Department of Defense
Fiscal Year (FY) 2017 President's Budget Submission

February 2016

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, $7,615,921,000.00 to remain available for obligation until September 30, 2018.

The following Justification Books were prepared at a cost of $1,209,553: 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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FY 2017 RDT&E, ARMY
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES

Introduction and Explanation of Contents

1. **General.** The purpose of this document is to provide summary information concerning the Research, Development, Test and Evaluation, Army program. The descriptive summaries are comprised of R-2 (Army RDT&E Budget Item Justification – program element level), R-2A (Army RDT&E Budget Item Justification – project level), R-3 (Army RDT&E Cost Analysis), R-4 (Schedule Profile Detail) and R-5 (Termination Liability Funding for MDAPs) Exhibits, which provide narrative information on all RDT&E program elements and projects through FY 2017.

2. **Relationship of the FY 2017 Budget Submitted to Congress to the FY 2016 Budget Submitted to Congress.** This paragraph provides a list of program elements/projects that are major new starts, restructures, developmental transitions, and terminated programs. Explanations for these changes can be found in the narrative sections of the Program Element R-2A Exhibits.

A. New Start Programs:

PE/Project	PE Title	Project Title
345251/FA8	Cyberspace Operations Forces and Force Support	Cyberspace Operations Forces and Force Support
363326/FA9	Security Initiatives	Security Initiatives
373150/EA5	Army Global Command & Control System	Strategic and Joint Mission Command
643308/EB7	Army Missile Defense Systems Integration	Army Space System Enhancement/Integration
643619/606	Close Combat Systems Adv Dev	Cntrmn/Barrier Adv Dev
643801/B47	Aviation Advanced Development	Future Vertical Lift Medium
654270/ET7	EW Development	Radio Frequency Interference Mitigation
654270/DX6	EW Development	Radio Frequency Interference Mitigation
654622/659	Family of Heavy Tactical Vehicles	Family of Hvy Tac Veh
654622/E40	Light Tactical Wheeled Vehicle	LTV Prototype
654645/EV8	Armored Systems Modernization on End Dev	Mobile Protected Firepower
654818/EW3	Army Tac Comm & Cont Hardware & Software	Unit Task Reorganization (UTR) Development
654822/EV4	General Fund Enterprise Business System (GFEBS)	General Fund Enterprise Business System Inc 2
664759/FA4	Major Test & Evaluation Investment	Warrior Injury Assessment Manikin (WIAMan)
675024/FB1	Anti-Tamper Technology Support	Anti-Tamper Technology Support
654818/EW3	Army Tac Comm &Cont Hardware & Software	Unit Task Reorganization (UTR) Development

B. Program Element/Project Restructures:

Old PE/Project	New Project Title	New PE/Project
0205778/EG2	Long Range Precision Fires (LRPF)	0607134/ES1
0303140/501	Army Key Mgmt System	0303140/DV4
0305204/D10	MQ-1C Gray Eagle	0203744/EB6
0601102/S14	Basic Resch in Clinical & Rehabilitative Med	0601102/ET6
0602787/874	Appl Resch in Clinical and Rehabilitative Med	0602787/ET4
0603002/840	Medical Advance Technology	0603002/ET5
0603827/S53	Personnel Airdrop System Development	0603827/ET8
0604120/ED5	Mounted	0604120/EH8
0604120/ED5	Dismounted	0604120/EJ2
0604280/DZ5	Manpack Radio	0605042/FA1
0604280/DZ5	Rifleman Radio	0605042/FA2
0604622/659	TWV Protection Kits	0604622/VR5
0604759/984	Range Radar Replacement Program (RRRP)	0604759/EY9
0604798/DY4	Network Integration Support	0604798/DY3
0604798/DY6	Brigade and Platform Integration Support	0604798/DY3
0604818/S75	Tactical Network Operations and Management	0604818/EK9
0604827/S75	Ground Soldier Ensemble	0604818/EQ8
0605031/EF5	Waveforms	0605031/EX6
0605457/DU4	FAAD C2 ED	0604741/126

C. Developmental Transitions:

Old PE/Project	New Project Title	New PE/Project
0204502/EF2	Integ/GrdSecSurv RespC	0605029/EQ2
0204502/EF2	Grnd-Based Opnl Surv Sys Expend (GBOSS-E)	0605033/EQ3
0303140/491	Defensive Cyber Operations	0605041/EV5
0603639/EC2	Adv Armor-Piercing (ADVAP)	0604802/EP5
0603639/EL8	Lightweight Cartridge Case for Small Caliber Ammo	0604802/EP6
0603639/656	120mm Cartridge (Advanced Multipurpose AMP)	0604802/ED7
0603782/372	Warfighter Information Network	0605535/EE8
0603827S54	Crew Served Weapons Engineering Development	0604601/EW4
0603850/472	Integrated Broadcast System	0305179/EF4
0605626/AC5	Enhanced Medium Alt Recon Surv Sys	0305206/EH3
0605898/M65	ATEC Joint	0605712/001
0606801/M46	AMCOM Cmd/Ctr Spt	0602705/H94
0606801/M46	AMCOM Cmd/Ctr Spt	0605024/FB1
0607865/DV8	Lower Tier Missile Defense (LTAMD) Capability	0604114/EX2
0604319/DU3	IFPC2	0605052/EY7

D. Program Terminations:

PE Title	PE/Project
Aircrew Integrated Sys Ad	0603827/152
PAC-3/MSE Missile	0605456/PA3

3. **Classification:** This document contains no classified data Appropriately cleared individuals can obtain further information on Classified/Special Access Programs by contacting the Department of the Army (ASA(ALT)) Special Programs Office.

Department of Defense
FY 2017 President's Budget
Exhibit R-1 FY 2017 President's Budget
Total Obligational Authority
(Dollars in Thousands)

14 Jan 2016

Appropriation	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Research, Development, Test & Eval, Army	6,744,134	7,562,170	1,500	7,563,670	7,515,399	100,522	7,615,921
Total Research, Development, Test & Evaluation	6,744,134	7,562,170	1,500	7,563,670	7,515,399	100,522	7,615,921

R-1C1: FY 2017 President's Budget (Published Version of PB Position), as of January 14, 2016 at 10:17:52

Department of Defense
FY 2017 President's Budget
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14 Jan 2016

Summary Recap of Budget Activities	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Basic Research	447,868	469,079		469,079	428,943		428,943
Applied Research	964,085	1,092,885		1,092,885	907,574		907,574
Advanced Technology Development	1,089,087	1,127,304		1,127,304	930,065		930,065
Advanced Component Development & Prototypes	298,467	506,123	1,500	507,623	550,635	9,375	560,010
System Development & Demonstration	1,604,756	2,085,147		2,085,147	2,265,094	84,043	2,349,137
RDT&E Management Support	1,166,015	1,070,581		1,070,581	1,136,134		1,136,134
Operational Systems Development	1,173,856	1,211,051		1,211,051	1,296,954	7,104	1,304,058
Total Research, Development, Test & Evaluation	6,744,134	7,562,170	1,500	7,563,670	7,515,399	100,522	7,615,921
Summary Recap of FYDP Programs							
General Purpose Forces	705,451	779,716		779,716	618,038		618,038
Intelligence and Communications	162,187	171,857		171,857	238,711	7,104	245,815
Research and Development	5,788,542	6,545,639	1,500	6,547,139	6,591,738	93,418	6,685,156
Central Supply and Maintenance	73,419	60,422		60,422	62,287		62,287
Administration and Associated Activities	233						
Classified Programs	14,302	4,536		4,536	4,625		4,625
Total Research, Development, Test & Evaluation	6,744,134	7,562,170	1,500	7,563,670	7,515,399	100,522	7,615,921

