electronic support, SIGINT, and cyber enabling capabilities to evaluate the combined capability performance over-the-air in an anechoic chamber.	4.586	4.835	4.911
Title: Combat ID Technology Demonstrations	3.123	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort augments and enhances existing light weight dismount and tactical vehicles systems to add real-time Combat Identification (CID) capabilities, along with embedded training, without significantly altering size, weight and power of current and emerging equipment packages. The focus is on making current systems and capabilities (weapon sites, radios, sensors, and etc.) multifunctional rather than adding stand-alone CID systems that would increase the burden on the Soldier. Work accomplished under PE 0602120A/project H15 compliments this effort. ***FY 2014 Accomplishments:*** Completed component modifications to multifunction laser, site and weapon orientation module which are used to increase probability of positive friend, enemy, neutral non-combatant identification at increased ranges; conducted laboratory and limited field test to demonstrate modified wireless personal area network waveforms and Soldier Radio Waveform, weapons orientation module and multifunction laser; documented and assessed user feedback and make appropriate component and integration modifications; matured non-cooperative target identification techniques.			
Title: EW Counter Countermeasures ***Description:*** This effort matures and demonstrates hardware and software to counter emerging electronic warfare threats to command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) platforms. Work being accomplished under PE 0602270A/project 906 compliments this effort. ***FY 2014 Accomplishments:*** Leveraged technical assessments of a family of threat systems and conducted a full vulnerability assessment on these systems, generated potential mitigation strategies, determined associated concept of operations and employment scenarios; matured and optimized mitigation strategies that have the highest probability of success by demonstrating the feasibility of the proposed approached in the laboratory, leveraging threat system components, surrogates and modeling and simulation resources. ***FY 2015 Plans:*** Extend capability to conduct hardware in the loop testing of a family of threat systems in a laboratory environment; assess current and emerging red force interference/jamming sources and characterize their performance and conduct modeling and simulation and hardware in the loop testing to determine the extent of potentially harmful effects on blue force EW/C4ISR sensors; generate candidate countermeasure techniques to neutralize these threat systems. ***FY 2016 Plans:*** Will analyze previously conducted testing of counter EW techniques to determine effectiveness against identified threats; develop and document standard EW technique assessment protocols to enable independent validation to be conducted of all results;	3.371	3.500	3.500

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
continue to demonstrate hardware in the loop testing to provide robust assessments and measurements using realistic threat and blue force systems.			
Title: Active Protection System (APS) Soft Kill ***Description:*** This effort matures and demonstrates hardware, software and techniques to provide an EW soft kill capability to the APS suite. This effort supports the Army's APS program to mature and demonstrate technologies to reduce vehicle weight by reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. Work being accomplished under PE 0602601A/project C05, PE 0602618A/project H80, PE 0603004A/project 232, PE 0603005A/project 221 and PE 0603313A/ project 263 compliments this effort. ***FY 2015 Plans:*** Mature sensor based threat detection, classification, tracking, warning and electronic countermeasure techniques in support of the APS science and technology program; conduct modeling and simulation (M&S) of potential electronic APS capabilities to evaluate and document potential system performance in operational scenarios. ***FY 2016 Plans:*** Will investigate and mature sensor framework to facilitate integration of cueing sensors and EW soft kill into the Modular Active Protection System (MAPS) architecture; mature algorithm to utilize a cueing sensor to enable threat detection and determine threat angle of arrival; mature tracking sensor to improve capability to provide accurate threat tracking and false alarm reduction, characterize threats, provide warning and fire control functions and confirm effective countermeasure performance; mature and conduct initial integration testing and demonstration to assess cueing sensor performance when integrated into the MAPS framework.	-	4.125	7.000
Title: Integrated RF Operations ***Description:*** This effort matures and demonstrates a capability to perform modeling and simulation (M&S) of geographically dispersed RF systems to provide a coordinated, collaborative and interoperable suite of EW capabilities. A modular software architecture will allow for rapid, cost effective development and integration of new EW capabilities, target signals of interest and environmental simulations. Work being accomplished under PE 603008A/project TR1 compliments this effort. ***FY 2015 Plans:*** Extend existing RF simulation M&S capabilities to accurately depict the interaction between EW systems and selected signals of interest (SOI); extend the M&S capability to enable new EW techniques and threat SOI to be rapidly and accurately developed	-	0.750	0.750

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
within the model environment to analyze the interaction between EW systems and various targets; validate the extended models and simulations to ensure accuracy and performance. ***FY 2016 Plans:*** Will develop improvements to RF M&S capabilities that increase M&S fidelity of blue force system performance and interactions with various SOI to enable the evaluation of advanced, emerging EW techniques; assess requirements to extend SOI models to improve fidelity and provide an accurate and consistent modeling environment.			
Accomplishments/Planned Programs Subtotals	14.943	17.443	19.439

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	81.951	79.934	49.449	-	49.449	52.190	58.142	56.688	59.300	-	-
206: *Missile Simulation*	-	2.226	1.764	1.731	-	1.731	2.435	2.475	2.488	2.574	-	-
263: *Future Msl Tech Integr(FMTI)*	-	53.829	32.386	27.572	-	27.572	28.484	34.629	34.183	35.916	-	-
704: *Advanced Missile Demo*	-	6.560	10.784	20.146	-	20.146	21.271	21.038	20.017	20.810	-	-
NA6: *Missile and Rocket Initiatives (CA)*	-	19.336	35.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures, fabricates, and demonstrates advanced rocket, missile, interceptor, and guided munition technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability. Project 206 develops high fidelity simulations for advanced tactical missiles and interceptors. Project 263 demonstrates missile and interceptor systems with capabilities to provide protection against rockets, artillery, and mortars; provide precision weapons for small units in close combat; provide precision long-range fires; and provide minimum smoke propulsion for aviation missiles. Project 704 demonstrates the capability to detect and track rocket, artillery, mortar, and unmanned air vehicles threats. Project G03 demonstrates missile-based deployable force protection and fire control systems as well as defense against unmanned aerial vehicles and rotary wing aircraft. NA6 is a congressional increase project.

Work in this PE is complimentary to PE 0602303A (Missile Technology), and is fully coordinated with PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603003A (Aviation Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), PE 0603270A (Electronic Warfare Technology), PE 0603734A (Combat Engineering Systems), and PE 0708045A (Manufacturing Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) located at Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	83.975	44.957	53.312	-	53.312
Current President's Budget	81.951	79.934	49.449	-	49.449
Total Adjustments	-2.024	34.977	-3.863	-	-3.863
• Congressional General Reductions	-	-0.023			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	35.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.700	-			
• SBIR/STTR Transfer	-2.724	-			
• Adjustments to Budget Years	-	-	-3.863	-	-3.863

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: NA6: *Missile and Rocket Initiatives (CA)*		
Congressional Add: *Program Increase*	19.336	35.000
Congressional Add Subtotals for Project: NA6	19.336	35.000
Congressional Add Totals for all Projects	19.336	35.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 206 / *Missile Simulation*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
206: *Missile Simulation*	-	2.226	1.764	1.731	-	1.731	2.435	2.475	2.488	2.574	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced modeling and simulation technologies for missile design and analysis. Evaluation of missile technology by means of modeling and simulation provides a cost-effective method that supports missile maturation throughout the weapon system life cycle. This effort permits a reduction in the number of flight tests required for programs of record as well as improves the confidence of flight test readiness and probability of flight test success.

This project support efforts in the Army science and technology Lethality portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center, (AMRDEC) Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Missile Simulation	2.226	1.764	1.731
Description: This effort matures and demonstrates advanced analysis and high fidelity modeling and simulation technologies for advanced missiles and interceptor design and analysis. Evaluation of missile technology through modeling and simulation provides a cost-effective method to support missile maturation throughout the weapon system life cycle. This effort shortens component design timelines, reduces integration activities, enables a reduction of flight tests required for programs of record and improves the confidence of flight test readiness and the probability of flight test success.			
FY 2014 Accomplishments: Completed scene generation technology for improved fidelity and runtime of complex millimeter wave (MMW) scenes; improved fidelity of complex modeling and simulation through the leveraging of advancements in microprocessor speed and throughput; enhanced endgame lethality modeling to evaluate the effectiveness of complex shaping of integrated blast fragmentation warheads; conducted component and system level analysis simulations.			
FY 2015 Plans: Design a radio frequency scene generation algorithm and begin hardware/software integration into hardware-in-the-loop to support testing of advanced MMW sensors. Design an integrated, cohesive sensor development modeling and simulation			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 206 / *Missile Simulation*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
environment to significantly reduce seeker design and development timeline. Complete missile life-cycle cost analysis model, optimized for use during the S&T phase of technology development to design in cost saving features. ***FY 2016 Plans:*** Will mature radio frequency (RF) scene generation algorithms and continue hardware/software integration into hardware-in-the-loop to support testing of advanced millimeter wave radar sensors. Will mature a modeling and simulation environment to significantly reduce seeker algorithm design and development timelines. Will refine and validate missile life-cycle cost analysis model against existing life-cycle cost information, optimized for use during the S&T phase of technology development to design in cost saving features. Will design and begin development of a testbed to explore advanced network integration techniques for emerging air and missile defense weapons reducing hardware integration costs and improving weapons pairing.			
Accomplishments/Planned Programs Subtotals	2.226	1.764	1.731

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / *Missile and Rocket Advanced Technology*	Project (Number/Name) 263 / *Future Msl Tech Integr(FMTI)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
263: *Future Msl Tech Integr(FMTI)*	-	53.829	32.386	27.572	-	27.572	28.484	34.629	34.183	35.916	-	-

A. Mission Description and Budget Item Justification

This project matures, fabricates, and demonstrates advanced missile and interceptor technologies, such as seekers, guidance and controls, propulsion, and airframes. The project goal is to reduce the life-cycle costs and cost per kill of precision guided missiles and interceptors.

This project support efforts in the Army science and technology Lethality and Ground Maneuver portfolio.

This project matures technologies from PE 0602303A and directly supports systems managed by the Program Executive Officer for Missiles and Space. Work in this project is in collaboration with PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technologies), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0708045A (Manufacturing Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Small Organic Precision Munition Integrated Technology ***Description:*** This effort designs, fabricates, integrates, and flight demonstrates critical components to enhance system-level performance of a small precision munition. The effort provides a soldier portable, 5.5 pound, precision guided munition to enable small units to organically dominate asymmetric threats in complex terrain. The goals include improved: target tracking that distinguishes soft targets (to include personnel), effects against soft targets, communication with munition in flight, and power sources for increased flight and storage time. This effort matures and demonstrates technology from PE 0602303A, PE 0602624 Project H28, and the Applied Smaller, Lighter, and Cheaper Munition Components effort. ***FY 2014 Accomplishments:*** Implemented and flight tested enhanced image stabilization and people tracking algorithms in form-factored modular hardware architecture; completed packaged design, fabricated, and flight tested final form-factored digital data link hardware.	10.223	-	-
Title: Technical Fire Control Technology	6.560	2.732	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort demonstrates Technical Fire Control technology necessary to generate and execute a firing solution for defeat of rocket, artillery, and mortar (RAM), Unmanned Aerial Systems (UAS), and/or Cruise Missile threats in the required timeline to protect ground forces. This effort develops Technical Fire Control technology to complement the interceptor development performed in the Guided Interceptor Technology for Defense against RAM, UAS and/or Cruise Missile, Hit-to-Kill Interceptor Technology for Defense against RAM, UAS and/or Cruise Missile, and Counter RAM, UAS and/or Cruise Missile Tracking and Fire Control (PE 0603313 Project 704) efforts. These combined efforts will conduct multiple interceptor Hardware-in-the-Loop (HWIL) demonstrations each year. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC) and other Air and Missile Defense programs. ***FY 2014 Accomplishments:*** Continued refinements and enhancements of Technical Fire Control nodes for the Counter RAM, UAS and/or Cruise Missile interceptors based on analysis of flight test performance; integrated updated Technical Fire Control node test articles with interceptor guidance sections and fire control systems in HWIL set-ups; conducted virtual and flight tests against single RAM, UAS and/or Cruise Missile targets using Technical Fire Control nodes to control each. ***FY 2015 Plans:*** Continue refinements and enhancements of Technical Fire Control nodes for Counter RAM, UAS, and Cruise Missile interceptors based on current threat analysis. Use these Technical Fire Control nodes to conduct virtual flight tests against emerging threats in HWIL			
Title: Guided Interceptor Concept Technology for defense against Rockets, Artillery, and Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missiles ***Description:*** This effort demonstrates a Guided missile-based Interceptor concept initially focused to defeat RAM, UAS, and Cruise Missile threats with the potential for precision ground-to-ground applications. This effort designs, fabricates, evaluates, and flight demonstrates a guided missile-based interceptor and launch system. The complementary effort in PE 0603313A, Project 704, Technical Fire Control Technology, provides the interceptor with a firing solution and launch command based on tracking of the UAS, RAM, and Cruise Missile threats. This effort will support the design, fabrication, integration, Hardware-in-the-Loop (HWIL) tests, and flight demonstration of multiple guided interceptors. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC) and other Air and Missile Defense programs. ***FY 2014 Accomplishments:*** Fabricated, integrated, and tested the alternative components for Guided interceptors; performed Hardware-In-The-Loop tests and pre-flight predictions to prepare for flight tests and reduce risk; conducted interceptor flight-test demonstrations against single RAM, UAS and/or Cruise Missile targets; analyzed test results and correlate to predicted and HWIL performance; updated the	16.909	7.325	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Battle Element system; and refined the system simulation based on performance demonstrated through preflight predictions and flight tests. Completed preliminary designs of affordable propulsion and advanced seeker technologies to extend CUAS/CCM interceptor effective range, enabling the defeat of both current and emerging threats. ***FY 2015 Plans:*** Complete Critical Design Reviews for alternative components for Guided interceptors to defeat RAM, UAS and Cruise Missile. Test form-factor components in HWIL to provide pre-flight predictions and reduce risk. Updates and refinements of the system simulation will be performed based on performance demonstrated in HWIL pre-flight predictions.			
Title: Hit-to-Kill Interceptor Concept Technology for Defense against Rockets, Artillery, and Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missiles ***Description:*** This effort demonstrates a compact, very light weight, RF seeker guided Hit-to-Kill (HTK) missile-based Interceptor concept initially focused to defeat RAM threats in flight with the potential for use on air launched platforms, small weapons platforms, and ground-to-ground applications. This effort designs, fabricates, and evaluates a Hit-to-Kill counter RAM system consisting of interceptors and a launch system. Complementary efforts include: Technical Fire Control Technology provides the firing solution and launch command and Counter RAM, UAS and/or Cruise Missile Tracking and Fire Control, PE 0603313A Project 704, provides tracking of the threat for intercept. This effort will support the design, fabrication, integration, and Hardware-in-the-Loop (HWIL) tests of multiple hit-to-kill interceptors. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC). ***FY 2014 Accomplishments:*** Continued flight tests of the Hit-To-Kill interceptor; continue Hardware-In-The-Loop tests and pre-flight predictions to prepare for additional guided flight tests and to reduce risk; conducted additional interceptor flight-test demonstrations against single and multiple RAM, UAS, and/or Cruise Missile targets; analyzed test results and correlate to predicted and HWIL performance; updated the Battle Element system; and refined the system simulation based on performance demonstrated through preflight predictions and flight tests. ***FY 2015 Plans:*** Continue integration and testing, and analysis of Hit-to-Kill (HTK) components; begin fabrication and testing of the active seeker for HTK to provide a Fire Control independent solution.	16.384	7.001	-
Title: Javelin Command Launch Unit (CLU) with External Far Target Locator (FTL) ***Description:*** This effort focuses on the designs, fabrication, and demonstration of technology for a highly accurate, externally-mounted Javelin FTL that integrates with the CLU and provides a means to significantly lighten the load of the Javelin close-combat missile system. The system-technology construct comprises an externally mounted FTL connected to the Javelin	1.200	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Command Launcher Units. This construct will reduce the weight and volume of the FTL capability for close-combat weaponry carried by the individual Soldiers while increasing lethality, survivability, and situational awareness for Small Unit operations. This effort transitions, integrates, and demonstrates technology from PE 0602303A, Project 214, "Smaller, Lighter, Cheaper Tactical Missile Technologies" and "Micro Inertial Navigation Sensor for Networked Javelin Command Launch Unit (CLU) with Far Target Locator (FTL)". ***FY 2014 Accomplishments:*** Completed: FTL-sensor lightweight-composite housing design; the initial design and fabrication of miniaturized electronics; development and integration of first-build software for the Javelin CLU.			
Title: Low-cost Extended Range Air Defense ***Description:*** This effort focuses on developing key enabling technologies for a lower-cost interceptor system for a low- to medium-altitude, medium- to long-range capability. Resulting technologies will enable interceptor integration into a net-enabled Air and Missile Defense Task Force architecture and protection of assets within a 150km diameter Area of Operations. Technologies will be designed for the defeat of tactical UAS and Cruise Missile threats with secondary capability against Large Caliber Rockets (LCR), Short Range Ballistic Missiles (SRBM), and Tactical Air-to-Surface Missiles (TASMS) at extended range and to be interoperable with existing Integrated Air and Missile Defense (IAMD) Force. This effort continues in FY15 in PE 0603313A, Project 704. ***FY 2014 Accomplishments:*** Completed systems and operational analysis of medium- to long-range missile-based interceptor given anticipated area of operations and anticipated force structure. Began detailed design of integrated missile system.	2.553	-	-
Title: Low Cost Tactical Extended Range Missile ***Description:*** This effort focuses on maturation, fabrication, and demonstration of technologies for low-cost precision fires missile capable of deep strike engagements. The aim is to provide extended range and expanded target set capability through advanced propulsion, new payload technology, and maintain effectiveness in Global Positioning System (GPS) challenged environments through new and novel navigation technologies. ***FY 2015 Plans:*** Conduct trade studies through simulation to determine subsystem requirements for delivery of enhanced lethal effects to long range targets; evaluate the target sets at various ranges and match payload technologies with the threat sets; match propulsion	-	5.200	9.638