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Central Supply and Maintenance	73,419	60,422		60,422	62,287		62,287
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14 Jan 2016

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

Line No	Program Element Number	Item	Act	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Sec
1	0601101A	In-House Laboratory Independent Research	01	13,125	13,018		13,018	12,381		12,381	U
2	0601102A	Defense Research Sciences	01	249,855	279,118		279,118	253,116		253,116	U
3	0601103A	University Research Initiatives	01	79,122	72,603		72,603	69,166		69,166	U
4	0601104A	University and Industry Research Centers	01	105,766	104,340		104,340	94,280		94,280	U
	Basic Research			447,868	469,079		469,079	428,943		428,943	
5	0602105A	Materials Technology	02	45,563	68,314		68,314	31,533		31,533	U
6	0602120A	Sensors and Electronic Survivability	02	45,792	58,374		58,374	36,109		36,109	U
7	0602122A	TRACTOR HIP	02	16,358	6,879		6,879	6,995		6,995	U
8	0602211A	Aviation Technology	02	62,046	56,884		56,884	65,914		65,914	U
9	0602270A	Electronic Warfare Technology	02	19,333	19,243		19,243	25,466		25,466	U
10	0602303A	Missile Technology	02	61,144	53,553		53,553	44,313		44,313	U
11	0602307A	Advanced Weapons Technology	02	37,464	38,028		38,028	28,803		28,803	U
12	0602308A	Advanced Concepts and Simulation	02	26,505	27,862		27,862	27,688		27,688	U
13	0602601A	Combat Vehicle and Automotive Technology	02	71,811	98,439		98,439	67,959		67,959	U
14	0602618A	Ballistics Technology	02	83,610	117,801		117,801	85,436		85,436	U
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	3,865	3,866		3,866	3,923		3,923	U
16	0602623A	Joint Service Small Arms Program	02	6,633	5,487		5,487	5,545		5,545	U
17	0602624A	Weapons and Munitions Technology	02	62,131	83,340		83,340	53,581		53,581	U
18	0602705A	Electronics and Electronic Devices	02	72,442	64,301		64,301	56,322		56,322	U

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19	0602709A	Night Vision Technology	02	44,694	38,807		38,807	36,079		36,079	U
20	0602712A	Countermine Systems	02	28,597	36,568		36,568	26,497		26,497	U
21	0602716A	Human Factors Engineering Technology	02	23,434	23,681		23,681	23,671		23,671	U
22	0602720A	Environmental Quality Technology	02	15,288	20,850		20,850	22,151		22,151	U
23	0602782A	Command, Control, Communications Technology	02	33,117	36,160		36,160	37,803		37,803	U
24	0602783A	Computer and Software Technology	02	10,514	12,656		12,656	13,811		13,811	U
25	0602784A	Military Engineering Technology	02	66,582	80,909		80,909	67,416		67,416	U
26	0602785A	Manpower/Personnel/Training Technology	02	21,280	24,735		24,735	26,045		26,045	U
27	0602786A	Warfighter Technology	02	31,597	39,295		39,295	37,403		37,403	U
28	0602787A	Medical Technology	02	74,285	76,853		76,853	77,111		77,111	U
		Applied Research		964,085	1,092,885		1,092,885	907,574		907,574	
29	0603001A	Warfighter Advanced Technology	03	75,833	55,973		55,973	38,831		38,831	U
30	0603002A	Medical Advanced Technology	03	104,997	108,584		108,584	68,365		68,365	U
31	0603003A	Aviation Advanced Technology	03	99,762	103,136		103,136	94,280		94,280	U
32	0603004A	Weapons and Munitions Advanced Technology	03	72,176	82,663		82,663	68,714		68,714	U
33	0603005A	Combat Vehicle and Automotive Advanced Technology	03	143,606	135,571		135,571	122,132		122,132	U
34	0603006A	Space Application Advanced Technology	03	6,664	5,554		5,554	3,904		3,904	U
35	0603007A	Manpower, Personnel and Training Advanced Technology	03	11,677	12,636		12,636	14,417		14,417	U

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36	0603008A	Electronic Warfare Advanced Technology	03	43,416							U
37	0603009A	TRACTOR HIKE	03	7,492	7,502		7,502	8,074		8,074	U
38	0603015A	Next Generation Training & Simulation Systems	03	16,103	17,425		17,425	18,969		18,969	U
39	0603020A	TRACTOR ROSE	03	14,483	11,912		11,912	11,910		11,910	U
40	0603125A	Combating Terrorism - Technology Development	03	23,334	33,520		33,520	27,686		27,686	U
41	0603130A	TRACTOR NAIL	03	3,440	2,381		2,381	2,340		2,340	U
42	0603131A	TRACTOR EGGS	03	2,406	2,431		2,431	2,470		2,470	U
43	0603270A	Electronic Warfare Technology	03	27,238	32,874		32,874	27,893		27,893	U
44	0603313A	Missile and Rocket Advanced Technology	03	78,302	104,449		104,449	52,190		52,190	U
45	0603322A	TRACTOR CAGE	03	11,105	10,999		10,999	11,107		11,107	U
46	0603461A	High Performance Computing Modernization Program	03	214,614	222,159		222,159	177,190		177,190	U
47	0603606A	Landmine Warfare and Barrier Advanced Technology	03	12,795	13,966		13,966	17,451		17,451	U
48	0603607A	Joint Service Small Arms Program	03	7,055	5,105		5,105	5,839		5,839	U
49	0603710A	Night Vision Advanced Technology	03	46,056	40,929		40,929	44,468		44,468	U
50	0603728A	Environmental Quality Technology Demonstrations	03	11,311	14,727		14,727	11,137		11,137	U
51	0603734A	Military Engineering Advanced Technology	03	17,124	26,845		26,845	20,684		20,684	U
52	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	38,098	38,147		38,147	44,239		44,239	U

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53	0603794A	C3 Advanced Technology	03		37,816		37,816	35,775		35,775	U
		Advanced Technology Development		1,089,087	1,127,304		1,127,304	930,065		930,065	
54	0603305A	Army Missle Defense Systems Integration	04	25,672	29,347		29,347	9,433		9,433	U
55	0603308A	Army Space Systems Integration	04	13,804	25,061		25,061	23,056	9,375	32,431	U
56	0603619A	Landmine Warfare and Barrier - Adv Dev	04		45,757		45,757	72,117		72,117	U
57	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04		13,426		13,426	28,244		28,244	U
58	0603639A	Tank and Medium Caliber Ammunition	04	25,317	46,749		46,749	40,096		40,096	U
59	0603747A	Soldier Support and Survivability	04	8,633	2,801	1,500	4,301	10,506		10,506	U
60	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	9,255	13,472		13,472	15,730		15,730	U
61	0603774A	Night Vision Systems Advanced Development	04	3,521	7,292		7,292	10,321		10,321	U
62	0603779A	Environmental Quality Technology - Dem/Val	04	7,529	8,813		8,813	7,785		7,785	U
63	0603790A	NATO Research and Development	04	2,839	6,075		6,075	2,300		2,300	U
64	0603801A	Aviation - Adv Dev	04					10,014		10,014	U
65	0603804A	Logistics and Engineer Equipment - Adv Dev	04	13,188	21,233		21,233	20,834		20,834	U
66	0603807A	Medical Systems - Adv Dev	04	22,825	31,962		31,962	33,503		33,503	U
67	0603827A	Soldier Systems - Advanced Development	04	9,194	22,994		22,994	31,120		31,120	U
68	0604100A	Analysis Of Alternatives	04	9,685	9,805		9,805	6,608		6,608	U

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69	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04					35,132		35,132	U
70	0604115A	Technology Maturation Initiatives	04	43,083	35,917		35,917	70,047		70,047	U
71	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	11,447	30,058		30,058	83,279		83,279	U
72	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	92,475	155,361		155,361				U
73	0305251A	Cyberspace Operations Forces and Force Support	04					40,510		40,510	U
		Advanced Component Development & Prototypes		298,467	506,123	1,500	507,623	550,635	9,375	560,010	
74	0604201A	Aircraft Avionics	05	39,583	18,639		18,639	83,248		83,248	U
75	0604270A	Electronic Warfare Development	05	5,792	18,843		18,843	34,642		34,642	U
76	0604280A	Joint Tactical Radio	05	9,454	4,546		4,546				U
77	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	9,355	8,763		8,763	12,172		12,172	U
78	0604321A	All Source Analysis System	05	5,532	4,309		4,309	3,958		3,958	U
79	0604328A	TRACTOR CAGE	05	19,929	15,138		15,138	12,525		12,525	U
80	0604601A	Infantry Support Weapons	05	36,826	89,661		89,661	66,943		66,943	U
81	0604604A	Medium Tactical Vehicles	05	202							U
82	0604611A	JAVELIN	05	4,006	3,945		3,945	20,011		20,011	U
83	0604622A	Family of Heavy Tactical Vehicles	05	12,768				11,429		11,429	U
84	0604633A	Air Traffic Control	05	17,066	10,076		10,076	3,421		3,421	U
85	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	2,663	15,374		15,374	39,282		39,282	U

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Line No	Program Element Number	Item	Act	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Sec
86	0604642A	Light Tactical Wheeled Vehicles	05					494		494	U
87	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05					9,678		9,678	U
88	0604710A	Night Vision Systems - Eng Dev	05	58,997	67,582		67,582	84,519		84,519	U
89	0604713A	Combat Feeding, Clothing, and Equipment	05	2,983	1,763		1,763	2,054		2,054	U
90	0604715A	Non-System Training Devices - Eng Dev	05	8,775	27,155		27,155	30,774	33	30,807	U
91	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	15,294	34,569		34,569	53,332		53,332	U
92	0604742A	Constructive Simulation Systems Development	05	4,394	23,364		23,364	17,887		17,887	U
93	0604746A	Automatic Test Equipment Development	05	10,685	8,960		8,960	8,813		8,813	U
94	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	9,699	9,138		9,138	10,487		10,487	U
95	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	33,422	21,622		21,622	15,068		15,068	U
96	0604798A	Brigade Analysis, Integration and Evaluation	05	82,957	99,242		99,242	89,716		89,716	U
97	0604802A	Weapons and Munitions - Eng Dev	05	17,312	21,379		21,379	80,365		80,365	U
98	0604804A	Logistics and Engineer Equipment - Eng Dev	05	23,652	46,039		46,039	75,098		75,098	U
99	0604805A	Command, Control, Communications Systems - Eng Dev	05	5,116	2,683		2,683	4,245		4,245	U
100	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	29,441	45,412		45,412	41,124		41,124	U
101	0604808A	Landmine Warfare/Barrier - Eng Dev	05	53,579	55,215		55,215	39,630		39,630	U

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Line No	Program Element Number	Item	Act	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Sec
102	0604818A	Army Tactical Command & Control Hardware & Software	05	29,690	131,639		131,639	205,590		205,590	U
103	0604820A	Radar Development	05	5,022	12,309		12,309	15,983		15,983	U
104	0604822A	General Fund Enterprise Business System (GFEBS)	05	5,500	21,155		21,155	6,805		6,805	U
105	0604823A	Firefinder	05	22,587	2,967		2,967	9,235		9,235	U
106	0604827A	Soldier Systems - Warrior Dem/Val	05	5,942	18,776		18,776	12,393		12,393	U
107	0604854A	Artillery Systems - EMD	05	1,838	1,953		1,953	1,756		1,756	U
108	0605013A	Information Technology Development	05	64,982	60,358		60,358	74,236		74,236	U
109	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	62,831	121,011		121,011	155,584		155,584	U
110	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	88,797	226,210		226,210	184,221		184,221	U
111	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05					4,980		4,980	U
112	0605030A	Joint Tactical Network Center (JTNC)	05	8,615	13,357		13,357	15,041		15,041	U
113	0605031A	Joint Tactical Network (JTN)	05	17,305	18,055		18,055	16,014		16,014	U
114	0605032A	TRACTOR TIRE	05		5,677		5,677	27,254		27,254	U
115	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05					5,032		5,032	U
116	0605034A	Tactical Security System (TSS)	05					2,904		2,904	U
117	0605035A	Common Infrared Countermeasures (CIRCM)	05	169,196	101,570		101,570	96,977	10,900	107,877	U
118	0605036A	Combating Weapons of Mass Destruction (CWMD)	05					2,089		2,089	U

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119	0605041A	Defensive CYBER Tool Development	05					33,836		33,836	U
120	0605042A	Tactical Network Radio Systems (Low-Tier)	05					18,824		18,824	U
121	0605047A	Contract Writing System	05					20,663		20,663	U
122	0605051A	Aircraft Survivability Development	05		78,112		78,112	41,133	73,110	114,243	U
123	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05					83,995		83,995	U
124	0605350A	WIN-T Increment 3 - Full Networking	05	108,851	33,515		33,515				U
125	0605380A	AMF Joint Tactical Radio System (JTRS)	05	6,616	11,455		11,455	5,028		5,028	U
126	0605450A	Joint Air-to-Ground Missile (JAGM)	05	80,585	83,054		83,054	42,972		42,972	U
127	0605456A	PAC-3/MSE Missile	05	33,709	2,272		2,272				U
128	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	147,250	222,075		222,075	252,811		252,811	U
129	0605625A	Manned Ground Vehicle	05	47,265	39,247		39,247				U
130	0605626A	Aerial Common Sensor	05	20,328	2		2				U
131	0605766A	National Capabilities Integration (MIP)	05	18,254	10,599		10,599	4,955		4,955	U
132	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	43,302	32,486		32,486	11,530		11,530	U
133	0605830A	Aviation Ground Support Equipment	05	9,655	13,880		13,880	2,142		2,142	U
134	0210609A	Paladin Integrated Management (PIM)	05	77,210	152,288		152,288	41,498		41,498	U
135	0303032A	TROJAN - RH12	05	983	5,022		5,022	4,273		4,273	U