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
technologies with range and missile size; evaluate emerging navigation technologies for GPS challenged environments; evaluate requirements for compatibility with both current and future long range launch systems. ***FY 2016 Plans:*** Will complete initial simulation trade studies determining subsystem requirements for delivery of enhanced lethal effects to long range targets; mature multi-functional payload technologies to service the broad threat set of targets with one warhead; mature and perform preliminary testing of advanced propulsion technologies that provide low cost energy management to enhance kinematic performance for long range precision fires; mature navigation technologies for GPS challenged environments in order to enhance the precision of long range precision fires in denied environments; design and fabricate control actuation system hardware, develop navigation algorithms and perform structural analysis for tail controlled long range rockets.			
Title: Active Protection System Interceptor Demonstration ***Description:*** This effort matures, integrates and demonstrates modular hard-kill Active Protection System (APS) technologies with the Hit Avoidance Architecture and APS Common Controller and matures modeling and simulation for system integration and demonstration. Specifically the hard kill APS portion and modeling and simulation efforts will be addressed by AMRDEC. This effort supports the Army's Active Protection System (APS) program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. This effort supports the development of an APS Common Architecture enabling adaptable APS solutions that can be integrated across Army vehicle platforms as required. This effort compliments work being accomplished under PE 0602601A/Project C05, PE 0602618A/Project H80, PE 0603004A/Project 232, PE 0603005A/Project 221, and PE 0603270A/Project K16. ***FY 2015 Plans:*** Begin integration of a modular hard-kill active protection sub-system (including countermeasures, detection sensors, and tracking sensors) with a common controller through a common architecture for use in an integrated survivability suite on a combat vehicle. ***FY 2016 Plans:*** Will advance APS modeling and simulation to configure and evaluate subsystem integration on physical and virtual demonstrator platforms; evaluate mature, hard-kill countermeasure subsystems for adaption to the Modular Active Protection System (MAPS) controller, through the common architecture, allowing hardware integration with a physical demonstrator combat vehicle platform.	-	3.125	6.000
Title: Hunter Killer Missile Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, Hardware-in-the-Loop (HWIL) test, and flight demonstration of technology for an affordable discriminate extended range precision missile to include critical component technologies such as advanced propulsion, seekers, fire control, datalink, guidance and controls, and maneuverable airframes.	-	7.003	7.803

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2015 Plans: Conduct trade studies to determine subsystem requirements. Identify critical components and begin designing and maturation of those critical components such as propulsion, datalink, and tracker. Begin development of system-level modeling and simulation necessary to mature and evaluate concepts for prediction of system capability across a broad spectrum of missions. Evaluate fire control requirements and identify key technologies. ***FY 2016 Plans:*** Will complete initial trade studies determining system and subsystems requirements for an affordable discriminate extended range precision missile; advance development of system-level modeling and simulation to mature and evaluate concepts for system performance predictions; mature key critical subsystem technologies in support of identified system requirements such as propulsion and navigation; mature maneuverable airframe guidance and controls algorithms.			
Title: Close Combat Weapons Technology ***Description:*** This effort addresses close combat weapon systems technology to include seeker, navigation and materials technology to enable a lightweight command launch unit for the man-portable Javelin weapon system, and system trade studies, and technology maturation and demonstration for a next generation close combat precision missile system for dismounted and mounted maneuver. This effort is coordinated with PE 0602709A/Night Vision Technology. ***FY 2016 Plans:*** Will finalize fabrication, integration, and testing of reduced weight, advanced composite housing including foam components for Javelin Light Weight Command Launch Unit (LW CLU); fabricate, integrate, and test an inertial navigation sensor with increased accuracy to include on-the-move capabilities (both targeting and navigation) and reduced size, weight, and power (SWaP) to provide precision for far target location; fabricate, integrate, and test a target acquisition sensor for the Javelin LW CLU increasing target acquisition range and reducing SWaP; perform system-level trade studies to identify critical technology needs such as seekers, propulsion and guidance for a next generation close combat missile system; mature key technologies for a next generation close combat missile system.	-	-	4.131
Accomplishments/Planned Programs Subtotals	53.829	32.386	27.572

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
704: *Advanced Missile Demo*	-	6.560	10.784	20.146	-	20.146	21.271	21.038	20.017	20.810	-	-

A. Mission Description and Budget Item Justification

This project matures advanced missile system concepts and related hardware to enhance weapon system lethality, survivability, agility, versatility, deployability, and affordability for defense against future air and ground, armored and non-armored threats.

This project support efforts in the Army science and technology Lethality portfolio.

Work in this project is in collaboration with PE 0602624A (Weapons and Munitions Technologies).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Counter Rockets, Artillery, Mortars (RAM), unmanned aerial systems (UAS), and Cruise Missile Tracking and Fire Control	6.560	5.498	7.254
Description: This effort matures and demonstrates system technology to provide 360 degree, near hemispherical coverage for tracking and intercept of RAM, UAS, and/or Cruise Missile threats. This effort determines the trajectory and location of the incoming RAM, UAS, and/or Cruise Missile threats and feeds that information to the technical fire control node to generate a firing solution provided to the guidance section of each of the missile interceptors. Complementary work is conducted in the Technical Fire Control Technology, Guided Interceptor Technology for defense against Rockets, Artillery, and Mortars, and Hit-to-Kill Interceptor Technology for Defense against Rockets, Artillery, and Mortars and Unmanned Aerial Systems, and Cruise Missiles efforts in PE 0603313A Project 263. The demonstration of an active seeker version of the Hit-to-Kill Interceptor is conducted in this effort leveraging the active seeker development in the Seeker and Guidance Technology for Air Defense effort in this Project. These efforts will be evaluated through Hardware-in-the-Loop (HWIL) tests and multiple interceptor flights. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC) and other Air and Missile Defense programs.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Used final test bed and/or existing counter RAM, UAS, and Cruise Missile tracking and fire control systems for interceptor flight tests against RAM, UAS, and Cruise Missile targets, and verified tracking and fire control simulations based on results of Hardware-In-the-Loop and flight tests. ***FY 2015 Plans:*** Demonstrate and assess performance utilizing existing counter RAM, UAS, and Cruise Missile tracking and fire control systems networked information against the full range of target types (RAM, UAS, Cruise Missile), scenarios and multiple engagements utilizing simulations and HWIL. ***FY 2016 Plans:*** Will test and refine autopilot algorithms of the active Hit-to-Kill (HTK) interceptor to provide protection against incoming RAM threats that can take target location updates from any applicable fire control sensor; refine and verify aerodynamic performance predictions; and update the HTK system simulation used for system performance prediction and analysis.			
Title: Low-cost Extended Range Air Defense ***Description:*** This effort matures key technologies of a lower-cost interceptor system with a low- to medium-altitude, medium- to long-range capability. This effort will enable lower cost interceptor integration into a net-enabled Air and Missile Defense Task Force for the protection of high value assets. Technologies will address the defeat of air defense threats such as Unmanned Aerial Systems (UAS) and Cruise Missile threats with secondary capabilities against Large Caliber Rockets (LCR), Short Range Ballistic Missiles (SRBM), and Tactical Air-to-Surface Missiles (TASMS). This effort continues from 0603313A, Project 263 in FY14. ***FY 2015 Plans:*** Complete initial design of a medium- to long-range interceptor including identification of critical interceptor technology and component performance requirements. Begin development of interceptor component technologies to include propulsion, seeker, guidance, navigation and controls and begin development of an interceptor simulation. ***FY 2016 Plans:*** Will complete design and begin static testing of solid rocket motor; complete target generator for hardware-in-the-loop calibration and testing of active radar seeker, guidance electronics, and control system; complete wind tunnel testing and aerodynamic analysis of interceptor.	-	5.286	6.087
Title: Seeker and Guidance Technology for Air Defense ***Description:*** This effort focuses on the maturation and integration of seeker and guidance technologies supporting air defense missile systems. Technologies addressed enable the defeat of multiple air defense threats such as Rockets, Artillery, and Mortars, Unmanned Aerial Systems (UAS) and Cruise Missile threats with secondary capabilities against Large Caliber Rockets (LCR), Short Range Ballistic Missiles (SRBM), and Tactical Air-to-Surface Missiles (TASMS).	-	-	6.805

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2016 Plans: Will mature active seeker for the Hit-to-Kill interceptor for utilization against RAM threats in the "Counter Rockets, Artillery, Mortars (RAM), unmanned aerial systems (UAS), and Cruise Missile Tracking and Fire Control" effort; mature low-cost active radio frequency (RF) seeker detailed design and begin fabrication and testing of seeker sub-systems for low-cost extended range air defense interceptor; continue maturation of guidance algorithms and navigation technology to support low-cost extended range air defense interceptor; mature low-cost extended range air defense interceptor hardware-in-the-loop simulation and software integration facilities for calibration and testing of active RF seekers, guidance electronics units, and control systems.			
Accomplishments/Planned Programs Subtotals	6.560	10.784	20.146

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** NA6 / *Missile and Rocket Initiatives (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
NA6: *Missile and Rocket Initiatives (CA)*	-	19.336	35.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Missile and Rocket advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	19.336	35.000
FY 2014 Accomplishments: Matured, fabricated, and demonstrated advanced rocket, missile, interceptor, and guided munition technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability.		
FY 2015 Plans: Program increase for missile and rocket advanced technology development		
Congressional Adds Subtotals	19.336	35.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603322A / *TRACTOR CAGE*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	11.857	11.105	10.999	-	10.999	11.107	11.311	11.385	11.611	-	-
B92: *DB92*	-	11.857	11.105	10.999	-	10.999	11.107	11.311	11.385	11.611	-	-

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	11.077	11.105	11.080	-	11.080
Current President's Budget	11.857	11.105	10.999	-	10.999
Total Adjustments	0.780	-	-0.081	-	-0.081
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.780	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.081	-	-0.081

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	213.238	221.518	177.159	-	177.159	177.190	182.338	183.339	186.373	-	-
DS7: *High Performance Computing Modernization Program*	-	174.567	181.518	177.159	-	177.159	177.190	182.338	183.339	186.373	-	-
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	38.671	40.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) addresses the supercomputing requirements of DoD scientists and engineers by (1) demonstrating/maturing the most advanced, leading-edge computational architectures and exploiting these systems with complementary specialized expertise; (2) demonstrating/maturing the Defense Research and Engineering Network (DREN) which investigates/demonstrates/matures leading-edge digital networking and security technologies to securely deliver computational capabilities to the distributed DoD RDT&E community; and (3) leveraging specialized expertise from DoD, other federal departments/agencies, industry, and academia to demonstrate/mature leading-edge software application codes. DoD Supercomputing Resource Centers (DSRCs) provide extensive computational capabilities and demonstrate/mature emerging technologies that address the supercomputing requirements of the DoD RDT&E community in the areas of hardware, software, and programming environments. All HPCMP sites are interconnected to each other, the DoD HPC RDT&E community, and other major defense sites via DREN, a research network which investigates/demonstrates/matures (a) state-of-the-art digital networking technologies to ensure a robust distributed environment and (b) the most advanced digital security capabilities to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities. The HPCMP's software application effort (a) optimizes/enhances/demonstrates/matures critical DoD physics-based and parallel discrete event software in order to allow scientists and engineers to execute scientific calculations with precision and efficiency on advanced, leading-edge supercomputers, (b) demonstrates/matures robust immersive collaborative programming environments to improve science and engineering workflows, and (c) demonstrates/matures leading-edge computational technology from academia and industry. These synergistic activities collectively demonstrate/mature horizontal technologies that are exploited throughout the DoD RDT&E community, ensuring the DoD maintains the most advanced research ecosystem in the areas of computationally-intensive modeling and design.

Work in this project supports the Army S&T Innovation Enablers Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*

B. Program Change Summary ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**
Previous President's Budget	220.565	181.609	178.460	-	178.460
Current President's Budget	213.238	221.518	177.159	-	177.159
Total Adjustments	-7.327	39.909	-1.301	-	-1.301
• Congressional General Reductions	-	-0.091			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	40.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-7.327	-			
• Adjustments to Budget Years	-	-	-1.301	-	-1.301

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*		
Congressional Add: *Congressional Increase*	38.671	40.000
Congressional Add Subtotals for Project: DW5	38.671	40.000
Congressional Add Totals for all Projects	38.671	40.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
DS7: *High Performance Computing Modernization Program*	-	174.567	181.518	177.159	-	177.159	177.190	182.338	183.339	186.373	-	-

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) addresses the supercomputing requirements of DoD scientists and engineers by (1) demonstrating/maturing the most advanced, leading-edge computational architectures and exploiting these systems with complementary specialized expertise; (2) demonstrating/maturing the Defense Research and Engineering Network (DREN) which investigates/demonstrates/matures leading-edge digital networking and security technologies to securely deliver computational capabilities to the distributed DoD RDT&E community; and (3) leveraging specialized expertise from DoD, other federal departments/agencies, industry, and academia to demonstrate/mature leading-edge software application codes. DoD Supercomputing Resource Centers (DSRCs) provide extensive computational capabilities and demonstrate/mature emerging technologies that address the supercomputing requirements of the DoD RDT&E community in the areas of hardware, software, and programming environments. All HPCMP sites are interconnected to each other, the DoD HPC RDT&E community, and other major defense sites via DREN, a research network which investigates/demonstrates/matures (a) state-of-the-art digital networking technologies to ensure a robust distributed environment and (b) the most advanced digital security capabilities to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities. The HPCMP's software application effort (a) optimizes/enhances/demonstrates/matures critical DoD physics-based and parallel discrete event software in order to allow scientists and engineers to execute scientific calculations with precision and efficiency on advanced, leading-edge supercomputers, (b) demonstrates/matures robust immersive collaborative programming environments to improve science and engineering workflows, and (c) demonstrates/matures leading-edge computational technology from academia and industry. These synergistic activities collectively demonstrate/mature horizontal technologies that are exploited throughout the DoD RDT&E community, ensuring the DoD maintains the most advanced research ecosystem in the areas of computationally-intensive modeling and design.