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136	0304270A	Electronic Warfare Development	05	8,961	12,686		12,686	14,425		14,425	U
		System Development & Demonstration		1,604,756	2,085,147		2,085,147	2,265,094	84,043	2,349,137	
137	0604256A	Threat Simulator Development	06	21,691	27,535		27,535	25,675		25,675	U
138	0604258A	Target Systems Development	06	9,778	16,684		16,684	19,122		19,122	U
139	0604759A	Major T&E Investment	06	54,281	66,580		66,580	84,777		84,777	U
140	0605103A	Rand Arroyo Center	06	19,817	19,382		19,382	20,658		20,658	U
141	0605301A	Army Kwajalein Atoll	06	169,699	203,905		203,905	236,648		236,648	U
142	0605326A	Concepts Experimentation Program	06	18,757	19,430		19,430	25,596		25,596	U
143	0605502A	Small Business Innovative Research	06	172,658							U
144	0605601A	Army Test Ranges and Facilities	06	271,377	279,896		279,896	293,748		293,748	U
145	0605602A	Army Technical Test Instrumentation and Targets	06	43,961	51,550		51,550	52,404		52,404	U
146	0605604A	Survivability/Lethality Analysis	06	33,210	33,246		33,246	38,571		38,571	U
147	0605606A	Aircraft Certification	06	4,667	4,760		4,760	4,665		4,665	U
148	0605702A	Meteorological Support to RDT&E Activities	06	6,289	8,303		8,303	6,925		6,925	U
149	0605706A	Materiel Systems Analysis	06	20,578	20,403		20,403	21,677		21,677	U
150	0605709A	Exploitation of Foreign Items	06	8,418	10,396		10,396	12,415		12,415	U
151	0605712A	Support of Operational Testing	06	48,953	49,337		49,337	49,684		49,684	U
152	0605716A	Army Evaluation Center	06	54,468	52,694		52,694	55,905		55,905	U
153	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	1,081	938		938	7,959		7,959	U
154	0605801A	Programwide Activities	06	63,687	60,319		60,319	51,822		51,822	U

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155	0605803A	Technical Information Activities	06	28,781	28,478		28,478	33,323		33,323	U
156	0605805A	Munitions Standardization, Effectiveness and Safety	06	62,168	64,604		64,604	40,545		40,545	U
157	0605857A	Environmental Quality Technology Mgmt Support	06	2,512	3,186		3,186	2,130		2,130	U
158	0605898A	Management HQ - R&D	06	48,951	48,955		48,955	49,885		49,885	U
159	0303260A	Defense Military Deception Initiative	06					2,000		2,000	U
160	0909999A	Financing for Cancelled Account Adjustments	06	233							U
	RDT&E	Management Support		1,166,015	1,070,581		1,070,581	1,136,134		1,136,134	
161	0603778A	MLRS Product Improvement Program	07	17,852	18,397		18,397	9,663		9,663	U
162	0603813A	TRACTOR PULL	07		9,461		9,461	3,960		3,960	U
163	0605024A	Anti-Tamper Technology Support	07					3,638		3,638	U
164	0607131A	Weapons and Munitions Product Improvement Programs	07		4,945		4,945	14,517		14,517	U
165	0607133A	TRACTOR SMOKE	07		7,569		7,569	4,479		4,479	U
166	0607134A	Long Range Precision Fires (LRPF)	07					39,275		39,275	U
167	0607135A	Apache Product Improvement Program	07	86,099	65,562		65,562	66,441		66,441	U
168	0607136A	Blackhawk Product Improvement Program	07	48,406	66,653		66,653	46,765		46,765	U
169	0607137A	Chinook Product Improvement Program	07	35,424	32,407		32,407	91,848		91,848	U
170	0607138A	Fixed Wing Product Improvement Program	07	819	1,151		1,151	796		796	U
171	0607139A	Improved Turbine Engine Program	07	49,328	51,164		51,164	126,105		126,105	U

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172	0607140A	Emerging Technologies from NIE	07	4,916	2,481		2,481	2,369		2,369	U
173	0607141A	Logistics Automation	07	3,513	1,673		1,673	4,563		4,563	U
174	0607665A	Family of Biometrics	07	1,332	13,237		13,237	12,098		12,098	U
175	0607865A	Patriot Product Improvement	07	57,962	89,816		89,816	49,482		49,482	U
176	0202429A	Aerostat Joint Project - COCOM Exercise	07	43,248	10,565		10,565	45,482		45,482	U
177	0203726A	Adv Field Artillery Tactical Data System	07	1,224							U
178	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	33,996	35,719		35,719	30,455		30,455	U
179	0203735A	Combat Vehicle Improvement Programs	07	297,423	354,667		354,667	316,857		316,857	U
180	0203740A	Maneuver Control System	07	43,453	15,408		15,408	4,031		4,031	U
181	0203744A	Aircraft Modifications/Product Improvement Programs	07	40				35,793		35,793	U
182	0203752A	Aircraft Engine Component Improvement Program	07	372	364		364	259		259	U
183	0203758A	Digitization	07	5,765	4,361		4,361	6,483		6,483	U
184	0203801A	Missile/Air Defense Product Improvement Program	07	4,917	3,154		3,154	5,122		5,122	U
185	0203802A	Other Missile Product Improvement Programs	07	40,468	35,951		35,951	7,491		7,491	U
186	0203808A	TRACTOR CARD	07	19,347	34,686		34,686	20,333		20,333	U
187	0205402A	Integrated Base Defense - Operational System Dev	07	4,196	10,750		10,750				U
188	0205410A	Materials Handling Equipment	07	802	402		402	124		124	U

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189	0205412A	Environmental Quality Technology - Operational System Dev	07	270							U
190	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	78,720	64,159		64,159	69,417		69,417	U
191	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	43,791	36,727		36,727	22,044		22,044	U
192	0208053A	Joint Tactical Ground System	07	10,209	20,515		20,515	12,649		12,649	U
194	0303028A	Security and Intelligence Activities	07	12,518	6,998		6,998	11,619		11,619	U
195	0303140A	Information Systems Security Program	07	13,627	31,154		31,154	38,280		38,280	U
196	0303141A	Global Combat Support System	07	5,225	21,574		21,574	27,223		27,223	U
197	0303142A	SATCOM Ground Environment (SPACE)	07	9,978	9,355		9,355	18,815		18,815	U
198	0303150A	WWMCCS/Global Command and Control System	07	2,493	7,034		7,034	4,718		4,718	U
201	0305179A	Integrated Broadcast Service (IBS)	07		750		750				U
202	0305204A	Tactical Unmanned Aerial Vehicles	07	20,290	13,225		13,225	8,218		8,218	U
203	0305206A	Airborne Reconnaissance Systems	07		22,870		22,870	11,799		11,799	U
204	0305208A	Distributed Common Ground/Surface Systems	07	20,155	25,592		25,592	32,284		32,284	U
205	0305219A	MQ-1C Gray Eagle UAS	07	46,472				13,470		13,470	U
206	0305232A	RQ-11 UAV	07					1,613		1,613	U
207	0305233A	RQ-7 UAV	07	16,389	11,797		11,797	4,597		4,597	U
208	0307665A	Biometrics Enabled Intelligence	07	1,973					7,104	7,104	U
209	0310349A	Win-T Increment 2 - Initial Networking	07	3,123	3,800		3,800	4,867		4,867	U

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Line No	Program Element Number	Item	Act	FY 2015 (Base & OCO)	FY 2016 Base Enacted	FY 2016 OCO Enacted	FY 2016 Total Enacted	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Sec
210	0708045A	End Item Industrial Preparedness Activities	07	73,419	60,422		60,422	62,287		62,287	U
9999	9999999999	Classified Programs		14,302	4,536		4,536	4,625		4,625	U
		Operational Systems Development		1,173,856	1,211,051		1,211,051	1,296,954	7,104	1,304,058	
Total Research, Development, Test & Eval, Army				6,744,134	7,562,170	1,500	7,563,670	7,515,399	100,522	7,615,921	

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603001A *I Warfighter Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	75.833	55.973	38.831	-	38.831	40.937	43.523	44.355	45.242	-	-
242: *Airdrop Equipment*	-	3.113	2.696	3.618	-	3.618	3.704	3.760	3.802	3.845	-	-
543: *Ammunition Logistics*	-	2.721	2.738	2.284	-	2.284	2.325	2.341	2.387	2.435	-	-
C07: *Joint Service Combat Feeding Tech Demo*	-	2.979	2.155	2.134	-	2.134	2.165	2.203	2.278	2.357	-	-
J50: *Future Warrior Technology Integration*	-	46.611	32.621	26.550	-	26.550	29.310	31.764	32.364	33.011	-	-
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	13.000	9.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	7.409	6.763	4.245	-	4.245	3.433	3.455	3.524	3.594	-	-

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 Department of Defense (DoD) Combat Feeding Research and Engineering Board.

Efforts in this PEsupport the Army Science and Technology Soldier/Squad, Lethality, and Ground Maneuver Portfolios.

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 0602787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603015A (Next Generation Training and Simulation Systems), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0603710A (Night Vision Advanced Technology), PE 0602784A (Military Engineering Technology), and PE 0603734A (Military Engineering Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603001A *I Warfighter 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 Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA and the Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ.

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	78.109	46.973	38.831	-	38.831
Current President's Budget	75.833	55.973	38.831	-	38.831
Total Adjustments	-2.276	9.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	9.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.276	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Program Increase*	1.000	9.000
Congressional Add: *Environmental Control Systems*	12.000	-
Congressional Add Subtotals for Project: J52	13.000	9.000
Congressional Add Totals for all Projects	13.000	9.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
242: *Airdrop Equipment*	-	3.113	2.696	3.618	-	3.618	3.704	3.760	3.802	3.845	-	-

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 Project support the Army Science and Technology Soldier/Squad Portfolio.

Work in this project is fully coordinated with program Element (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 Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Airdrop/Aerial Delivery	3.113	2.696	3.618
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 of delivering cargo to remote locations and/or complex terrains. This effort also provides technologies that increase safety during personnel insertions into theaters of operations. This work further evolves breakthroughs from PE 0602786A/Project 283 and is coordinated with PE 0602786A/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.			
FY 2015 Accomplishments: Matured and demonstrated in-flight Joint Precision Aerial Delivery System (JPADS) collision avoidance capability to reduce collision/catastrophic damage and loss of vital supplies; matured precision delivery and landing accuracy for lifecycle cost			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
reduction efficiencies and lower retrograde; began 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; optimized large scale helicopter auto hookup prototypes for multiple airdrops to increase ground operator safety; demonstrated both half- and full-scale technologies for passively stabilizing the flight characteristics with helicopter sling load payloads; demonstrated low-cost, low-weight skidboard to reduce materials and decrease manufacturing and transportation costs; matured and demonstrated a tactical aerial resupply capability to resupply/unburden the small unit/squad. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will conduct multiple airdrop demonstrations of prototype adaptive flight software and hardware component technologies for precision aerial delivery systems that overcome rigging errors and broken control lines. These demonstrations will also validate parachute actuator placement, optimized parachute designs, parachute sensor capabilities, and airdrop system stealth capabilities in order to reduce the cost, weight, and logistics burden of utilizing aerial delivery systems; mature and demonstrate passive helicopter sling load stability concepts with operational payloads; demonstrate initial static line reserve parachute automatic activation device prototype on T-11R parachute with mannequins to validate utility.			
Accomplishments/Planned Programs Subtotals	3.113	2.696	3.618

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
543: *Ammunition Logistics*	-	2.721	2.738	2.284	-	2.284	2.325	2.341	2.387	2.435	-	-

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 Portfolios. Work in this project is related to, and fully coordinated with Program Element (PE) 0603005A and PE 0602601A.

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 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 2015	FY 2016	FY 2017
Title: Automated Material Handling Technology	2.335	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 2015 Accomplishments:*** Completed tactical navigation development and adapted robotic add-on kits to rough terrain environment for 5,000 lb forklift; demonstrated the integrated system. ***FY 2016 Plans:*** Complete development of the robotic add-on kit for rough terrain 5,000 lb forklift and conduct the final demonstration.			
Title: Explosive Safety for Automated Base Camp Planning	0.386	0.400	-
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 2015 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Completed database and ammunition planning/management software module integration; validated the module compatibility with base camp planning. ***FY 2016 Plans:*** 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.			
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:*** Conduct preliminary design of environmental monitoring and data delivery mechanisms for artillery ammunition.	-	0.755	-
Title: Automated Supply Point-Scaleable ***Description:*** This effort demonstrates globally responsive supply point operations capable of meeting predictive demand through automated cargo identification, handling, and movement technologies. ***FY 2017 Plans:*** Will develop software architecture for the command, control, and integration of Automated Supply Point – Scalable operational functions.	-	-	2.284
Accomplishments/Planned Programs Subtotals	2.721	2.738	2.284

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
C07: *Joint Service Combat Feeding Tech Demo*	-	2.979	2.155	2.134	-	2.134	2.165	2.203	2.278	2.357	-	-

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 Project support the Army Science and Technology Soldier/Squad Portfolio.

Work in this project complements and is fully coordinated with Program Element (PE) 0602787A (Medical Technology) and 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 Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Joint Combat Feeding Equipment and Food Protection Technology Demonstration	1.729	-	-
Description: This effort demonstrates technologies in support of the DoD Veterinary Service Activity (VSA) to improve field detection and identification capabilities of chemical and biological threats in foods. This effort provides new threat detection tools and sensors for food inspectors. This effort also demonstrates equipment and energy technologies to expand the capability and reduce the logistics footprint of field feeding systems.			
FY 2015 Accomplishments: Demonstrated novel field sensor technologies to detect and identify toxic chemicals in food; evaluated and demonstrated commercial off the shelf technologies in support of DoD VSA mission; continued demonstration of novel technologies to improve fuel efficiency, increase operation in harsh environments and improve mean time between failure for field feeding equipment;			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
demonstrated reduced reliance on field generators in field kitchens, thus decreasing fuel costs, resupply demands, and risk to logistics/resupply personnel.			
Title: Ration Stabilization and Nutrient Delivery Technology Demonstration ***Description:*** This effort matures and demonstrates novel nutritional biochemistry, food processing, and packaging technologies to enhance nutrition, improve food stabilization, and optimize ration packaging to support Warfighter physical and cognitive performance on the battlefield. ***FY 2015 Accomplishments:*** Demonstrated increased bio-availability and stability of phytonutrients within ration components to improve Warfighter performance and recovery time; validated safety, acceptability, cost, and shelf-life of rations processed in novel stabilization technologies for application to operational rations and extended shelf-life; demonstrated increased availability of nutrition components for Soldier post-mission physical recovery.	1.250	-	-
Title: Joint Service Combat Feeding Technical Demonstration ***Description:*** Beginning in Fiscal Year (FY) 2016, 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, improve food stabilization, and optimize 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 of chemical and biological threats in foods. This effort provides new threat detection tools and sensors for food inspectors. This effort also demonstrates equipment and energy technologies to expand the capability and reduce the logistics footprint of field feeding systems. This work further evolves breakthroughs from PE 0602786A/ Project H99 and is coordinated with PE 0602787A/Project 869. ***FY 2016 Plans:*** 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	2.134