Work in this project supports the Army S&T Innovation Enablers Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Department of Defense (DoD) Supercomputing Resource Centers (DSRCs)	88.329	96.929	94.538
Description: The effort investigates, demonstrates, and matures general and special-purpose supercomputing environments that incorporate the most advanced, leading-edge computational architectures, distributed mass storage technologies, and data analysis methodologies; employs complementary specialized expertise to mature and exploit these environments; enables the			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
DoD RDT&E community to effectively and efficiently investigate, demonstrate, and mature a broad range of technologies through advanced computational methods. ***FY 2014 Accomplishments:*** Refined and exploited the advanced capabilities of 11 previously demonstrated supercomputers (culminating in the ability to complete 5,200 trillion floating point operations per second) in order to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 computational technology areas (CTAs): (1) space and astrophysical sciences, (2) structural mechanics, (3) fluid dynamics, (4) chemistry and materials science, (5) electromagnetics and acoustics, (6) climate/weather/ocean modeling and simulation, (7) signal/image processing, (8) forces modeling and simulation, (9) electronics, networking, and systems, (10) environmental quality, and (11) integrated modeling and test environments; demonstrated the viability of three large, tightly-integrated supercomputers containing leading-edge (i.e. 2014) processor, memory, disk input/output (I/O), interconnect, and operating system (OS) capabilities (culminating in the ability to complete 2,700 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the 11 CTAs cited above; demonstrated the ability to interactively apply portions of supercomputers to complex, geographically distributed near-real-time use cases (e.g. Army weather forecasts for geographically distributed test ranges); demonstrated the ability to interactively prepare/analyze extraordinarily large input and output data sets (e.g. 10 trillion bytes in size) from a remote location (e.g. thousands of miles away); demonstrated software and hardware-based methods for sharing memory across computational nodes to provide scientists and engineers large blocks contiguous memory (e.g. trillions of bytes) for use cases that require large matrices; investigated the energy required to address representative DoD use cases through experimentation and a sophisticated modeling of supercomputer hardware and application software in order to determine the benefits of simultaneous multi-threading (SMT) and 32-bit Acorn RISC Machine (ARM) processors for DoD supercomputing workloads. (NOTE: Europe's long-term supercomputing roadmap depends heavily on ARM processors.) ***FY 2015 Plans:*** Refine and exploit the advanced capabilities of 14 previously demonstrated supercomputers (culminating in the ability to complete 7,900 trillion floating point operations per second) in order to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 computational technology areas (CTAs): (1) space and astrophysical sciences, (2) structural mechanics, (3) fluid dynamics, (4) chemistry and materials science, (5) electromagnetics and acoustics, (6) climate/weather/ocean modeling and simulation, (7) signal/image processing, (8) forces modeling and simulation, (9) electronics, networking and systems, (10) environmental quality, and (11) integrated modeling and test environments; demonstrate the viability of six (or more) large, tightly-integrated supercomputers containing leading-edge (i.e. 2015) processor, memory, disk input/output (I/O), interconnect, and operating system (OS) capabilities (culminating in the ability to complete 9,000 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the 11 CTAs cited above; mature the ability to interactively apply portions of supercomputers to complex, geographically distributed			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
near-real-time use cases (e.g. Army weather forecasts for geographically distributed test ranges); mature the ability to interactively prepare/analyze extraordinarily large input and output data sets (e.g. 10 trillion bytes in size) from a remote location (e.g. thousands of miles away) ; mature software and hardware-based methods for sharing memory across computational nodes to provide scientists and engineers large blocks contiguous memory (e.g. trillions of bytes) for use cases that require large matrices; demonstrate graphical user interface (GUI) access to supercomputers without requiring software to be added to the client machine in order to allow scientists and engineers located at sites with prohibitive security practices to apply supercomputing to DoD use cases; demonstrate the ability to use both general-purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) into order to expand the breadth of DoD use cases that can be addressed by supercomputing; investigate the energy required to address representative DoD use cases through experimentation and a sophisticated modeling of supercomputer hardware and application software in order to determine the benefits of 64-bit Acorn RISC Machine (ARM) processors for DoD supercomputing workloads (NOTE: Europe's long-term supercomputing roadmap depends heavily on ARM processors.); investigate (in collaboration with Lawrence Livermore National Laboratory) the power consumption, performance, and reliability of supercomputers relative to environmental parameters within a supercomputing facility. ***FY 2016 Plans:*** Will refine and exploit the advanced capabilities of 20 (or more) previously demonstrated supercomputers (culminating in the ability to complete 16,900 trillion floating point operations per second) in order to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 computational technology areas (CTAs): (1) space and astrophysical sciences, (2) structural mechanics, (3) fluid dynamics, (4) chemistry and materials science, (5) electromagnetics and acoustics, (6) climate/weather/ocean modeling and simulation, (7) signal/image processing, (8) forces modeling and simulation, (9) electronics, networking and systems, (10) environmental quality, and (11) integrated modeling and test environments; will demonstrate the viability of two (or more) large, tightly-integrated supercomputers containing leading-edge (i.e. 2016) processor, memory, disk input/output (I/O), interconnect, and operating system (OS) capabilities (culminating in the ability to complete 10,000 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the 11 CTAs cited above; will further mature graphical user interface (GUI) access to supercomputers without requiring software to be added to the client machine in order to allow scientists and engineers located at sites with prohibitive security practices to apply supercomputing to DoD use cases; will mature the ability to use both general-purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) in order to expand the breadth of DoD use cases that can be addressed by supercomputing; will investigate data-intensive supercomputing architectures for DoD use cases in which it is more economical to move (in real-time) the executable code to the data (as opposed to the standard approach of moving the data to the executable code) in order to expand the breadth of DoD use cases that can be addressed by supercomputing.			
Title: Defense Research and Engineering Network (DREN)	28.896	31.443	30.397

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort investigates, demonstrates, and matures state-of-the-art digital networking technologies to ensure a robust distributed environment among HPCMP sites, the DoD HPC RDT&E community, and other major defense sites; investigates, demonstrates, and matures the most advanced digital security capabilities to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities; employs complementary specialized expertise to mature and exploit this environment. ***FY 2014 Accomplishments:*** Demonstrated DREN III (a new advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDT&E communities; refined and exploited the HPCMP's Defense Information Systems Agency (DISA) accredited Level 3 computer network defense capability to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities; investigated the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated) networking communities-of-interest (COIs); demonstrated the ability to acquire a robust set of performance data for DREN III (i.e. bandwidth, latency, jitter, and configuration information) to ensure the network attributes are suitable for complex DoD RDT&E use cases; demonstrated the ability to observe the security profile of DREN III using a cloud of over 100 sensors in order to support the HPCMP's DISA-accredited Level 3 computer network defense capability; demonstrated the ability to provide secure access to DoD supercomputers through new web authentication technologies in order to facilitate the FY15 DSRC demonstration of GUI access to supercomputers. ***FY 2015 Plans:*** Refine and exploit DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDT&E communities; further refine and exploit the HPCMP's DISA-accredited Level 3 computer network defense capability to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities; demonstrate the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated) networking communities-of-interest (COIs); mature the ability to acquire a robust set of performance data for DREN III (i.e. bandwidth, latency, jitter, and configuration information) to ensure the network attributes are suitable for complex DoD RDT&E use cases; mature the ability to observe the security profile of DREN III using a cloud of over 100 sensors in order to support the HPCMP's DISA-accredited Level 3 computer network defense capability; investigate hardware architecture and software stack enhancements for network sensors to simultaneously allow (1) active support for the HPCMP's DISA-accredited Level 3 computer network defense capability and (2) active experimentation for novel, adaptive, cyber-security detection and intervention methods; investigate (in coordination with White House, Office of Science and Technology Policy [OSTP], the National Science Foundation [NSF], and the Army Research Laboratory [ARL]) the viability of software-defined networks (SDNs) to allow traditional Internet protocol (IP) and experimental protocol networks to coexist within a common DoD networking infrastructure; demonstrate (in collaboration with the DoD CIO's			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Office, U.S. Cyber Command, the National Security Agency [NSA], the Defense Information Systems Agency [DISA], and the Army Research Laboratory [ARL]) a DoD enterprise information system continuous monitoring (ISCM) capability to ingest robust, diverse host-based and network-based near-real-time information in order to provide a persistent situational awareness (SA); demonstrate (in collaboration with Lawrence Livermore National Laboratory) novel parallel discrete event simulation (PDES) methods to facilitate large-scale networking and cybersecurity research using supercomputers. ***FY 2016 Plans:*** Will further refine and exploit DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDT&E communities; will further refine and exploit the HPCMP's DISA-accredited Level 3 computer network defense capability to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities; will mature the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated) networking communities-of-interest (COIs); will demonstrate hardware architecture and software stack enhancements for network sensors to simultaneously allow (1) active support for the HPCMP's DISA-accredited Level 3 computer network defense capability and (2) active experimentation for novel, adaptive, cyber-security detection and intervention methods; will demonstrate (in coordination with White House, Office of Science and Technology Policy [OSTP], the National Science Foundation [NSF], and the Army Research Laboratory [ARL]) the ability to employ software-defined networks (SDNs) to allow traditional Internet protocol (IP) and experimental protocol networks to coexist within a common DoD networking infrastructure; will mature (in collaboration with the DoD CIO's Office, U.S. Cyber Command, the National Security Agency [NSA], the Defense Information Systems Agency [DISA], and the Army Research Laboratory [ARL]) a DoD enterprise information system continuous monitoring (ISCM) capability to ingest robust, diverse host-based and network-based near-real-time information in order to provide a persistent situational awareness (SA).			
Title: Software Applications ***Description:*** This effort investigates, demonstrates, and matures software applications to provide for the adaptation of broadband, widely used applications and algorithms to address research, development, test and evaluation (RDT&E) requirements. The Computational Research Engineering Acquisition Tools and Environments (CREATE) initiative demonstrates and matures advanced application codes to allow scientists and engineers to use supercomputers to design and analyze virtual prototypes of DoD ships, fixed-wing aircraft, rotorcraft, ground vehicles, and radio frequency (RF) antennas; HPCMP Institutes demonstrate and mature advanced supercomputing application codes to address critical high-impact DoD challenges (e.g. blast protection for platforms and personnel, high-power microwaves and lasers, munition sensitivities, and mobile network designs/prototypes); the Productivity, Enhancement, Technology Transfer, and Training (PETTT) initiative (1) optimizes/enhances critical DoD physics-based and parallel discrete event software in order to allow scientists and engineers to execute scientific calculations with precision and efficiency on advanced, leading-edge supercomputers, (2) demonstrates/matures robust immersive collaborative	57.342	53.146	52.224

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
programming environments to improve science and engineering workflows, and (3) demonstrates/matures leading-edge computational technology from academia and industry			
FY 2014 Accomplishments: Demonstrated fixed-wing aircraft model which accounts for both the aerodynamic effects of the air-frame as well as the airflow of the jet engine in order to (a) specify a design modification which reduced the engine intake turbulence for the A-10 Warthog and (b) certify store-separation for military aircraft (i.e. to validate that a bomb or missile can be safely released from an aircraft); demonstrated rotorcraft model to determine if new blade proposed by Boeing for the CH-47F Chinook increased payload allowance while still allowing the same maximum forward velocity; demonstrated radio frequency (RF) electromagnetics (EM) model (a) to determine the EM scattering for jet engines and (b) to analyze the performance of antenna systems for military platforms; demonstrated structural model to determine (a) naval vessel vulnerability due to underwater explosions and (b) surface/ underwater maneuverability (e.g. for the Ohio Replacement Submarine); demonstrated coupled-physics model for conducting analyses of alternatives (AoAs) for concept ship designs (Navy used model to assess over 22,000 design options for the LX(R) Amphibious Assault Ship and to conduct initial Small Surface Combatant (SSC) studies under the direction of the Secretary of the Navy); investigated initial suite of computational models which couple (a) the high-fidelity dynamics of multi-bodies (i.e. interconnected rigid/flexible parts of an unpowered vehicle), (b) a model of a vehicle powertrain (i.e. components necessary to generate power and deliver that power to the road/surface), and (c) a physics-based model of the surrounding environment in order to virtually test vehicle mobility across a wide range of scenarios; investigated detonation shock dynamics for a GPS-guided munition (Excalibur) used in close-support situations (i.e. within 150m of friendly troops) and matured detonation shock dynamics portion of shock physics code ALE3D; demonstrated directed energy computational model used to improve the design (i.e. double the output power) of an air-launched directed-energy weapon intended to incapacitate/damage electronic systems; demonstrated parallel data analytics code used to reduce (by a factor of ~20) the processing time of large data generated by semiannual Army Network Integration Evaluation (NIE); matured model for examining personnel/platform blast protection (e.g. determining blast effects on (a) wheeled armored personnel carriers (APCs) and (b) vehicle occupants in support of Occupant Centric Platform (OCP) and Warrior Injury Assessment Manikin (WIAMAN) blast experiments); demonstrated initial capability to model grooved ductile (i.e. deformable) concrete slabs in order to refine designs for future military runways; investigated important explosive detonation code under an experimental execution framework to examine the viability of legacy codes on future (i.e. exascale) architectures			
FY 2015 Plans: Mature jet engine propulsion portion of fixed-wing aircraft model to account for engine dynamics under cruise flight conditions; mature rotorcraft model to address the complex multi-physics (i.e. fluid dynamics and structural mechanics) required to analyze the Joint Multi-Role (JMR) Helicopter (an anticipated replacement for over 4,000 medium-lift helicopters); investigate coupled-physics model for conducting analyses of alternatives (AoAs) for fixed-wing aircraft concept designs; mature radio frequency			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
(RF) electromagnetics (EM) model to increase dynamic range of features sizes (i.e. minute details on a large platform) in order to determine the optimal placement of antennas on a heavily armed ground-attack aircraft variant of the C-130 (i.e. the AC-130 Specter); mature structural ship model to assess naval vessels under various (a) sea-states (i.e. ocean conditions), (b) complex maneuvers, and (c) degrees of stability (e.g. intact and damaged); mature model for conducting analyses of alternatives (AoAs) for concept ship designs to support further Small Surface Combatant (SSC) studies under the direction of the Secretary of the Navy; demonstrate suite of computational models which couple (a) the high-fidelity dynamics of multi-bodies (i.e. interconnected rigid/flexible parts of an unpowered vehicle), (b) a model of a vehicle powertrain (i.e. components necessary to generate power and deliver that power to the road/surface), and (c) a physics-based model of the surrounding environment in order to virtually test vehicle mobility across a wide range of scenarios; further mature model for examining personnel/platform blast protection (e.g. determining blast effects on (a) wheeled armored personnel carriers (APCs) and (b) vehicle occupants in support of Occupant Centric Platform (OCP) and Warrior Injury Assessment Manikin (WIAMAN) blast experiments); investigate, demonstrate, and mature computational models via PETTT to address critical DoD HPC RDT&E needs			
FY 2016 Plans: Will further mature jet engine propulsion portion of fixed-wing aircraft model to account for engine dynamics under transient flight conditions (i.e. complex maneuvers); will further mature rotorcraft model to address the intricate maneuvers required to analyze the Joint Multi-Role (JMR) Helicopter (an anticipated replacement for over 4,000 medium-lift helicopters); will mature coupled-physics model for conducting analyses of alternatives (AoA) for fixed-wing aircraft concept designs to investigate (a) next generation cargo aircraft (i.e. potential future replacements for the C-130 and C-17) and (b) advanced precision-guided Army parachutes for deployment of equipment and supplies to ground troops; will further mature radio frequency (RF) electromagnetics (EM) model to assess the ability to shrink antennas for F-22s and F-35s using advanced materials (e.g. meta-materials – artificial substances engineered to have properties not found in nature); will further mature multi-physics ship model to allow refined ship/shock analysis for underwater/surface explosions, capturing the effects of moderate and severe structural damage; will further mature multi-physics ship model to allow detailed propeller analysis, capturing the effects of cavitation [i.e. the creation of voids/bubbles]; will further mature model for conducting analyses of alternatives (AoAs) for concept ship designs by incorporating cost as a design variable; will mature suite of computational models which couple (a) the high-fidelity dynamics of multi-bodies (i.e. interconnected rigid/flexible parts of an unpowered vehicle), (b) a model of a vehicle powertrain (i.e. components necessary to generate power and deliver that power to the road/surface), and (c) a physics-based model of the surrounding environment in order to virtually test vehicle mobility across a wide range of scenarios; will further mature model for examining personnel/platform blast protection (e.g. determining blast effects on (a) wheeled armored personnel carriers (APCs) and (b) vehicle occupants in support of Occupant Centric Platform (OCP) and Warrior Injury Assessment Manikin (WIAMAN) blast experiments); will investigate, demonstrate, and mature computational models via PETTT to address critical DoD HPC RDT&E needs			
Accomplishments/Planned Programs Subtotals	174.567	181.518	177.159

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DW5 / *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	38.671	40.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This is a Congressional increase to the High Performance Computing Modernization Program.

This project enables the Defense research, development, test and evaluation (RDT&E) community to resolve critical scientific and engineering problems more quickly, and with more precision, using advanced, physics-based computer simulation supported by high performance computing (HPC) technology. The computational expertise and resources enable DoD personnel to analyze phenomena that are often impossible, not cost effective, too time-consuming, or too dangerous to study any other way. The High Performance Modernization Program (HPCMP) supports the requirements of the DoD's scientists and engineers in three major areas of effort: supercomputing resource centers, the Defense Research and Engineering Network (DREN), and support for software applications. DoD Supercomputing Resource Centers (DSRCs) provide extensive capabilities and demonstrate new technologies that address user requirements for hardware, software, and programming environments. Efforts of the DSRCs are augmented by dedicated HPC project investments (DHPIs) that address near real-time and real-time HPC requirements. The total aggregate computational capability is roughly 1.7 quadrillion floating point operations per second (1.7 petaFLOPS); this capability is expected to double by 2013. All sites in the HPC Modernization Program are interconnected to one another, the user community, and major defense sites via the DREN, a research network which matures and demonstrates state of the art computer network technologies. The DREN interconnects 45 user and center sites at network speeds of up to 3 gigabits per second. The Software Application Support (SAS) effort optimizes and improves the performance of critical common DoD applications programs to run efficiently on advanced HPC systems, matures and demonstrates leading-edge computational technology from academic and commercial partners, and provides collaborative programming environments.