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
reduce Soldier load; demonstrate novel ration packaging material technologies (e.g., bio-based hybrid materials) to reduce ration packaging waste. ***FY 2017 Plans:*** Will fabricate and demonstrate modular and tailorable field feeding prototypes that reduce water demand, reduce waste generation, and are self-powered or externally powered with alternative fuel/energy to improve sustainment maneuverability and reduce the logistical footprint and cost; validate diagnostic tools and sanitizing methodologies to detect and eliminate pathogens within ration systems; mature and demonstrate nutrient based strategies to enhance Soldier cognitive and physical performance; demonstrate alternative packaging and processing technologies to preserve nutrient retention and reduce costs.			
Accomplishments/Planned Programs Subtotals	2.979	2.155	2.134

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
J50: *Future Warrior Technology Integration*	-	46.611	32.621	26.550	-	26.550	29.310	31.764	32.364	33.011	-	-

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 that corresponds 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 Project support the Army Science and Technology Soldier/Squad Portfolio.

Work in this project complements and is fully coordinated with Program Element (PE) 0602786A (Warfighter Technology), PE 0602618A (Ballistics Technology), PE 0602105A (Materials Technology), PE 0602787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603015A (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 Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Soldier/Small Unit Ballistic and Blast Protection	3.900	4.275	4.202
Description: This effort utilizes a cross-disciplinary, human-focused approach to mature and demonstrate technologies that optimize tradeoffs in ballistic and blast protective component design. This effort focuses on maturing and demonstrating proven components that have potential to significantly increase protection for individual Soldiers and/or reduce physical load at equal or			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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 Program Executive Office (PEO)-Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2015 Accomplishments:*** Demonstrated combat eye protection technologies that provide 15% improved ballistic performance without degradation in optical quality and scratch resistance; provided weight versus threat-standoff trade space analysis to inform reduced weight small arms protective insert development; demonstrated relevant technologies and validated methods to enable assessment and verification of service life requirements for body armor components; developed knowledge products from successfully demonstrated protection 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:*** 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. ***FY 2017 Plans:*** Will complete demonstration of the improved single lens multi-threat protective eyewear system prototype; mature and optimize improved low velocity impact protection components for helmets; mature test device and methodology to validate anti-fogging properties of combat eyewear; optimize radiation detection methodologies for evaluating emerging active hearing protection products.			
Title: Soldier/Small Unit Multi-Threat Protection	8.781	7.560	4.836
Description: This effort focuses on maturing and demonstrating multifunctional protective component materials, sub-systems, and 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 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Matured and demonstrated improved multifunctional protective textile technologies with enhanced durability, signature management performance, insect resistance, and flame resistance; matured and integrated hearing protection technology that mitigates noise exposure while maintaining auditory situational awareness; demonstrated 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; developed 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:*** 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 effects of pattern size and color on visual signature management; demonstrate improved flame resistant fabric with enhanced durability and reduced cost. ***FY 2017 Plans:*** Will mature multi-threat protective technologies for clothing and individual equipment in environmental extremes such as tropical and arctic; complete demonstration and validate performance of prototype uniforms with thermal signature management capabilities; fabricate and demonstrate improved multifunctional flame resistant fabrics with signature management capabilities.			
Title: Soldier and Small Unit Systems Integration and Demonstration	10.846	-	-
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 Science and Technology community. This efforts supports risk reduction demonstrations and produces validated analytical results for decision makers. This effort is fully 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 Accomplishments:*** Conducted integrated, operationally-relevant systems-level demonstrations with the potential to increase protective equipment performance against a wide range of threats while decreasing weight; conducted system assessment and documented system performance parameters for a dismounted route planning tool, which interfaces with three existing military mission planning			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
platforms; matured and demonstrated tactically relevant performance of handheld unmanned sensor platform in simulated operational environments; demonstrated 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; participated in significant Army demonstrations, exercises, and war games 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) ***Description:*** This effort pursues a mature and maintainable architecture for a biological (human) platform that utilizes a common Soldier, Equipment, Task (SET) framework at the system level. The architecture will provide a unifying performance construct that considers human dimension and 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-offs. 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 foundational efforts including human performance assessment measures and evaluation devices required at various testing locations. This effort develops standardized methodologies required for demonstrations to provide operationally relevant assessments. This effort is coordinated with PE 0602716A/Project H70, PE 0602786A/Project H98, 0603015A/Project S28, PE 0603710A/Project K70, PE 0602308A/Project C90, PE 0602787A/Project 869, and PE 0603004A/Project 232. ***FY 2015 Accomplishments:*** Led 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; identified required improvements to modeling and simulation capabilities to perform and support quantitative analyses and evaluations; developed the Soldier biological (human) platform architecture, and Soldier and squad level metrics gaps; enhanced capabilities for virtual simulation for Soldier and small units; advanced data collection tools to support the integration and measurement of the effects of Soldier-worn equipment in the SSEA; exercised the architecture as it is developed to test and refine its capabilities; provided knowledge products such as verified component and system performance data, TRL assessments, trade-off analyses, and standardized performance metrics for capability demonstrations and acquisition decisions and future requirements development. ***FY 2016 Plans:*** 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	11.854	12.261	11.795

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will optimize, refine, and streamline the system engineering tools and processes which were developed to support the Soldier as a System capability; continue integration of tools and processes against specific pilot projects to demonstrate the benefits of SSEA against cognitive, physical, and social aspects of Soldier performance; exploit performance assessment methodologies to identify personal sensing suite; mature the population-level analysis design tool for creating a human model of a Soldier's size and shape based on statistical methods; mature the repeatable standard method for obtaining accurate 3 Dimensional (3D) models of equipped Warfighters.			
Title: Soldier and Small Unit Mission Command/Situational Awareness (SA) and Power and Energy Integration ***Description:*** This effort matures and demonstrates mission command and power and energy technologies 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/Project H11, PE0602705A/Project H94, and PE 0603710A/Project K70. ***FY 2016 Plans:*** Begin to integrate situational awareness and power capabilities to include information portrayal software, display technology, data collection and analyzing devices, and 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 scenarios (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 and individual equipment from Soldiers' movement (e.g., knee movement) to reduce power requirements and resupply needs for Soldiers. ***FY 2017 Plans:*** Will demonstrate proof of principle concepts of near term technologies such as wireless power transfer and distribution, wireless personal area network, energy harvesting, portable power management, and integrated power and data situational awareness; validate power and energy investments through analyses that consider component technologies as well as viability of integration onto the Soldier system and within the operational framework; mature and demonstrate the integration mission information technologies for situational awareness such as augmented reality and information portrayal on head-borne devices; mature and	-	5.819	2.359