Work in this project supports the Army S&T Innovation Enablers (formerly named Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Congressional Increase	38.671	40.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DW5 / *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
FY 2014 Accomplishments: Congressional increase for the High Performance Computing Modernization Program. ***FY 2015 Plans:*** Congressional increase for the High Performance Computing Modernization Program.		
Congressional Adds Subtotals	38.671	40.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	22.233	13.070	13.993	-	13.993	17.451	18.659	18.644	18.972	-	-
608: *Countermine & Bar Dev*	-	22.233	13.070	12.008	-	12.008	15.465	16.674	16.658	16.986	-	-
683: *Area Denial Sensors*	-	-	-	1.985	-	1.985	1.986	1.985	1.986	1.986	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates sensor components, subsystems and neutralization technologies that can be used by dismounted forces, ground and air platforms to detect, identify and mitigate the effects of landmines, improvised explosive devices, minefields, and other explosive hazards/threats. This PE also conducts modeling and simulation activities to assess the effectiveness of detection and neutralization concepts. Project 608 supports the maturation and demonstration of enabling component and subsystems for counter explosive hazards and countermine technologies in the areas of countermine and barrier development and Project 683 funds efforts on area denial sensors.

Work in this PE is fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602622A (Chemical, Smoke and Equipment Defeating Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602712A (Countermine Systems), PE 0602784A (Military Engineering Technology), PE 0603004 (Weapons and Munitions Advances Technologies), PE 0603270 (Electronic Warfare Technology) and PE 0603710A (Night Vision Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	22.794	13.074	14.095	-	14.095
Current President's Budget	22.233	13.070	13.993	-	13.993
Total Adjustments	-0.561	-0.004	-0.102	-	-0.102
• Congressional General Reductions	-	-0.004			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.561	-			
• Adjustments to Budget Years	-	-	-0.102	-	-0.102

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 608 / *Countermine & Bar Dev*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
608: *Countermine & Bar Dev*	-	22.233	13.070	12.008	-	12.008	15.465	16.674	16.658	16.986	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates counter explosive hazard technologies for finding and neutralizing surface and buried threats in varying vegetation, soil, weather and diurnal conditions. Activities include remote/standoff detection of individual explosive hazards and minefields and neutralization of explosive threats, landmines and minefields. This project also evaluates airborne explosive hazard detection sensors and fabricates them for lightweight plug-and-play use, on manned and Unmanned Aerial Systems (UASs) in mission specific applications. Efforts are supported by modeling and simulation assessments to define potential system effectiveness.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

This project supports Army science and technology efforts in the Ground Maneuver, Soldier, Air and Command, Control, Communications and Intelligence portfolios.

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Ft. Belvoir, VA. Minefield neutralization efforts are closely coordinated with Navy/US Marine Corps.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Explosive Hazard Detection for Manned and Unmanned Aerial Systems ***Description:*** This effort provides manned and unmanned aerial systems (UASs) the capability to detect explosive threats, threat deployment activities, minefields and Home Made Explosives (HME). ***FY 2014 Accomplishments:*** Demonstrated the performance of the specialized sensor integrated on the PUMA Small Unmanned Aerial Vehicle (SUAV) in a relevant environment; validated and tested the compatibility of the multi-spectral sensor developed for the Shadow Tactical Unmanned Aerial Vehicle (TUAV) with the communications architecture of the airframe and ground station.	6.263	-	-
Title: Ground Vehicle Explosive Hazard Detection ***Description:*** This project improves detection of low metal/low contrast explosive threats buried in the road, such as Improvised Explosive Devices (IEDs) and antitank landmines. Currently, Ground Penetrating Radar (GPR) capabilities for detection of explosive threats in an electronic warfare environment are limited by radar receiver technology and detection latency. Improving the signal to noise ratio and acquisition rates reduces susceptibility to electromagnetic interference and improves the interoperability with electronic countermeasures, while continuing to improve detection and reduce false alarms. This project improves detection of explosive hazards when emplaced along the sides of roads. Technology is also needed to increase standoff	13.031	10.056	12.008

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 608 / *Countermine & Bar Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
detection and defeat distances, both in roads and off routes, enabling faster rates of advance and safer operations to support early entry and route clearance missions. ***FY 2014 Accomplishments:*** Integrated and demonstrated performance of initial full size four-panel digital GPR array with greater detection; integrated and demonstrated performance of ground vehicle based, forward looking Electro-Optical/infrared (EO/IR) sensor; matured sensor fusion algorithms and cueing techniques to enable handoff of potential in-road threats detected in front of the vehicle to the on-board digital GPR for confirmation of threat locations to enable increased rates of advance during route clearance operations. ***FY 2015 Plans:*** Demonstrate a digital GPR array in a militarily relevant environment and evaluate detection performance against buried threat devices with and without presence of electronic countermeasures; integrate ground vehicle based, forward looking EO/IR sensor on a military vehicle. ***FY 2016 Plans:*** Will mature target detection algorithms for digital GPR array for identification of explosive hazards in roads and for precision marking; mature forward looking EO/IR sensor suite with optimized spatial and spectral resolutions, multi-step target detection algorithms and automated decision making tools to provide integrated capabilities; integrate EO/IR and GPR sensors data and analysis architectures to fuse target nominations from the standoff and localization sensors into a Graphical User Interface (GUI); demonstrate Light Detection and Ranging (LIDAR) sensor to image and identify side attack targets and threats and baseline target detection algorithms to detect road side explosive hazards.			
Title: Dismounted Explosive Hazard Detection ***Description:*** This effort matures, fabricates and evaluates lab demonstrators based on two different technologies to improve dismounted forces' capability to detect Improvised Explosive Hazards (IEDs) and landmines. This effort develops an illumination capability and modifies target detection algorithms for integration into current demonstrator digital goggles. This helmet mounted capability will aid the dismounted forces as they execute route clearance missions by improving detection of command initiation wires, trip wires and indicators of IED emplacement such as disturbed earth. A next generation handheld explosive hazard detector technology will also be developed and matured with improved IED detection capabilities and Size, Weight, and Power (SWaP) characteristics. The next generation handheld detector technology may be inserted into the current AN/PSS-14 Mine Detector as an upgrade or may be a new handheld detector. ***FY 2014 Accomplishments:*** Collected data in relevant environments using an improved digital night vision goggle with a new counter IED mode demonstrator and optimized target detection algorithms; demonstrated performance of low/no-metal hand held buried explosive hazard detector	2.939	3.014	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 608 / *Countermine & Bar Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
against realistic IED and mine targets (including both metallic, non-metallic and command wire threat components) by integrating metal detector and ground penetrating radar technologies into a single system. ***FY 2015 Plans:*** Demonstrate advanced handheld GPR antenna and improved wideband metal detection coils and collect data in field conditions for development of improved target detection algorithms.			
Accomplishments/Planned Programs Subtotals	22.233	13.070	12.008

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 683 / *Area Denial Sensors*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
683: *Area Denial Sensors*	-	-	-	1.985	-	1.985	1.986	1.985	1.986	1.986	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates surveillance, command and control technology components for alternative area protection systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). The technology includes distributed personnel surveillance systems and command and control systems to be used with man-in-the-loop overwatch fires. This project uses modeling and simulation to evaluate new concepts and modify doctrine. This project also fabricates components, as well as system architectures and conducts evaluations at the system level in field settings.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

This project supports Army science and technology efforts in the Ground and Command, Control, Communications and Intelligence portfolios.

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Area Denial Sensors ***Description:*** This effort matures and demonstrates current networked sensor and sensor fusion technology efforts to provide detection, identification, and classification for remotely delivered sensor systems and area denial munitions. Key technologies to be matured and demonstrated include deployable multi-mode sensors, fused sensor information, and local area network communications to meet requirements for man-in-the-loop command and control. ***FY 2016 Plans:*** Will mature deployable multi-mode sensor architecture that can be integrated into remote delivery munitions focusing on harsh shock environments; mature sensor fusion technologies to provide operator management of many remotely employed multi-mode sensor nodes to provide situational awareness and area denial effects.	-	-	1.985
Accomplishments/Planned Programs Subtotals	-	-	1.985

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 683 / *Area Denial Sensors*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	4.902	7.318	5.105	-	5.105	5.839	5.787	5.874	5.990	-	-
627: *Jt Svc Sa Prog (JSSAP)*	-	4.902	7.318	5.105	-	5.105	5.839	5.787	5.874	5.990	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced technologies that provide greater lethality, target acquisition, fire control, and range at a significantly reduced weight. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden while maintaining or improving current levels of performance.

Efforts in this program element support the Lethality Science and Technology portfolio.

Work in this PE is related to and fully integrated with the efforts funded in PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology) and PE 0602618A (Ballistic Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	5.027	7.321	5.143	-	5.143
Current President's Budget	4.902	7.318	5.105	-	5.105
Total Adjustments	-0.125	-0.003	-0.038	-	-0.038
• Congressional General Reductions	-	-0.003			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.125	-			
• Adjustments to Budget Years	-	-	-0.038	-	-0.038

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603607A / *Joint Service Small Arms Program*	Project (Number/Name) 627 / *Jt Svc Sa Prog (JSSAP)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
627: *Jt Svc Sa Prog (JSSAP)*	-	4.902	7.318	5.105	-	5.105	5.839	5.787	5.874	5.990	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced technologies that provide greater lethality, target acquisition, fire control, training effectiveness and range at a significantly reduced weight. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden while maintaining or improving current levels of performance.

Efforts in this program element support the Soldier Science and Technology portfolio.

Work in this PE is related to and fully integrated with the efforts funded in PE 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Small Arms Weapons and Fire Control Integration	1.786	5.665	-
Description: Breadboard concepts from the Advanced Fire Control Technology for Small Arms (0602623A/H21) will be integrated into lab demonstrators and evaluated on relevant current (M4, M16, M249, M240) and developmental small arms systems to optimize affordability, target acquisition, fire control, weight, and lethality. Project transitions to Project Manager Soldier Weapons (PM SW). ***FY 2014 Accomplishments:*** Completed integration of the daytime electro-optic fire control demonstrator with target tracking algorithms and range determination component technologies for machine gun mounted optics; demonstrated capability to track multiple targets and increase probability of hit by 100% out to a range of 1200 meters. ***FY 2015 Plans:*** Perform final developmental testing and assessments in a relevant environment; demonstrate compatibility with current M240 machine gun in actual system environments; achieve TRL 6 for matured component technologies and transition Technical Data Package (TDP).			
Title: Small Arms Grenade Munitions Integration and Evaluation	3.116	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*	**Project (Number/Name)** 627 / *Jt Svc Sa Prog (JSSAP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: The best breadboard concepts from the Advanced Lethality Armament Technology for Small Arms (0602623A/H21) project will be integrated into a 40mm ammunition prototype and evaluated on current (M203, M320, and M32 40mm grenade launchers) small arms systems to optimize affordability, effects and lethality. Project transitions to Project Manager Maneuver Ammunition Systems (PM MAS). ***FY 2014 Accomplishments:*** Minimized dispersion and drag variation of the M433 40mm grenade through exterior design modifications in order to maximize the range of the projectile; integrated the smaller fuze and sensor components into the improved projectile body; demonstrated improved warhead and ballistic performance; transitioned grenade design improvements to PM-MAS. Initiated weapon effectiveness study to understand target and advanced projectile interactions for overwhelming lethal effects.			
Title: Advanced Small Unit (Squad) Small Arms Technology Demonstration ***Description:*** Identify, advance, and demonstrate advanced technologies leading to the ability to improve Small Unit level effectiveness and utilize new small arms technological concepts to improve range overmatch capability against like-sized threat elements. ***FY 2015 Plans:*** Demonstrate enabling technologies that double maximum effective range of door-breaching munition from 33m to 66m; double the maximum effective range to 2km for .50 caliber ammunition; increase probability of hit and hard target penetration; and double probability of hit for rifles from 0-600m ***FY 2016 Plans:*** Will demonstrate a closed loop fire control weapon modification kit to compensate for dismounted shooter wobble. User-interface components will be controlled via target tracking software and embedded mobile processing hardware that optically monitor target position relative to point of aim in order to double probability of hit for rifles from 0-600m.	-	1.653	0.403
Title: Small Arms Material and Process Technology Demonstration ***Description:*** This effort addresses state of the art material substrates and surface coatings matured in PE 0602623A to improve reliability, reduce maintenance and improve weapon diagnostics through embedded technology. ***FY 2016 Plans:***	-	-	1.696

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*	**Project (Number/Name)** 627 / *Jt Svc Sa Prog (JSSAP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will demonstrate the application of solids substances that eliminate the need to apply lubricant to weapon components, reduce carbon fouling that builds up from weapon firing and reduce weapons maintenance time; achieve TRL 6 for matured technologies; and transition Technical Data Package (TDP) formulation.			
Title: Volume Effects ***Description:*** This effort addresses the maturation and demonstration of emerging small arms technologies from PE 0602623A efforts into current and next generation weapon systems to address Volume (sustained suppressive and lethal fires for area targets) capability gaps for improved effectiveness at extended ranges. ***FY 2016 Plans:*** Will mature fire control and ammunition technologies for lightweight medium machine gun (up to 1200 meters range) and lightweight heavy machine gun (up to 2400 meters range) to support emerging next generation weapon system requirements to provide the capability to achieve desired accuracy and incapacitating effects with volume fire.	-	-	2.152
Title: Precision Effects ***Description:*** This effort addresses the maturation and demonstration of emerging small arms technologies from PE 0602623A efforts into current and next generation weapon systems to address precision fire (Precision fire is support fire in the offense during the assault and engagement of targets to the maximum effective range of the weapon) and Fire Control capability gaps for improved accuracy at extended ranges. ***FY 2016 Plans:*** Will mature and demonstrate advanced future sniper rifles, advanced optics and image processing algorithms and spotting scopes technologies to support emerging precision weapon system requirements with the ability to achieve desired accuracy and incapacitating effects with precision fire against personnel targets for the squad (up to 600m) and the Platoon (up to 2400m).	-	-	0.854
Accomplishments/Planned Programs Subtotals	4.902	7.318	5.105

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*	**Project (Number/Name)** 627 / *Jt Svc Sa Prog (JSSAP)*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	43.459	44.119	40.929	-	40.929	44.968	40.135	44.000	44.872	-	-
K70: *Night Vision Adv Tech*	-	19.867	27.331	26.740	-	26.740	27.793	22.802	26.657	27.186	-	-
K73: *NIGHT VISION SENSOR DEMONSTRATIONS (CA)*	-	8.000	-	-	-	-	-	-	-	-	-	-
K86: *Night Vision, Abn Sys*	-	15.592	16.788	14.189	-	14.189	17.175	17.333	17.343	17.686	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates sensor technologies that increase Warfighter situational awareness, survivability and lethality by providing sensor capabilities to acquire and engage targets at longer ranges in complex environments and operational conditions (e.g. day/night, obscured, smoke, adverse weather and other degraded visual environments). Project K70 pursues technologies that improve the Soldier's ability to see at night, provide rapid wide area search, multispectral aided target detection (AiTD), integrate disparate sensor architectures, and enable passive long range target identification (ID beyond threat detection) in ground test-beds. Project K86 matures and evaluates sensors and algorithms designed to detect targets (vehicles and personnel) in camouflage, concealment and deception from airborne platforms, and provides pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602712A (Countermine Systems), PE 0603001A (Warfighter Advanced Technology), PE 0602211A (Aviation Technology), PE 0603003A (Aviation Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603606A (Landmine Warfare and Barrier Advanced Technology), PE 0603774A (Night Vision Systems Advanced Development) and PE 0604710A (Night Vision Systems Engineering Development).