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
demonstrate the complex human systems integration challenges of situational understanding from tactical handheld devices used by dismounted Soldiers; demonstrate efficiency and safe levels of power transfer for small unit power.			
Title: Soldier and Small Unit Human Systems Performance	11.230	2.706	3.358
Description: This effort 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 0602786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/Project H94. 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 2015 Accomplishments:*** Validated individual Soldier mission relevant human performance metrics sensitive to equipment load and fatigue; optimized operationally relevant physical and cognitive measures to quantify the effect associated with physically and mentally demanding workloads; provided data and modeling approaches whose outputs make explicit trade-space between human functional capability and equipment configuration that supports informed technology development; field-validated 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; matured personal augmentation design for opportunities such as simple mechanical augmentation; transitioned mature knowledge products for human performance (e.g., thermal burden models, load-related metabolic energy cost, etc.); validated 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:*** Optimize biomechanics 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. ***FY 2017 Plans:*** Will mature and demonstrate a dynamic visualization tool that utilizes existing measures of physical, cognitive, and social performance across a spectrum of operational missions; expand ability to predict human performance outcomes through the application of metrics transitioned from applied research; compare and demonstrate human systems integration tools and simulations against operational tasks and missions to correlate lab to field data to strengthen prediction of Soldier and squad			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
performance; demonstrate ability to measure impacts of technologies such as information portrayal to optimize Soldier and squad performance (e.g. increased resilience and readiness) for increased overmatch.			
Accomplishments/Planned Programs Subtotals	46.611	32.621	26.550

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	13.000	9.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Advanced Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase ***FY 2015 Accomplishments:*** Program increase for warfighter advanced technology ***FY 2016 Plans:*** Program increase for warfighter advanced technology	1.000	9.000
Congressional Add: Environmental Control Systems ***FY 2015 Accomplishments:*** Congressional increase for Environmental Control Systems	12.000	-
Congressional Adds Subtotals	13.000	9.000

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	7.409	6.763	4.245	-	4.245	3.433	3.455	3.524	3.594	-	-

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, require no Military Construction, and need 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 assesses the performance capabilities using metrics and methodologies developed under PE 0602786A/Project VT4. Demonstrated EBC equipment is transitioned to Product Manager (PM)-Force Sustainment Systems (PM FSS).

Efforts in this project support the Army Science and Technology Soldier/Squad Portfolio.

Work in this project complements and is fully coordinated with Program Element (PE) 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602784A (Military Engineering Technology), PE 0603734A (Military Engineering Advanced Technology), 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).

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 Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Expeditionary Base Camp (EBC) Technology Demonstrations	7.409	6.763	4.245
Description: This effort matures and demonstrates 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. This work further evolves breakthroughs from PE 0602786A/Project VT4, PE 0602786A/Project H99 and is coordinated with PE0603001A/Project C07, PE0602105A/Project H84, PE 0602784A/Project			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
T40, PE 0603734A/Project T08, PE 0603004A/Project L97, PE 0603005A/Project 497, PE 0603125A/Project DF5, and PE 0603772A/Project 101. ***FY 2015 Accomplishments:*** Began 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; demonstrated self-sustaining living module(s); integrated technology concept(s) and systems engineering models for handling and treatment of black waste and demonstrated technical feasibility; matured, analyzed, and demonstrated water demand reduction technologies for developing a method to trade off net water savings with potential energy consumption increases; further improved photovoltaic power generating solar shade system technology for demonstration; optimized concepts, models, components, and systems for sustainability/logistics demonstration. ***FY 2016 Plans:*** 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; 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. ***FY 2017 Plans:*** Will demonstrate improved flame resistance shelter systems to ensure safe living environments for Soldiers; provide a fully integrated base camp system demonstration that reduces fuel and water demands, resupplies, and waste backhaul; demonstrate rapidly deployable compact and lightweight shelter technologies that reduce shelter set-up time and manpower requirements, increase transportability, and improve shelter protection from ballistic threats; optimize manufacturing processes for novel shelter materials to improve material performance for cost savings.			
Accomplishments/Planned Programs Subtotals	7.409	6.763	4.245

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603002A *I Medical Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	104.997	108.584	68.365	-	68.365	70.847	71.919	73.341	74.463	-	-
810: *Ind Base Id Vacc&Drug*	-	17.882	18.719	16.762	-	16.762	17.842	18.004	18.359	18.607	-	-
814: *NEUROFIBROMATOSIS*	-	15.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
840: *Combat Injury Mgmt*	-	28.559	30.572	19.131	-	19.131	19.907	20.263	20.660	20.983	-	-
945: *BREAST CANCER STAMP PROCEEDS*	-	0.536	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	16.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	0.000	0.000	11.656	-	11.656	11.731	11.923	12.162	12.403	-	-
FH4: *Force Health Protection - Adv Tech Dev*	-	1.626	1.268	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
MM3: *Warfighter Medical Protection & Performance*	-	17.394	19.025	20.816	-	20.816	21.367	21.729	22.160	22.470	-	-

Note

In Fiscal Year (FY) 2017 the Clinical and Rehabilitative Medicine efforts will move from Project 840 to Project ET5. Starting in FY17 Project FH4 funding and research will move to Project MM3.

A. Mission Description and Budget Item Justification

This Program Element (PE) maturates and demonstrates advanced medical technologies including drugs, vaccines, medical diagnostic devises, measures for identification and vector control, and developing medical practices and procedures to effectively protect and improve the survivability of United States Forces across the entire spectrum of military operations. Tri-Service coordination 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 will 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 matures 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 (medical 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, nerve and vascular 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. Starting in FY17 the funding for the Clinical and Rehabilitative Medicine Research Program moves from project 840 to project ET5.

Project ET5 starts in FY17 and the funding for the Clinical and Rehabilitative Medicine Research Program moves from project 840 to project ET5. Project ET5 conducts validation studies on safety and effectiveness of drugs, biologics, medical devices, procedures, and rehabilitative strategies intended to minimize long-term effects from battlefield injuries. This project supports advancing technology supporting clinical and rehabilitative solutions to restore function of ocular and visual system post injury; and advancing regenerative techniques to restore the function and appearance of damaged tissues by regenerating skin, muscle, nerve, vascular and bone in battle-injured casualties.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A *I Medical Advanced Technology*

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. Starting in FY17 the FH4 funding and research will be merged into project MM3.

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 (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. Starting in FY17 the FH4 funding and research will be merged into project MM3.

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; United States Army Medical Research Institute of Infectious Diseases, Ft Detrick, MD; United States Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; United States Army Institute of Surgical Research, Joint Base San Antonio, TX; United States Army Aeromedical Research Laboratory (USAARL), Ft Rucker, AL; the Naval Medical Research Center (NMRC), Silver Spring, MD; United States Army Dental Trauma Research Detachment (USADTRD), Joint Base San Antonio, TX.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A *I Medical Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	106.264	69.584	68.365	-	68.365
Current President's Budget	104.997	108.584	68.365	-	68.365
Total Adjustments	-1.267	39.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	39.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.686	-			
• SBIR/STTR Transfer	-1.953	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 814: *NEUROFIBROMATOSIS*		
Congressional Add: *Neurofibromatosis Research Program*	15.000	15.000
Congressional Add Subtotals for Project: 814	15.000	15.000
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	39.000	39.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
810: *Ind Base Id Vacc&Drug*	-	17.882	18.719	16.762	-	16.762	17.842	18.004	18.359	18.607	-	-

Note

In Fiscal Year (FY) 2017 the Drugs to Prevent/Treat Parasitic Diseases and Vaccines for Prevention of Malaria research areas are merged into Advanced Technology on drugs and vaccines against parasitic diseases.