Work in this PE is performed by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*

B. Program Change Summary ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**
Previous President's Budget	44.387	44.138	44.228	-	44.228
Current President's Budget	43.459	44.119	40.929	-	40.929
Total Adjustments	-0.928	-0.019	-3.299	-	-3.299
• Congressional General Reductions	-	-0.019			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.928	-			
• Adjustments to Budget Years	-	-	-3.299	-	-3.299

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: K73: *NIGHT VISION SENSOR DEMONSTRATIONS (CA)*		
Congressional Add: *Program Increase*	8.000	-
Congressional Add Subtotals for Project: K73	8.000	-
Congressional Add Totals for all Projects	8.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K70: *Night Vision Adv Tech*	-	19.867	27.331	26.740	-	26.740	27.793	22.802	26.657	27.186	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates high-performance integrated sensor/multi-sensor technologies to increase target detection range, extend target identification range, and reduce target acquisition (TA) timelines for dismounted Soldiers and tactical vehicles against threats that are beyond today's detection ranges or are partially obscured by terrain, weather or other features.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Air and Soldier Portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC) /Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Weapon Sight Technology	6.102	6.186	-
Description: This effort develops, integrates and demonstrates critical components for the next generation of weapon sight systems for mounted and dismounted Soldier use to provide improved actionable intelligence and the tools to assist in recognizing and identifying friend or foe.			
FY 2014 Accomplishments: Integrated and evaluated an integrated sensor fusion kit (combines situational awareness and target handoff) and existing fielded equipment and improved algorithms to reduce false alarms for an affordable ultra violet (UV)/virtual pointer (VP) and hand-held targeting technology; leveraged and integrated latest generation of high performance Focal Plane Arrays (FPAs), displays, advanced optics, direction finding and wireless data component technologies for lighter weight, lower power, clip-on weapon sight with improved range performance.			
FY 2015 Plans: Improve sensor processing efficiency and demonstrate crew served weapon sight with increased range, ID capability and reduced Size, Weight, and Power (SWaP); leverage new optical design and high performance uncooled infrared detector to complete			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
design of next generation sniper weapon sight with reduced SWaP; begin design studies of conformal head mounted composite waveguide displays with day/night usability and wireless interface for remote display of weapon sight imagery.			
Title: Tactical Ground Persistent Surveillance and Targeting ***Description:*** This effort matures and demonstrates high-performance integrated sensor/multi-sensor technologies to increase local situational awareness and target discrimination capabilities and reduce target acquisition (TA) timelines for dismounted Soldiers, combat vehicles, tactical robots, ground and urban sensors against threats that are beyond today's ranges or discrimination capabilities or are partially obscured by terrain. ***FY 2014 Accomplishments:*** Increased sensor resolution with large format focal plane arrays and improved active illumination coverage to demonstrate long range, rapid and positive target recognition; improved gimbal performance through a combination of mechanical and electrical techniques to provide stabilized imagery for the sensor surveillance suite; demonstrated improved moving target indicator software capable of human and small unmanned aerial vehicle target recognition with improved system performance by leveraging laser range finder, cross-cueing with radars and advanced real-time signal processing of infrared imagery. ***FY 2015 Plans:*** Mature and validate algorithms for ground to air infrared search and track capabilities; optimize techniques to include rotating camera(s), stacked prisms, and staring arrays to improve 360 degree coverage and increase affordability; demonstrate high resolution target tracking and identification for target handoff and engagement.	6.108	5.443	-
Title: Advanced Sensors for Precision ***Description:*** This effort matures and demonstrates technologies that allow combat vehicle commanders and crewmen to detect more rapidly, identify and geo-locate threat targets to enable fire control for platform weaponry. The effort leverages advanced Infrared (IR) imaging technology, 3-Dimensional (3D) imaging sensor techniques, emerging multispectral laser technologies and precise far target location technology to increase target detection range, extended target and reduce target acquisition timelines. This effort supports the Army's Active Protection System (APS) program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. ***FY 2014 Accomplishments:*** Integrated next generation, high definition component technologies to rapidly detect and identify threats while on-the-move for vehicle sights; demonstrated flash detection capability coupled with acoustics for cueing and bullet tracking; developed hardware and software for detection and negation of sniper optics. ***FY 2015 Plans:***	7.657	10.688	11.573

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Validate low cost integrated uncooled IR sensors for Situational Awareness (SA) and muzzle flash detection; improve design for active threat sensor detection of uncooled and cooled IR sensors; mature clutter rejection techniques for reduced false alarms and threat sensor point of origin determination; exploit existing and emerging laser technologies and determine limitations for suppression of threat night vision and electro-optic imaging sensors; begin development of concept demonstrator hardware to demonstrate detection/suppression in a single waveband. ***FY 2016 Plans:*** Will demonstrate uncooled IR for SA and muzzle flash detection and on the move performance of ground hostile fire detection and algorithms; optimize design for pre-shot threat sensor detection of uncooled and cooled IR sensors; demonstrate hostile fire clutter rejection techniques for reduced false alarms and threat sensor point of origin determination and assess performance for an expanded threat set; validate laser technologies and limitations for pre-shot suppression of threat sensors; demonstrate stationary pre-shot detection/suppression of threat imaging sensors at objective ranges; perform perception experiments on pre-shot suppression to determine metrics and system requirements.			
Title: Sensor Interoperability ***Description:*** This effort is developing and demonstrating an interoperability architecture that allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge. The goal is to develop standards, data models, and protocols that provide a common language for sensor systems to connect, publish their capabilities and needs, and interact with other systems even on disadvantaged networks. The benefits are increased sensor collaboration, more rapid time to decision, reduced soldier load, and lowered integration costs. ***FY 2015 Plans:*** Model and simulate the sensor portion of the Computing Environment (CE); mature and evaluate sensor to network standards including implementation specifications and guides; implement standards, demonstrate, evaluate and refine interoperability of Electro-optic/Infrared, radar sensors, chemical, biological, radioactive, nuclear, explosive (CBRNE) systems, biometric sensors; mature and demonstrate sensor imagery and metadata products as well as Dynamic, Distributed, Discover (D3) configuration capability. ***FY 2016 Plans:*** Will develop methodologies for sensor interoperability and appropriate data flow across security classification domains; develop approaches to tailoring data request results that minimize network bandwidth requirements; improve the architecture and framework using distributed networked resources such as storage, processing, bandwidth to provide redundancy, robustness, and fault tolerance in both Enterprise and Tactical networks.	-	4.000	3.500
Title: Soldier System Architecture	-	1.014	1.018

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort designs, develops and matures soldier sensor, optics, displays and electronic system interfaces that will be incorporated into the larger Soldier system architecture to improve the individual Soldier's effectiveness / efficiency, reducing burden while reducing total operational costs. This effort is coordinated with PE 0603001A/Project J50, PE 0602716A/Project H70, PE 0602786A/Project H98, 060315A/Project S28, and 0603004A/Project 232. ***FY 2015 Plans:*** Develop Measures of Effectiveness / Measures of Performance (MOE/MOP) for the sensor, optics, displays and electronic systems used by the individual Soldier and integrate these MOE/MOPs into the overall Soldier System Architecture. ***FY 2016 Plans:*** Will evaluate MOE/MOP for the sensor, optics, displays and electronic systems used by the individual Soldier and refine MOE/MOPs as part of the overall Soldier System Architecture.			
Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE) ***Description:*** This effort provides uncooled Infrared (IR) sensor technologies to improve survivability through increased Situational Awareness (SA) in all conditions and environments, to include (DVE), for manned and unmanned ground vehicle systems. Current uncooled IR requires improvement in sensitivity and development of signal processing techniques to penetrate obscurants. Integration of improved sensors, signal processing algorithms, and data fusion will maintain mission capabilities in DVE (e.g. smoke, dust, fog). Demonstration of scalable, multi-function (360 degree SA, Hostile Fire Detection (HFD), Aided Driving), low cost SA systems with in-vehicle displays that can be tailored to the ground platform and mission requirements will bring timely and useful information to the vehicle crew and squad. Joint effort with TARDEC under PE 0602601, PROJ C05 and 0603005, PROJ 221. Fully coordinated with PE 0602709, PROJ H95. ***FY 2016 Plans:*** Will evaluate technologies that support ground SA in DVE to include optimized uncooled IR sensors with optical filtering or signal processing techniques, integration of sensor combinations and modalities, and fusion of sensor data; evaluate concepts for scalability and multi-function sensor capability that can be applied to tactical vehicles and combat platforms; explore industry approaches for automotive driving aids for automated personnel and obstacle detection and applicability to military environments.	-	-	4.840
Title: Soldier Maneuver and Lethality Sensors ***Description:*** This effort matures and demonstrates dismounted Soldier capabilities that improve Soldier mobility, maneuver, situational awareness, threat detection, targeting and lethality. Innovative technologies for Soldier weapon or head mounted sensors, head mounted displays, and tactical lasers will be provided for user evaluation. These technologies address human factors / human dimension and lower weight, reduce cost, and improve performance of Soldier based sensor systems.	-	-	5.809

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2016 Plans: Will design head mounted High Definition (HD) color waveguide displays to replace heavier and larger prism based devices to enable use with protective eyewear; incorporate improved display components for injection node and holograms to increase brightness and reduce image distortion for day/night usability; improve Soldier target engagement by evaluating crosswind profile measurement, self boresighting reticle, and thru sight situational awareness technologies.			
Accomplishments/Planned Programs Subtotals	19.867	27.331	26.740

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K73 / *NIGHT VISION SENSOR DEMONSTRATIONS (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K73: *NIGHT VISION SENSOR DEMONSTRATIONS (CA)*	-	8.000	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Night Vision advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	8.000	-
FY 2014 Accomplishments: Demonstrated Night Vision Electro-Optical and Infrared (EO/IR) technology to address Warfighter needs in the areas of situational awareness, operations in degraded visual environments (DVE) and Soldier/Squad mobility.		
Congressional Adds Subtotals	8.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K86: *Night Vision, Abn Sys*	-	15.592	16.788	14.189	-	14.189	17.175	17.333	17.343	17.686	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates intelligence, surveillance, reconnaissance, targeting and pilotage technologies in support of the Army's aviation and networked systems. This effort focuses on improved reconnaissance, surveillance and target acquisition and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for Army vertical lift aircraft and utility helicopters and unmanned aerial systems (UAS). UAS payload efforts mature and demonstrate small, lightweight, modular, payloads (electro-optical/infrared, laser radar, designator) to support target detection, identification, location, tracking and targeting of tactical targets for the Brigade Combat Team.

The project supports Army science and technology efforts for the Air and Command, Control, Communications and Intelligence portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is fully coordinated with PE 0602211A (Aviation Technology) PE 0603003A (Aviation Advanced Technology).

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC) /Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Airborne Unmanned Persistent Imaging ***Description:*** This effort demonstrates day and night persistent surveillance imaging and enhanced reconnaissance, surveillance and target acquisition (RSTA) capabilities from a single payload on the Grey Eagle Unmanned Aerial System (UAS). The technology will be applied to smaller/lighter UASs as miniaturized large format sensors mature. ***FY 2014 Accomplishments:*** Completed system flight testing; matured Step-Stare capability, demonstrated local-area persistent surveillance for small unit situational awareness; demonstrated automated target cueing, vehicle and dismount tracking, image mosaicing and mapping, and provided imagery and target report products to the small unit network; demonstrated high definition (HD) dual band 720 pixel format Mid Wave Infrared (MWIR) and Long Wave Infrared (LWIR) imagery to determine best band for battlefield conditions and improved performance in adverse weather.	4.730	-	-
Title: High Definition Aviation Displays	6.665	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort develops and demonstrates an advanced monocular, see-through, high definition, digital, helmet mounted display (HMD) to replace Apache's analog, cathode ray tube-based Integrated Helmet and Display Sight System (IHADSS) and provides a baseline for future aviation HMDs. ***FY 2014 Accomplishments:*** Completed fabrication of wide field of view system demonstrators; conducted laboratory performance characterization of complete HMD system and aero-medical human factors conformance; finalized platform integration activities; conducted ground and flight test demonstrations and user evaluation.			
Title: Multifunction Imagers for Rotary Wing ***Description:*** This effort matures and demonstrates an economical sensor capability by developing multifunction sensor modules for increased performance of pilotage capability in a Degraded Visual Environment (DVE) at lower total life cycle cost than separate sensor systems. Work in this effort is coordinated with DVE efforts in PE 0602211A, Aviation Technology, Project 47A. ***FY 2014 Accomplishments:*** Developed a dual-speed 60/1000 Hz Readout Integrated Circuit (ROIC) that enables a single infrared (IR) sensor to provide simultaneous day/night imagery for applications such as pilotage; integrated the dual-purpose IR sensor into a multifunction sensor module with other low-light night vision technology to provide a multi-spectral capability; conducted trade studies to optimize sensor placement for multiple applications performance over the entire flight envelope, including degraded visual environments. ***FY 2015 Plans:*** Fabricate a dual-purpose IR sensor with the dual speed ROIC; continue integration of dual-purpose IR sensors with other low-light night vision technology; develop pilotage image processing algorithms in the dual purpose IR sensor; develop threat warning algorithms for use with IR sensor operating at 1000 Hz frame rate; begin flight testing to validate pilotage sensor and processing technologies for performance in degraded visual environments. ***FY 2016 Plans:*** Will complete integration of dual-purpose IR sensors with other low-light night vision technology; characterize performance of threat warning algorithms and pilotage sensor under brownout and rain DVE through a series of laboratory, field and flight test measurements; identify performance issues and optimize threat warning algorithms and pilotage sensors.	4.197	10.042	9.982
Title: Local Area ISR for Tactical Small Units	-	4.746	2.207

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort develops and demonstrates sensors enabling simultaneous display of wide and narrow field-of-view (FOV) infrared imagery for enhanced situational awareness/targeting and multi-band image fusion and the ability to image battlefield laser spot locations for improved targeting accuracy and reduced fratricide caused by laser misalignment. ***FY 2015 Plans:*** Conduct design trade study to retrofit existing turret with optical components to provide simultaneous wide FOV and independently steerable narrow FOV capability through optical beam splitting of the existing common sensor payload dual-band Mid Wave (MW)/ Long Wave (LW) Infrared (IR) camera; begins maturation of a compact, high definition, 3-band (visible, near infrared, shortwave infrared) camera module to enable imaging of battlefield lasers and multi-band image fusion. ***FY 2016 Plans:*** Will complete design to retrofit existing turret with optical components to provide simultaneous wide FOV and independently steerable narrow FOV capability; demonstrate compact, high definition, 3-band (visible, near infrared, shortwave infrared) camera module			
Title: Pilotage Sensor Fusion ***Description:*** This effort develops and matures sensor fusion utilizing combinations of sensing modalities (active and/or passive) and associated real-time processing algorithms and architectures to produce synthetic scene representations that provide increased information content as opposed to scenes produced from existing single mode sensor solutions. ***FY 2015 Plans:*** Collect field data from multiple sensor modalities (e.g. passive/active infrared, radar, shortwave light detection and ranging) under Degraded Visual Environment (DVE) conditions; identify exploitable features associated with each modality; begin development of algorithm approaches to produce synthetic scenes for presentation to the pilot. ***FY 2016 Plans:*** Will validate exploitable features associated with multiple sensing modalities to aid with operations under DVE; demonstrate algorithm approach for fusion of two sensor modalities that provides increased situational awareness to the pilot as compared to either single sensor modality.	-	2.000	2.000
Accomplishments/Planned Programs Subtotals	15.592	16.788	14.189

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	11.540	11.445	10.727	-	10.727	11.137	10.382	10.570	10.773	-	-
002: *Environmental Compliance Technology*	-	1.920	3.171	3.278	-	3.278	3.262	2.190	2.336	2.431	-	-
025: *Pollution Prevention Technology*	-	2.920	-	1.489	-	1.489	1.489	1.488	1.489	1.489	-	-
03E: *Environmental Restoration Technology*	-	6.700	6.024	5.960	-	5.960	6.386	6.704	6.745	6.853	-	-
03F: *Environmental Quality Tech Demonstrations (CA)*	-	-	2.250	-	-	-	-	-	-	-	-	-

Note

FY16 increase for pollution prevention efforts.

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates technologies that assist the Army in becoming environmentally compliant and limiting future liability without compromising readiness or training assets critical to the success of the future force. Project 002 demonstrates tools and methods for compliance with environmental laws relevant to conservation of natural and cultural resource laws while providing a flexible realistic training environment for mission activities. Project 025 demonstrates pollution prevention tools and methods to minimize the Army's use and generation of toxic chemicals and hazardous wastes. Project 03E focuses on maturation and demonstration of technologies for advanced life cycle analysis, advanced sensing, and advanced remediation of Army-unique toxic or hazardous materials. This program demonstrates technological feasibility and transitions mature technologies from the laboratory to the user. Technologies developed by this program element improve the ability of the Army to achieve environmental restoration and compliance at its installations, at active/ inactive ranges and other training lands, and in modernization programs. Technologies demonstrated focus on reducing current and future environmental liability costs.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy and supports the Army Strategy for the Environment.

This program is fully coordinated and complementary to PE 0602720A (Environmental Quality Technology).

Work in this PE is performed by the US Army Engineer Research and Development Center, Vicksburg, MS, and the US Army Research, Development, and Engineering Command, Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	**Date:** February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*

B. Program Change Summary ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**
Previous President's Budget	11.739	9.197	8.690	-	8.690
Current President's Budget	11.540	11.445	10.727	-	10.727
Total Adjustments	-0.199	2.248	2.037	-	2.037
• Congressional General Reductions	-	-0.002			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	2.250			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.199	-			
• Adjustments to Budget Years	-	-	2.037	-	2.037

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2014**	**FY 2015**
Project: 03F: *Environmental Quality Tech Demonstrations (CA)*		
Congressional Add: *Program Increase*	-	2.250
Congressional Add Subtotals for Project: 03F	-	2.250
Congressional Add Totals for all Projects	-	2.250

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 002 / *Environmental Compliance Technology*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
002: *Environmental Compliance Technology*	-	1.920	3.171	3.278	-	3.278	3.262	2.190	2.336	2.431	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies transitioned from PE 0602720A (Environmental Quality Technology), Projects 048 and 896, that assist Army installations and operations in achieving environmental compliance. Army facilities are subject to fines and facility shutdowns for violation of federal, state, and local environmental regulations. Efforts under this project enable the Army to reduce environmental constraints at installations while complying with the myriad of federal, state, and host country environmental regulations and policy. Current and planned efforts enable the Army to efficiently characterize, evaluate, assess, and sustain training and testing capacity; power and water management in contingency operations and on installations; and noise mitigation and management. Technologies demonstrated aim to reduce the cost of resolving compliance issues for the Army, avoid reductions in availability of training facilities, and sustain the viability of testing and training ranges as well as protect the critical resources, i.e., land, air, and waters of the Army.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy, and supports the Army Strategy for the Environment.

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Sustainable Ranges and Lands	1.920	3.171	0.303
Description: This effort provides ecosystem vulnerability assessment and ecosystem analysis, monitoring, modeling and mitigation technologies to support sustainable, unconstrained, realistic access and use of the Army's ranges and lands. This effort demonstrates environmentally safe and cost effective technologies to manage and reduce the increase in noise and pollution concerns associated with training ranges.			
FY 2014 Accomplishments: Evaluated emerging biofiltration technologies applicable to gray water treatment at contingency bases based on technology performance, efficiency, and robustness; developed full scale design specifications for a robust gray water pretreatment component technology based on biofiltration evaluation; developed detailed technology test plan in coordination with Army Test			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 002 / *Environmental Compliance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and Evaluation Command, US Army Public Health Command, and US Army Tank Automotive Research, Development and Engineering Center; matured a dynamic simulation model which integrates the complex adaptive system algorithms representing the dynamic operating systems of a contingency base. ***FY 2015 Plans:*** Develop and evaluate gray water treatment and reuse system (G-WTRS) that is designed to reduce water demand and sustainment cost at 600-3000 personnel contingency operating bases; perform pilot scale testing of G-WTRS prototype; conduct baseline flow, water quality, energy consumption, and maintenance testing; optimize G-WTRS design and operation based on pilot scale testing for maximal performance and energy efficiency; facilitate Army Evaluation Center certification of G-WTRS; mature an intuitive integrated planning, design, and analysis model that addresses power, water, waste and protection related design and resource requirements for contingency bases ranging in size from 50-2000 population; validate standalone models for power, water, waste (solid, sanitary, and hazardous) and protection; mature characterization and forecasting capabilities to assess multi-scale ecological response to compliance mandated altered fire regimes and the consequences for accessible, sustainable and realistic military training lands. ***FY 2016 Plans:*** Will mature and validate the design for a robust, operationally-efficient gray water reuse system that can reduce water demand at Contingency Operating Bases (COBs) of 600-3000 Pax capacity that will result in US Army Public Health Command and US Army Test and Evaluation Command safety and performance approval for fully integrated grey water reuse system for Contingency bases.			
Title: Adaptive & Resilient Installations ***Description:*** This effort demonstrates sustainable, cost efficient and effective facilities; and provides technologies and techniques for achieving resilient and sustainable installation and base operations. Investigates the applicability of utilizing automotive adaptive construction techniques to impact manpower and materials necessary for contingency construction through the development of a prototype additive constructive system utilizing cementitious materials. ***FY 2016 Plans:*** Will integrate contingency base planning, design, operations and management modeling tools that link with the Joint Construction Management System (JCMS) to provide a single system for all Services to plan and execute construction in support of the Joint Force. Will assess the cementitious material requirements and characteristics required for automated additive construction that will be assessed utilizing a rudimentary pre development prototype system.	-	-	2.975
Accomplishments/Planned Programs Subtotals	1.920	3.171	3.278

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 002 / *Environmental Compliance Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 025 / *Pollution Prevention Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
025: *Pollution Prevention Technology*	-	2.920	-	1.489	-	1.489	1.489	1.488	1.489	1.489	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project matures and demonstrates pollution prevention advanced technologies required for sustainable operation of Army weapon systems, to include compliance with regulations mandated by federal, state, and local environmental and health laws. Technology thrusts under this project include demonstration of advanced technologies to enable sustainment of propellant, explosive and pyrotechnic production and maintenance facilities and training ranges through elimination or significant reduction of environmental impacts. These technologies will ensure that advanced energetic materials required for future force's high performance munitions are developed that meet weapons lethality and survivability goals and that are compliant with environmental and health laws. Technology thrusts also include demonstration of technologies for reductions of waste streams at base camps and toxic metal reductions from surface finishing processes.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy and supports the Army Strategy for the Environment.

The project is fully coordinated and complementary to PE 0602720A, Project 895. This project transitions technologies developed under that PE.

Work in this project is performed by the Research, Development, and Engineering Command Army Research Laboratory, Aberdeen Proving Ground, MD, the Armaments Research, Development, and Engineering Center, Picatinny Arsenal, NJ, the Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL , the Natick Soldier Research, Development and Engineering Center, Natick, MA (NSRDEC), and the Tank Automotive Research, Development and Engineering Center (TARDEC), Warren, MI in conjunction with the Army Public Health Command, Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Pollution Prevention Technology	2.920	-	1.489
Description: This effort demonstrates pollution prevention advanced technologies required to sustain operation of Army weapons systems to comply with state, federal, and local environmental and health laws and regulations.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 025 / *Pollution Prevention Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Conventional Ammunition: Conducted large-scale performance and insensitive munitions testing on environmentally benign formulation in relevant end item; Pyrotechnics: Integrated chromate-free delay composition into relevant end item; Toxic Metal Reduction: Demonstrated alternatives to chromic acid anodizing for common aircraft substrates; Zero Footprint Camp: Selected and matured high-payoff approaches for reducing fresh water demand and wastewater generation in contingency bases. ***FY 2016 Plans:*** Conventional Ammunition: will qualify lead-free primary explosive from full-scale production lot; Pyrotechnics: will conduct prototype testing for chromate- and lead-free gasless delay formulations in a relevant end item; Toxic Metal Reduction: will conduct firing tests for large caliber gun barrel with hexavalent chromium-free liner.			
Accomplishments/Planned Programs Subtotals	2.920	-	1.489

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
03E: *Environmental Restoration Technology*	-	6.700	6.024	5.960	-	5.960	6.386	6.704	6.745	6.853	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies transitioned from PE 0602720A (Environmental Quality Technology), Projects 835 and 896 by addressing the management/mitigation of materials and chemicals released to the natural environment and residual environmental effects of military training and operations. The emphasis of this effort includes remediation of legacy materials, e.g., traditional explosives energetics, and unexploded ordinance; management of new materials, e.g., nanomaterials and emerging contaminants; and mitigation of residual impacts from implementation of sustainable technologies and processes. Technologies matured within this project enable the Army to cost effectively address current and future environmental liabilities resulting from the use of militarily relevant materials and chemicals in the environment. Current and planned efforts enable the Army to efficiently characterize, evaluate, assess, and remediate soil and water at installations, ranges, facilities, and during operations in the face of changing weather and climatic conditions. Efforts also identify ways to economically comply with the myriad of federal, state, and host country regulations dealing with contaminated soil and water. A key aspect of this work is the enhancement of risk assessment and life cycle analysis techniques that can more accurately predict and identify the environmental liabilities associated with fielding new systems and technologies. This program includes pilot scale field studies to establish technological feasibility and assess performance and productivity of the risk mitigation techniques.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy and supports the Army Strategy for the Environment.

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Sustainable Ordnance Mitigation and Management	1.450	1.335	1.300
Description: This effort develops real time detection and discrimination methodologies for unique and emerging non-metallic unexploded ordinance (UXO).			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Developed a networked semi- to-fully-autonomous mobile platform with the operational capability to mitigate hazardous UXOs on military ranges. ***FY 2015 Plans:*** Develop electromagnetic induction algorithms for detection and discrimination of emerging non-metallic intermediate electrically conductive materials- based munitions, and models and algorithms applicable to difficult sensing environments. ***FY 2016 Plans:*** Will validate algorithms for the detection and discrimination of intermediate electrically conductive material (IECM) munitions; and will conduct field evaluations of electromagnetic induction (EMI) sensor systems on test ranges with the capability to detect non-metallic IECM munitions.			
Title: Hazard Assessment for Military Materials ***Description:*** This effort demonstrates tools to assess hazard and risk of Army-unique chemicals and material. The tools provide for rapid environmental baseline survey reporting and screening assessments of existing and future militarily relevant compounds and allow for improved predictive risk assessment and provide environmental life cycle assessment capability. ***FY 2014 Accomplishments:*** Demonstrated a toolkit with optimized sensor technologies for rapid and reliable data collection providing real time analysis for contamination within an operational environment. ***FY 2015 Plans:*** Integrate a suite of environmental-quality sensors with analytical capabilities to provide environmental guidance and data visualization associated with environmental monitoring in Army operations in theater; develop rapid hazard screening tools for new Army compounds. ***FY 2016 Plans:*** Will mature sensor technologies (e.g. biological sensors, geochemical sensors and petroleum kit additions) for rapid and reliable data collection providing real time screening for contamination within an operational environment.	0.863	0.722	1.100
Title: Technologies for Sustainable and Green Operations and Acquisition ***Description:*** This effort investigates and matures technologies to control contaminant transport in environmental media on Army lands and mission spaces as well as assesses and demonstrates novel detection, remediation and mitigation capabilities for existing and emerging contaminants. ***FY 2014 Accomplishments:***	2.262	2.043	2.089

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Provided an integrated approach to contamination management in range and installation design; developed methods for the cost effective and environmentally protective management and/or removal of small (size of the granular media or smaller) metallic Depleted Uranium and residues from affected soils and sands; developed a virtual model for wastewater treatment of munitions production water and investigate new technologies for improved water quality of surface water and wetlands impacted by development and use of new munitions. ***FY 2015 Plans:*** Develop cost-effective, efficient, and integrative tools for remediation of contaminated wastewater from insensitive munitions production. Tools are planned for rapid transition under technology transition agreement with the Project Director Joint Services for next generation Army ammunition Industrial Base Insensitive Munitions (IM) Wastewater Treatment technologies. ***FY 2016 Plans:*** Will validate computational tools to predict the physical and chemical properties and toxicity of insensitive munitions to assess hazard potentials and health effects of insensitive munitions. Will mature predictive models and computational tools to assess surface water characterization and contaminate potential in austere environments.			
Title: Risk Prediction and Decision Technologies ***Description:*** The goal of this effort is to develop and provide integrated science and technology solutions to Army environmental challenges with a focus on acquisition lifecycle models to predict environmental attributes of emerging chemicals and materials that will proactively minimize impacts to the mission and to the Soldier. ***FY 2014 Accomplishments:*** Applied climate models, under site level simulation frameworks, to validate web-based visualization tools that provide a framework for assessing multi-stressor impacts due to predictive climatic changes; demonstrated appropriate protocols for generating/ parameterizing environmental risk data and parameterization for modifying existing life-cycle analysis of munitions constituents. ***FY 2015 Plans:*** Develop and demonstrate appropriate data, scenarios, and processes necessary for conducting the life cycle analysis of the antimony (Sb) containing small arms formulations, and for new insensitive munitions formulations, IMX 101 and 104. Economic life cycle assessments provide scientifically defensible approaches for determining environment risk, and increase confidence in anticipating product impact with respect to environmental regulatory requirements when fielding. ***FY 2016 Plans:***	2.125	1.924	1.471

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will mature experimental protocols and characterization factors in new small arms formulations for environmental risk determination; will mature and demonstrate software for interpreting life cycle impact assessment calculations using decision support tools.			
Accomplishments/Planned Programs Subtotals	6.700	6.024	5.960

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03F / *Environmental Quality Tech Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
03F: *Environmental Quality Tech Demonstrations (CA)*	-	-	2.250	-	-	-	-	-	-	-	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase ***FY 2015 Plans:*** Program increase	-	2.250
Congressional Adds Subtotals	-	2.250

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	23.838	17.606	20.145	-	20.145	20.684	22.416	22.817	23.184	-	-
T08: *Combat Eng Systems*	-	23.838	17.606	20.145	-	20.145	20.684	22.416	22.817	23.184	-	-

Note

FY16 increase for Engineered Resilient Systems.

A. Mission Description and Budget Item Justification

This program element (PE) demonstrates data and information architectures and software applications, as well as sensing systems, that can be used to provide Warfighters with timely, accurate, easily interpretable data and information for the operational and tactical mission environments, focusing physical and human terrain and weather; methodologies, software applications and hardware for improving ground vehicle mobility and countermobility to support ground force operations, including force projection; components, subsystems, and systems to increase the survivability of personnel, critical assets, and facilities through structures, shields, and barriers to combat highly adaptive and increasingly severe threats; and components, systems, and interoperable systems of systems for detecting threats, assessing situations, defending against threats, and communicating information and warnings for deployable force protection.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology).
Work in this PE is led, managed or performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	23.705	17.613	15.281	-	15.281
Current President's Budget	23.838	17.606	20.145	-	20.145
Total Adjustments	0.133	-0.007	4.864	-	4.864
• Congressional General Reductions	-	-0.007			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.750	-			
• SBIR/STTR Transfer	-0.617	-			
• Adjustments to Budget Years	-	-	4.864	-	4.864

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army												Date: February 2015
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*				Project (Number/Name) T08 / *Combat Eng Systems*			
COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T08: *Combat Eng Systems*	-	23.838	17.606	20.145	-	20.145	20.684	22.416	22.817	23.184	-	-

Note

not applicable for this item

A. Mission Description and Budget Item Justification

This project matures and demonstrates software and architectures for geospatial mapping applications and decision aids for the Warfighter; components, systems, system of systems and decision aids to enable ground vehicle mobility (freedom of movement), including force projection, countermobility to impede movement of threat forces; survivability and force protection to protect personnel, facilities and assets through design and reinforcement of structures, and deployable force protection to detect, assess, and defend against threats for troops deployed at smaller bases (such as bases being compromised or overrun). Work is in support of current and future ground force operations. Software and architectures for geospatial projects mature and validate geospatial decision tools in support of operations planning and decision making to advance utility for geospatial capability and techniques across the Army, services and coalition and to advance and mature the information architecture that supports the total Army's discovery and access to data, geospatial information and analytical tool suites. Deployable Force Protection (DFP) activities are focused on filling critical gaps in protecting forces operating at smaller, remote bases and include maturation, integration, and demonstration of components, systems and systems of systems for rapidly deployable threat detection in direct line-of-site and non-line-of-site environments; situation assessment to help reduce false alarms and decrease manpower required to monitor the environment; passive protection to mitigate blasts, direct, and indirect fire effects; and active defense to suppress or eliminate threats and threat systems. Work in survivability and force protection also includes maturing and demonstrating software to characterize blast effects generated from explosive events, such as improvised explosive device detonation in soils, and support design and decision aids. Work in mobility and force projection includes maturing and demonstrating software and hardware to assess and improve freedom of movement for ground forces. Engineered Resilient Systems (ERS) activities focus on developing capabilities for "upfront engineering" that will result in more operationally efficient and resilient systems that are more affordable in a more rapid fashion. This effort develops and demonstrates an end-to-end thread involving analysis to inform requirements, reduce risk, and assess lifecycle cost pre-milestone A through tradespace analytics for selected systems of interest.

Work in this project supports the Army S&T Ground Maneuver, Innovation Enablers and Command, Control, Communications and Intelligence (C3I) Portfolios.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy. This work is being fully coordinated and is complementary to the ERS work described in OSD PE 0603832D8Z.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology). Geospatial activities are coordinated with the National Geospatial Intelligence Agency (NGA).

Work in this project is led, managed or performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Geo-Enabled Mission Command Enterprise	4.162	5.106	2.505
Description: This effort matures methods and demonstrates data, information, and software tools and architectures to bring physical and human terrain and effects data into decision frameworks for consistent and accurate implementation in the Army Geospatial Enterprise (AGE). This provides ready-access of low-overhead, light-weight, analytic tools to other Services and DoD and increases situational awareness of the operational environment in support of mission planning and operations. ***FY 2014 Accomplishments:*** Demonstrated software tools for mission command systems to include digital operation order generation and collaborative Course of Action planning; demonstrated use and application of map-based narratives for military applications on the Secure Internet Protocol Router Network and Joint Worldwide Intelligence Communications System with advanced spatial and temporal visualization and collaboration engines; demonstrated geospatially enabled persistent surveillance and analytic capabilities based on mission, threat, terrain and weather to provide synchronization of unattended ground sensors and small unit unattended aerial systems for increased situational awareness of threats at small outposts, convoy operations and key urban locations. ***FY 2015 Plans:*** Evaluate and mature methods and techniques to facilitate efficient sharing of common geospatial information within Common Operating Environment and Army Programs of Record through delivery and exchange of geospatial data, information, and analytics between and among computing environments (e.g., Mobile/Handheld, Mounted, Data Center, Sensor, Command Post) within the Common Operating Environment. ***FY 2016 Plans:*** Will enhance digital plans and orders capability to drive course of action (COA) simulation and modeling; evaluate initial plan development and COA development capabilities within Map-based planning testbed environment; evaluate and demonstrate mature geospatial research on the representative computing environment systems within the common operating environment.			
Title: Deployable Force Protection Technology Integration Demonstrations and Red Teaming	16.196	-	-
Description: This effort matures, integrates and demonstrates rapidly deployable threat detection, situation assessment, passive protection and active defensive technology-enabled capabilities to meet critical capability gaps for troops operating remotely at smaller bases or integrated with local communities. The needs at these smaller bases (less than 300 persons, not all U.S. troops) are unique based on constraints in transportability, manpower, organic resources, lack of hardening of structures, resupply, and training for example. Moreover, lack of interoperability and scalability consume manpower and take away from time needed to perform missions. Threats include bases being overrun by hostiles; direct fire; rockets, artillery and mortars; and improvised explosive devices. Force protection challenges at these remote, smaller bases include providing increased standoff detection, blast and ballistic protection, and kinetic technologies subject to the constraints mentioned above. This effort begins to fill a			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
significant gap in force protection capabilities. This work is fully coordinated with PE0602784A/T40, Deployable Force Protection; PE 0602786A; PE0603313A/G03; and PE 0603125A. Work is performed by Army, Navy, and Air Force labs and centers. ***FY 2014 Accomplishments:*** Developed first-generation, low-logistic reinforcement technologies for indigenous structures typical of conditions in operating environments; demonstrate lightweight vehicle ramming protection kits for base perimeter protection; developed integrated sensor architecture including web and tactical services, with data exchange standards, protocols, and compliance tools for interoperability; demonstrated integrated pre-shot sniper detection and non-line-of-site threat detection capabilities with improved designs for deployed forces; demonstrated light-weight threat assessment tools for predictive capabilities; conducted full-scale demonstrations and user assessments and conducted red and blue team missions in asymmetric and relevant environments to identify further areas for improving robustness of design and implementation and to increase systems effectiveness.			
Title: Occupant-Centric Survivability ***Description:*** This effort develops a comprehensive model of improvised explosive device (IED) detonations in soils that accurately predicts the blast pressure and fragmentation of IEDs on ground vehicle systems in a wide range of operational environments. This work supports PEs 0633005/221 and 0622601/C05 in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC). ***FY 2014 Accomplishments:*** Demonstrated a comprehensive model of vehicle responses to mines/IEDs during Army Occupant Protection Suite Concept Demonstration. This model represented the next generation of Lagrangian Meshfree methods for airblast/fragmenting buried weapons of various sizes in different soils at a large range of burial depths. This model provided the Army with accurate predictions of the effect of IEDs on vehicles. ***FY 2015 Plans:*** Demonstrate live fire full-scale model benchmark tests for evaluation, and model validation under a range of soil and operational threat conditions.	0.724	0.500	-
Title: Austere Entry and Maneuver Support Demonstrations ***Description:*** This effort develops improved means for achieving Force Projection in coastal, estuary and riverine environments and an integrated sensing and simulation system for predicting physical conditions in these operational environments. ***FY 2014 Accomplishments:***	0.256	5.000	4.886

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Demonstrated a high performance computing computational testbed that allowed for evaluation of sensor and platform tradeoff studies of potential off-loading platforms and soldiers in the 9-man squad. ***FY 2015 Plans:*** Demonstrate simulation capability to enable rapid remote assessment of real-time structural capacity of infrastructure (airfields, ports, roads), river, estuary, and near shore; demonstrate initial assessment of littoral environment for entry operations; demonstrate initial austere airfield point of debarkation (APOD) assessment geospatial overlay capability to the Instrument Set, Reconnaissance and Surveying (ENFIRE) program; and demonstrate reduced-order hydrodynamic models for an operational littoral environment. ***FY 2016 Plans:*** Will demonstrate technologies for planning and conducting anti-access/area denial entry operations with non-existent, damaged or destroyed infrastructure. Will demonstrate rapidly deployed low-logistics kits for expedient bomb damage repair of airfield runways and terrain surface enhancement for landing of helicopters and Unmanned Aircraft Systems.			
Title: Integrated Base Protection ***Description:*** This effort demonstrates integrated protective technologies to plan and expediently construct Combat Outposts (COPs) and Patrol Bases (PBs). ***FY 2014 Accomplishments:*** Demonstrated the first version of decision support tools for planning of overall basing architecture that integrates and optimizes force protection architectures and basing functions; incorporated user feedback into second version of modeling software; demonstrated, using troops in the field, an initial perimeter barrier for perimeter security of a COP/PB constructed of advanced, reusable materials; evaluated troop constructability, protection, and retrograde value to optimize life-cycle cost and effectiveness of systems.	2.500	-	-
Title: Adaptive Protection Demonstrations ***Description:*** This effort demonstrates protection solutions for critical assets, including fixed and semi-fixed facilities, required to support shifting operational focus. A focus will be on technologies to defeat new advanced weapons threats to include low-logistics protective construction and facility protection, use of indigenous materials, innovative structural hardening and retrofit, and the synergistic use of camouflage, concealment and deception to increase the effectiveness of protection to critical assets. This effort also demonstrates integrated protective technologies for force protection basing to include planning and expedient protective construction for combat outposts. ***FY 2015 Plans:***	-	7.000	7.754

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Demonstrate the use of indigenous materials from areas of interest in protective construction for critical assets against effects of new advanced weapons threats; demonstrate initial force protection basing planning and protective construction for combat outposts to increase survivability of personnel and equipment against rocket and mortar attack; demonstrate baseline effectiveness in the use of camouflage, concealment, and deception techniques to increase survivability of fixed and semi-fixed facilities against new threat weapons by decreasing the probability of direct hit on critical assets; and demonstrate capability to construct expedient protection solutions for combat outposts and evaluate manpower requirements. ***FY 2016 Plans:*** Will demonstrate force protection technologies to reduce manpower and logistics for combat outpost and personnel base construction and operation and demonstrate life cycle planning tools. Demonstrate advanced material composed of indigenous constituents and conduct structural hardening experiments for mitigation against a wide range of advanced weapon threats.			
Title: Engineered Resilient Systems ***Description:*** This effort matures and demonstrates capabilities (tools and methodologies) to: rapidly create high-fidelity environmental data to support the simulation of system performance across varied places in the world for varied Army missions; provide input to/ obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. Engineered Resilient Systems (ERS) initiative has been identified as an S&T emphasis area by the Assistant Secretary of Defense for Research and Engineering, ASD(R&E). This effort focuses on Army systems of interest and on high-fidelity environmental data for the associated battlespace, linkages to force-on-force combat simulations representing the systems of interest, and on tools to explore trades in order to help inform requirements, reduce risk, and assess lifecycle cost pre-milestone A. This work is fully coordinated and is complementary to the ERS work described in Office of Secretary of Defense (OSD) PE 0602251D8Z project P227 and PE 0603832D8Z project PTBD. ***FY 2016 Plans:*** Will mature and demonstrate environmental scenario generation "tool-set one" based on a select set of missions within a geographical area and Army system of interest; identify andcraft initial operational scenarios and will conduct functional decomposition to generate a subset of key missions for system(s) of interest in concert with Army collaborators and processes and will use this to prioritize phased development; evolve and mature mission context and implementation tools and methodologies that link to combat simulations based on scenario(s) and mission(s) associated with selected Army system.	-	-	5.000
Accomplishments/Planned Programs Subtotals	23.838	17.606	20.145

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	34.042	39.149	38.163	-	38.163	40.239	45.246	46.085	46.997	-	-
101: *Tactical Command and Control*	-	23.644	19.134	14.992	-	14.992	14.997	15.539	17.178	17.514	-	-
243: *Sensors And Signals Processing*	-	10.398	20.015	23.171	-	23.171	25.242	29.707	28.907	29.483	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates technologies that allow the Warfighter to effectively collect, analyze, transfer and display situational awareness information in a network-centric battlefield environment. It matures and demonstrates architectures, hardware, software and techniques that enable synchronized mission command (MC) during rapid, mobile, dispersed and Joint operations. Project 101 matures and develops software, algorithms, services and devices to more effectively integrate MC across all echelons and enable more effective utilization of Warfighter resources through accelerated information to decisions and rapid MC on the move. Project 243 matures and demonstrates signal processing and information/intelligence fusion software, algorithms, services and systems for Army sensors; radio frequency (RF) systems to track and identify enemy forces and personnel; and multi-sensor control and correlation software and algorithms to improve reconnaissance, surveillance, tracking, and target acquisition.

Work in this PE is complimentary of PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602303A (Missile Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602782A (Command, Control, Communications Technology), and PE 0603270A (Electronic Warfare Technology); and fully coordinated with PE 0602783A (Computer and Software Technology) and PE 0603008A (Electronic Warfare Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering, Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	32.995	39.164	41.296	-	41.296
Current President's Budget	34.042	39.149	38.163	-	38.163
Total Adjustments	1.047	-0.015	-3.133	-	-3.133
• Congressional General Reductions	-	-0.015			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.750	-			
• SBIR/STTR Transfer	-0.703	-			
• Adjustments to Budget Years	-	-	-3.133	-	-3.133

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
101: *Tactical Command and Control*	-	23.644	19.134	14.992	-	14.992	14.997	15.539	17.178	17.514	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates software, algorithms, services and devices that move and display timely and relevant information across the battlefield to provide commanders at all echelons with situational awareness (SA) that allows them to understand, decide and act faster than their adversaries. This project also matures and demonstrates software, algorithms and devices supporting information storage and retrieval; digital transfer and display of battlefield SA, with an emphasis on navigation (nav), position (pos) location and resource information while keeping in mind the cognitive limit of the Soldier; synchronization of combined and Joint force operations; software, algorithms and services optimized for mission command on-the-move (MCOTM).

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering, Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Integrated Mission Command (MC)	13.730	15.107	10.414
Description: This effort matures and demonstrates technologies to reduce command post (CP) and command vehicle complexity by simplifying the MC software and hardware, and by managing required power systems to increase efficiency. Work accomplished under PE 0602782A/project 779 compliments this effort.			
FY 2014 Accomplishments: Developed and architecture for, designed, fabricated, coded and integrated a platoon level MC demonstration suite to provide actionable intelligence and timely information sharing over the Army's low bandwidth small unit tactical edge network; coded and integrated additional decision support and collaboration tools, including knowledge management and the necessary database connections, and deliver information pertinent to a small unit's mission to increase situational awareness/understanding and decrease tactical surprise; demonstrated this suite's capability to allow Soldiers to access and use all relevant information available on the network most effectively, accounting for the Soldier's cognitive abilities and contextual framework for ease of use and to ensure relevance of the delivered information to the unit's mission; analyzed social networks and identified in near real-			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
time team strengths, weaknesses, and vulnerabilities and highlighted collaboration opportunities which could be leveraged more effectively to foster the efficient use of combat power. ***FY 2015 Plans:*** Code, integrate, and validate a Company level (dismounted, mounted, CP) MC suite to provide actionable intelligence and timely information sharing over a Company level low bandwidth tactical network; code and integrate additional decision support and collaboration tools, including knowledge management and necessary database connections, that will increase situational awareness/understanding, decrease tactical surprise and deliver pertinent mission information from dismounted to CP; validate this suite's capability to allow Soldiers to access relevant information available on the network most effectively, accounting for Soldier cognitive abilities and contextual framework for ease of use and to ensure relevance of the delivered information to the upper echelons; for company level low bandwidth environments code, integrate, and validate an enhanced MC suite of collaborative software tools that allows for faster and more accurate target identification and handoff, real time alerts, freeform information collection, Soldier-composable leader tools, and support for operations across diverse human, geographical and Global Positioning System (GPS)-denied terrains. ***FY 2016 Plans:*** Will mature and demonstrate modular extensible common hardware, commander focused MC software applications and next generation tactical software architectures resulting in smaller, simpler, and less complex command; will demonstrate reduction in the complexity of MC software by focusing on specific commander tasks (e.g. visualize an end state, understand the current situation, and direct resources) rather than general staff functions and by providing data optimized for those tasks; will demonstrate both command post and vehicle instantiations of the mission equipment package to examine strength/weaknesses and trade-offs between the two; will mature and demonstrate MC software that dynamically assesses the mission and the battle space to help maximize mission success by managing limited and distributed resources, including operational energy, bandwidth and cognitive processing.			
Title: Battle Space Awareness and Positioning ***Description:*** This effort demonstrates position and navigation tools to mitigate the impacts of jamming, terrain features and obstacles such as buildings and caves that limit the performance of GPS receivers to enhance the performance of navigation systems in a GPS denied or degraded environment. Work being accomplished under PE 0602782A/project 779 compliments this effort. ***FY 2014 Accomplishments:*** Enhanced and demonstrated navigation sensors such as pedometry, human motion classification, and visual odometry fused with radio frequency and smart phone approaches to enhance pos/nav and improve positional situation awareness; integrated navigation sensor and network algorithms into personal Android based smart phones or tablets and demonstrate situational	3.644	4.027	4.578

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
awareness in a representative platoon size Soldier network; matured, integrated and demonstrated interfaces, software and protocols that will allow handheld electronics to integrate with emerging Modernized Code (M Code) capable secure GPS chips. ***FY 2015 Plans:*** Demonstrate sensor fusion for navigation systems for dismounted Soldiers and ground vehicles to allow modular and scalable system designs providing configuration flexibility to meet Soldier specific needs for navigation; integrate mature sensors into navigation systems such as radio frequency ranging sensors, vision based sensors, pseudolite receivers and sensors for signals of opportunity to reduce dependence upon GPS; evaluate advanced anti-jam antennas and M Code GPS receivers integrated with multi-global navigation satellite system receivers; design, code, and develop interfaces, protocols and software for networked navigation devices to share information and enhance navigation solutions for network users. ***FY 2016 Plans:*** Will mature multiple sensor fusion techniques to improve overall system performance for PNT on mounted, dismounted, and unmanned platforms; demonstrate aiding technologies such as cameras, ranging sensors, and velocimeters to augment the performance of inertial measurement unit (IMU)-based navigation when integrated into PNT systems to reduce GPS dependency; mature personal navigation system components for dismounted Soldier applications, including smaller IMUs, anti-jam antennas, and more efficient multi-Global Navigation Satellite System receivers requiring less power to operate; validate M-Code GPS receiver component performance for integration into PNT systems; optimize and improve pseudolite for both ground and airborne platforms and anti-jam antenna performance while reducing size, weight and cost for mounted and dismounted platforms.			
Title: Collaborative Battle Management ***Description:*** This effort matures and demonstrates mission command (MC) software to improve sharing and understanding of data between the intelligence and operations communities. ***FY 2014 Accomplishments:*** Designed, coded, fabricated and demonstrated an enhanced mission command capability with collaborative software tools that allows for faster and more accurate target identification and handoff, real time alerts, natural information collection, Soldier-composable leader tools, and support for operations across diverse human and geographic terrains to enable tactical overmatch for the small units by acting before the adversary can respond; developed these capabilities to operate in a platoon level low bandwidth tactical network using planned Army infrastructure.	6.270	-	-
Accomplishments/Planned Programs Subtotals	23.644	19.134	14.992

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
243: *Sensors And Signals Processing*	-	10.398	20.015	23.171	-	23.171	25.242	29.707	28.907	29.483	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates improved radar, sensor fusion, and correlation software, services, devices and systems for wide area reconnaissance, surveillance, tracking and targeting of platforms and individuals in all terrains, including complex and urban environments. Sensor fusion efforts mature and demonstrate software, algorithms and services for sensor management, data correlation, and relationship discovery for a multi-intelligence fusion system. Sensor and simulated sensor candidates may include moving-target-indicator/synthetic aperture radar, electro-optical/infrared (EO/IR), signals intelligence (SIGINT), measurements and signatures intelligence (MASINT), human intelligence (HUMINT) and biometrics.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground Maneuver and Air portfolios.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command, Communications - Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Collaborative ISR Sensors	4.834	10.466	9.075
Description: This effort fabricates multi-function ISR sensors and sensor management systems that act collaboratively to improve their individual performance and increase the effectiveness and action-ability of battlespace awareness/intelligence data in an area of operations. Efforts focus on existing, modified and emerging radar technologies in support of air defense & area/base camp protection. This effort implements an open architecture that is extensible to multiple base sizes and environments and allows growth for future ISR sensors. Work being accomplished under PE 62270/906 complements this effort.			
FY 2014 Accomplishments: Demonstrated improved target recognition, identification and classification for Counter-Target Acquisition (CTA) and air defense surveillance radars (lightweight counter-mortal radar (LCMR) and Enhanced Firefinder Radar (EQ-36)); demonstrated increased detection, identification and classification range and accuracy gained from correlating short (LCMR) and long range (EQ-36) radar systems; developed a method to allow ground sensors to cue airborne radars to events on the ground and allowed them to track			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
the scene in that area (i.e. cueing a ground moving target indicator radar to follow insurgents away from a rocket launch point after CTA radar has discovered the rocket's point of origin). ***FY 2015 Plans:*** Conduct an assessment of a variety of moving target indicator (MTI) data sources to establish metrics for quality of MTI data sets to improve radar design; establish a software development process to mature new and alternative concepts for increasing the information content of radar data and tracks; conduct an assessment to determine an optimal design of a multi-static beamforming radar; assess current counterfire and ISR radar programs of record to determine component, configuration and software modifications to design a more accurate multistatic (separated multiple transmit/receive elements) radar and to determine their potentials to search, track and classify small unmanned aerial systems (UAS); develop requirements for doppler resolution, search volume and update rate for improvements that are necessary for the system to perform a counter UAS mission; develop requirements for a low size, weight and power, man portable system to detect and locate small arms fire, dismounts and vehicles over a 360 degree search area; research the advantage of using existing gunshot detection systems to cue a radar to provide a more precise location of the shooter and reduce the probability of a false alarm. ***FY 2016 Plans:*** Will examine methods for enriching meta-data from moving target indicator (MTI) tracks and develop quality standards for MTI track data that will be used to quantify track confidence and information content; enhance existing algorithms to improve tracks by correlating data from other sources (SIGINT, full motion video, etc.) with MTI track data; conduct lab assessments of various hardware and software components of a low size, weight and power radar system capable of 360 degree search to detect and locate small arms fire, dismounts and vehicles; configure necessary interfaces to integrate radar capabilities with EO\IR pre-shot detection sensors; encode and mature software to implement the Army Mode 5 Level 2-Broadcast Identify Friend or Foe (IFF) capability, integrate it on existing ground based radar platforms and perform initial validation of IFF software.			
Title: Omni-directional Situational Awareness (SA) (Airborne) radar technologies ***Description:*** This effort matures and demonstrates low power multi-function SA sensors for small UAS and other aircraft to improve sensing and detection capabilities in support of wide-area persistent surveillance. ***FY 2015 Plans:*** Design a stationary airborne moving target indicator (MTI) penetrating radar capability for use on a fixed wing, moving platform; conduct modeling and simulation to evaluate processing techniques that could be applied to the fixed wing MTI scenario. ***FY 2016 Plans:*** Will mature modeling and simulation of subsystem and component level designs for the Ground Moving Target Indicator (GMTI) Penetrating radar system; identify standards and interface requirements necessary to facilitate integration into a next generation airborne intelligence, surveillance and reconnaissance platform; mature and analyze radar modes in synthetic aperture radar	-	3.000	5.157

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and GMTI for optimized utility under anticipated operational conditions; identify techniques for waveform optimization to mitigate spectrum challenges.			
Title: Advanced All Source Fusion	5.564	6.549	6.939
Description: This effort develops software technologies for intelligence/mission command (Intel/MC) mission collaboration to provide faster and higher quality decision making support for the commander and his key staff. Specific efforts focus on integrating intelligence, surveillance and reconnaissance (ISR) planning and execution at the Task Force/Battalion through troop-level, as well as efforts that provide the capability to identify, fuse, and trace/track specific targets in an asymmetric environment. Work accomplished under PE 0602270A/project 906 compliments this effort. ***FY 2014 Accomplishments:*** Continued to assess the utility of automated exploitation and fusion analysis tools for tactical edge users in a network constrained environment; matured data transformation services to provide intelligence data as SA reports for a small unit; employed correlation and pattern analysis algorithms to provide actionable and timely intelligence that is relevant to small units based on their geographic area, mission type and objective; integrated automated exploitation and fusion analysis tools, intelligence/ SA transformation services, threat prediction software, and enterprise data feeds into a proactive data service framework that supports timely situation understanding for a small unit; conducted networked laboratory experiments to validate this framework and gather user feedback. ***FY 2015 Plans:*** Develop software tools and analytics to produce intelligence products from big data sets (e.g. biometric databases); integrate Company Intelligence Support Team workflow tools, predictive analytics and data distribution services into the previously defined, network constrained environment; demonstrate integrated automated exploitation and fusion analysis tools, intelligence to SA transformation services, threat prediction software, and enterprise data feeds, quantify the improved ability of the end users to execute their missions and document the performance of the capabilities being demonstrated. ***FY 2016 Plans:*** Will develop integration specifications for a virtualized, automated, full spectrum analytic agent for big data sources; integrate and mature software and algorithms to visualize (location, orientation, field of view, etc) and virtually task all collection assets, across echelons and classification domains, in synchronization with MC and title authority control systems; mature Intel fusion software and algorithms to best tailor data streams, collection management processes and information displays to improve user understanding based on collected customer feedback and input from Soldiers.			
Title: Multi-mode Air Defense Radar Demonstration	-	-	2.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort investigates and develops the architectures, processing and components necessary to deliver next generation capability, flexibility and supportability to the fires family of radar systems. Efforts focus on development of a modular and scalable open architecture that is extensible to multiple radar systems technologies in support of air defense & area/base camp protection. Work being accomplished under PE 62270/906, 62120/H16, 62705/EM8/H94, and 62303/214 complements this effort. ***FY 2016 Plans:*** Will develop and mature hardware and software interface specifications that will serve as the basis for a scalable radar open system architecture that is intended for use in multiple configurations and mission scenarios; develop a Government owned data model standard for fires radar data at multiple levels of the data processing stack, from raw radar track data to processed targeting (meta) data, to enable netted sensor interoperability.			
Accomplishments/Planned Programs Subtotals	10.398	20.015	23.171

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	-	-	37.816	-	37.816	38.775	40.630	43.120	43.975	-	-
EL4: *Tactical Comms and Networking Technology Int*	-	-	-	23.229	-	23.229	22.769	24.572	24.405	24.890	-	-
EL5: *Secure Tactical Information Integration*	-	-	-	14.587	-	14.587	16.006	16.058	18.715	19.085	-	-

Note

Efforts in this PE were transferred from PE 0603008A beginning in FY16 for the purposes of correctly identifying the efforts as Command, Control and Communications Advanced Technology. Project EL4 efforts were transferred from PE 0603008A Project TR1 and Project EL5 efforts were transferred from PE 0603008A Project TR2.

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates technologies to address the seamless integrated tactical communications challenge with distributed, secure, mobile, wireless, and self-organizing communications networks and networked transceivers that will operate reliably in diverse and complex terrains, in all environments. Efforts demonstrate seamlessly integrated communications and information security technologies across all network tiers, ranging from unattended networks and sensors through maneuver elements using airborne and space assets. Project EL4 investigates and leverages antennas; wireless networking devices, protocols, and software; network operations tools and techniques; and combines these and other technology options in a series of command, control, communications, and computers, intelligence, surveillance, and reconnaissance (C4ISR) on-the-move (OTM) network modernization demonstrations to measure their potential battlefield effectiveness. Project EL5 researches information security devices, techniques, services, software and algorithms to protect tactical wired and wireless networks against modern network attacks; generate and distribute tactical cyber situational awareness; and focuses on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions.

Work in this PE is complimentary of PE 0602782A (Command, Control, Communications Technology), and fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602783A (Computer and Software Technology), PE 0603001A (Warfighter Advanced Technology), PE0603270A (Electronic Warfare Technology) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	-	-	-	-	-
Current President's Budget	-	-	37.816	-	37.816
Total Adjustments	-	-	37.816	-	37.816
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Other Adjustments 1	-	-	37.816	-	37.816

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
EL4: *Tactical Comms and Networking Technology Int*	-	-	-	23.229	-	23.229	22.769	24.572	24.405	24.890	-	-

Note

Efforts in this project were transferred from PE 0603008A Project TR1 beginning in FY16.

A. Mission Description and Budget Item Justification

This project matures and demonstrates key communications and mobile networking technologies, such as antennas, transceivers, transceiver components, networking software and novel techniques to provide secure, reliable, mobile network solutions that function in complex and diverse terrains. This project concentrates on four major goals: to provide a series of technology demonstrations of new and emerging command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) technology enabled capabilities to significantly reduce risk associated with the network-of-networks concept; to lower the size, weight power and cost of wireless networking systems deployed on Army platforms through hardware and software convergence; to provide critical improvements in the ability to communicate and move large amounts of information in radio frequency (RF) contested environments, in a seamless, integrated manner across the Army's highly mobile manned and unmanned force structure; and to assess the technology readiness level (TRL) of emerging network technologies in an operationally relevant environment.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground Maneuver, Air and Soldier/Squad portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Antenna and Hardware Technologies (Formerly named Antenna Technologies)	-	-	4.350
Description: This effort matures and demonstrates low cost, power efficient, communications and electronic warfare (EW) antenna technologies for terrestrial and tactical satellite ground terminals. The focus is to reduce the visual signature and cost of antennas and reduce the number of antennas required on platforms by proving the capability to transmit and receive on multiple frequency bands, such as X/K/KA/Q for satellite communication (SATCOM) and ultra-high frequency/very-high frequency (UHF/VHF) and L Band for terrestrial communications on the same antennas. This effort also develops small form factor interference			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
mitigation hardware for compatibility between communications and electronic warfare (EW) systems. Work accomplished under PE 0602782A/project H92 compliments this effort. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:*** Will perform extensive assessments and demonstrate distributed on-the-move SATCOM antenna arrays, using both live vehicles traversing test tracks and a sophisticated motion table that emulates the test track motions and other worst case scenarios; finalize a Government standard architecture for distributed SATCOM arrays to enable interoperability between various transceivers and antenna arrays; develop and mature small form factor RF interference mitigation hardware for compatibility between EW and communications systems.			
Title: RF Interoperability Through Convergence ***Description:*** This effort designs transceiver hardware and software standards and proof of concept that will reduce size, weight, power and cost of multiple communications and EW systems on tactical platforms. The standard and proof of concept demonstration takes advantage of common components within the communications and EW systems to define the internal and external interfaces to communications and EW devices. The effort includes implementing and publishing a reference architecture and associated specifications for a modular, open systems approach for integrating military communications and EW devices. Work being accomplished under PE 603270A/project K16 compliments this effort. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:*** Will complete the maturation of the radio reference architecture, specification and application program interfaces sufficient to begin detailed design discussions about radio component design and configurations with potential commercial suppliers as well as Military platform developers for integration into their vehicles; continue to expand the reference architecture to include EW systems, and codify in the form of electronics chassis, backplane, wiring, power, mounting, RF, control and topology specification (the A-kit); provide a more realistic demonstration, moving from a lab table-top environment to a demonstrator vehicle mock-up, possibly using an actual vehicle, and with an expanded demonstration of the radio modules, antennas, filters, switches and radio components (the B-kit).	-	-	3.000
Title: C4ISR On-The-Move (OTM) ***Description:*** This effort provides a venue for the demonstration of new and emerging C4ISR technologies. This venue performs risk mitigation and technology assessments by evaluating the Technology Readiness Levels (TRLs) of candidate Army science and technology (S&T) and best of Industry efforts to support tactical network modernization. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:***	-	-	8.846

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will assess and demonstrate early Operation-Intelligence network convergence concepts in a real field environment using a mix of S&T, Programs Of Record (PORs) and industry offerings to provide early performance feedback to S&T and PORs that rely upon robust tactical networks; apply field based risk reduction techniques to the integration of new S&T technologies as well as adapting/adopting the best industry products to provide rigorously evaluated demonstrator systems for Soldier assessment; assess new S&T systems and provide data to determine the appropriate TRL to inform PORs preparing to transition these technologies to assure leadership has the right information to make critical acquisition decisions and provide technical risk reduction to assure that any issues are identified early enough to be corrected before formal testing; evaluate both Mission Command and Actionable Intelligence S&T products from a performance perspective and validate their TRLs.			
Title: Communication Networking Technologies ***Description:*** This effort matures and demonstrates components, software, algorithms and services that enable Army tactical wireless networks to operate more efficiently in both the use of RF spectrum and network resources for terrestrial and Satellite Communication (SATCOM) systems. This effort matures and demonstrates software to improve performance of wireless tactical networks in austere and hostile RF spectrum environments by composing and coding algorithms and protocols that sense network and spectrum conditions, to automatically adapt network node behaviors to make more efficient use of available resources. Efforts target improving RF communications performance in complex terrain, enabling communications while simultaneously operating electronic protection devices. Efforts also include adapting commercial wireless technology for use in the tactical environment. Work accomplished under PE 0602782A/project H92 and 0603794A EL5 compliments this effort. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:*** Will investigate and mature tactical waveform protocols and architectures to support frequency hopping at timeslot boundaries using parameters chosen by the waveform software to improve radio network performance in a dynamic spectrum contested environment; continue to mature tactical multifunction waveform software, algorithms and techniques to optimize coordinated signal scheduling features that allow improved interoperability between RF functions such as communications and EW jamming; continue to mature and begin implementation of suitable routing protocols to increase performance of the network and develop and mature feasible approaches to enable networking in Global Positioning System-denied environment.	-	-	4.033
Title: Networking technologies for Wireless Personal Area Networks (WPAN) ***Description:*** This effort develops and matures wireless personal area network (WPAN) technology for the Soldier in a manner approved by the National Security Agency (NSA) for up to Secret data traffic. This effort is coordinated with PE 0603001A/Project J50. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:***	-	-	3.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will complete evaluations of WPAN system designs for performance, reliability and security; finalize specification and architecture development of WPAN hardware interfaces and software; iform WPAN standards for security and interface development; fabricate and code several candidate WPAN designs; validate WPAN designs for electromagnetic compatibility, low probability of intercept and low probability of detection in the laboratory and RF chamber; conduct field evaluations of selected design(s) on multiple Soldier Systems.			
Accomplishments/Planned Programs Subtotals	-	-	23.229

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603794A / *C3 Advanced Technology*	Project (Number/Name) EL5 / *Secure Tactical Information Integration*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
EL5: *Secure Tactical Information Integration*	-	-	-	14.587	-	14.587	16.006	16.058	18.715	19.085	-	-

Note

Efforts in this project were transferred from PE 0603008A Project TR2 beginning in FY16.

A. Mission Description and Budget Item Justification

This project matures and demonstrates software, algorithms and services that focus on tactical cyber situational awareness, autonomous network defense, cross domain security and encryption solutions to secure the Army's tactical network. Efforts focus on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions. This project codes, optimizes, and demonstrates software based technologies for intrusion detection, high assurance internet protocol (IP) encryption, seamless communications across security boundaries, as well as information sharing across operations and intelligence functions. These capabilities to automate, protect, monitor, report and access cyber elements of the tactical network are intended to greatly reduce Soldier burden and protect the Army's tactical network by building upon enterprise solutions from commercial, Department of Defense, Department of the Army and other government agencies. This project cumulatively builds science and technology capabilities in accordance with Army Cyber Material Development Strategy and the Office of the Secretary of Defense Cyber Community of Interest.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground Maneuver, Air and Soldier/Squad portfolios.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications Electronics Research Development and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Tactical Defensive Cyber	-	-	14.587
Description: This effort matures and demonstrates technologies that create new methods for proactively defending resource constrained tactical wireless networks against cyber attack using nontraditional methodologies. Work being performed under PE / projects 0602782/H92, 0602783/Y10 and 0603794A/EL4 complement this effort. This effort transferred from PE 0603008A Project TR2 in FY16.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL5 / *Secure Tactical Information Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will integrate and mature software to provide a holistic cyber situational awareness picture offering actionable information for the Brigade network assurance team to quickly and accurately assess the cyber battle space, detect/defend against known cyber weapons being employed against U.S. military assets, and enable network adaptation to ensure commander intent can be exercised in theater; design, fabricate, code and mature a reprogrammable logic single chip cryptographic engine which includes anti-tamper and security boundary technology (both information security functions and crypto engine) and complies with the National Security Agency Crypto Modernization Initiative and the Key Management Infrastructure Program of Record; assess, develop and mature novel network attack/defense behavior models for tactical radio routing; mature and integrate novel tactical radio cyber behavior sensors to provide cyber situational awareness for military radio networks; perform analysis of current satellite communications (SATCOM) systems to determine the optimal integration path to achieve protected SATCOM architectures that will support protection methods aimed at hardening the modulation methods, software coding and component redundancy used in SATCOM systems; mature and optimize precision polarization concepts to optimize communications system security by employing multiple communications paths and bandwidth expansion techniques; perform modeling, simulation and emulation of network systems to assess performance in contested environments; design and develop security for network protocols.			
Accomplishments/Planned Programs Subtotals	-	-	14.587

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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