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 United States 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 four areas:
(1) Prevention/Treatment of Parasitic (organism living in or on another organism) Diseases
(2) Bacterial Disease Threats (diseases caused by bacteria)
(3) Viral Disease Threats (diseases caused by viruses)
(4) Diagnostic Systems and Vector Identification and 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 United States Army Medical Institute of Infectious Disease (USAMRIID) and coordinated with the Naval Medical Research Center (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 Program Element 0603807A, Project 808.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 Walter Reed Army Institute of Research, Silver Spring, MD, and its overseas laboratories; USAMRIID, Fort Detrick, MD; and the 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 2015	FY 2016	FY 2017
Title: Drugs to Prevent/Treat Parasitic Diseases	2.172	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. In FY17 this research area and the Vaccines for Prevention of Malaria research area are merged into one task area titled Advanced Technology Research on drugs and vaccines against parasitic diseases. ***FY 2015 Accomplishments:*** Advanced new generation drugs with improved therapeutic index (largest dose producing no toxic symptoms) through small animal model testing. Performed 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 are used in clinical testing for safety and effectiveness in human volunteers. 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). Transition best therapeutic (treatment or drug promoting disease healing) and preventive drug candidates to advanced development.			
Title: Vaccines for Prevention of Malaria	5.014	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			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
drugs. In FY17 this research area and the Drugs to Prevent/Treat Parasitic Diseases research area are merged into one task area titled Advanced Technology Research on drugs and vaccines against parasitic diseases. ***FY 2015 Accomplishments:*** Continued to conduct human safety and effectiveness clinical trials of new formulations of vaccine candidates supporting transition into Advanced Development. Conducted human clinical studies to assess how long malarial vaccination sustains protection levels. Down selected lead P. falciparum vaccine candidates for transition into Advanced Development ***FY 2016 Plans:*** Continue conducting human safety and effectiveness clinical trials of new formulations of vaccine candidates including weakened (so they do not cause disease) malaria sporozoites (infective stage of the parasite) in human volunteers to assess their safety and effectiveness. Down-select the best vaccine candidate for transition to advanced development.			
Title: Advanced Technology Research on drugs and vaccines against parasitic diseases ***Description:*** This effort selects promising anti-parasitic drug candidates for treating malaria and leishmaniasis for testing in humans, prepares data packages required for FDA approval of testing in humans. Studies have shown that the malaria parasite can become resistant to existing drugs, which makes it necessary to continually develop new and more effective and safe treatments. 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. In FY17 the Vaccines for Prevention of Malaria research area and the Drugs to Prevent/Treat Parasitic Diseases research area are merged into one task area titled Advanced Technology Research on drugs and vaccines against parasitic diseases. ***FY 2017 Plans:*** Will down-select a lead compound from Triazine group which will be used in clinical testing for safety and effectiveness (protection against controlled human malaria infection) in human volunteers. Will conduct clinical testing of eight-aminoquinoline class drugs (i.e. primaquine) to assess the break-down within human body in order to improve drug safety and effectiveness for treatment and prevention of relapsing malarias (persons getting sick second time after drug treatment). Will conduct trials in human volunteers with recombinant DNA and viral vector based vaccine candidates to assess their safety and effectiveness. Will test new particle based platform (self-assembling protein nanoparticle based vaccine) in humans to improve performance of selected vaccine candidates. Will down-select the best vaccine candidate for transition to advanced development.	-	-	6.591
Title: Bacterial Disease Threats	4.812	4.518	3.880

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort selects promising candidate vaccines against each of the three main bacterial causes of diarrheas (E. coli, Campylobacter, and Shigella; 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 2015 Accomplishments:*** Conducted expanded vaccine candidate safety and effectiveness human clinical trials with two diarrheal pathogens, Shigella, and EnteroToxigenic E. coli (ETEC). Transitioned best successful down-selected vaccine candidates to Advanced Development. ***FY 2016 Plans:*** Prepare data packages to present to the FDA for approval for human testing of vaccine candidates for bacterial diarrheal agents. 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. Transition the best Shigella, ETEC & Campylobacter vaccine candidates, respectively, to Advanced Development. ***FY 2017 Plans:*** Will complete clinical trials with monovalent (one type) additional vaccine candidates identified in FY16 to present to the FDA for approval for human testing of vaccine candidates for bacterial diarrheal agents. Will conduct extended safety/efficacy/dosing study in humans by using different escalating doses of candidate vaccines against Shigella, and ETEC. This will also allow understanding protection mechanisms of these vaccine candidates. Will transition the new Shigella, and ETEC vaccine candidates to Advanced Development.			
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-based) in animals, prepare FDA investigational new drug technical data packages, and conducts clinical testing of candidate vaccines in humans. ***FY 2015 Accomplishments:*** Completed clinical testing of selected hantavirus and dengue vaccine candidates for safety and initiated expanded clinical studies to test the efficacy of the candidate vaccine in human volunteers. Initiated expanded clinical testing for efficacy studies with multivalent dengue vaccine in US adults with new vaccine lots. Also initiated clinical studies for effectiveness in dengue endemic countries with best down-selected candidates. Refined the final vaccine formulation and delivery into human body. Initiated the development of a human challenge model for all four dengue viruses. Under this model, volunteers vaccinated with a dengue	4.782	5.116	5.035

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
vaccine candidate were deliberately "challenged" with attenuated dengue viruses to assess whether or not the candidate vaccine could prevent dengue infection. ***FY 2016 Plans:*** Conduct assessments of vaccine effectiveness and safety among human populations immunized with experimental dengue vaccines. Continue development and testing of the experimental dengue human challenge model initiated in FY15. Continue clinical trials with candidate DNA vaccine against hantaviruses and continue to look for a commercial partner and a country where hantaviruses infections regularly occur, to conduct large scale clinical trials (FDA required). Coordinate with the FDA to establish specific guidelines for the licensure of a hantavirus DNA vaccine. ***FY 2017 Plans:*** Will assess safety and initial immunogenicity (ability to provoke an immune response) of vaccine candidates measured from sera and immune cells obtained from human volunteers enrolled in dengue vaccine trial conducted with commercial partner. Will assess safety of controlled human dengue infection with newly developed Dengue attenuated viruses that will be used in future clinical trials in lieu of natural infection caused by mosquito bite to assess effectiveness of candidate dengue vaccines. Will assess if antibody responses will be acceptable over a traditional expanded safety, efficacy, and dosing studies in humans. There is currently no animal disease model for Hantavirus causing Hemorrhagic Fever with Renal Syndrome. Could prove difficult to conduct a traditional safety/efficacy/dosing study in humans for vaccine assessment due to the marginally low incidence of disease, we will pursue a vaccine efficacy evaluation strategy based on establishing surrogate markers of protection, i.e. antibodies that neutralize the virus(es) against the disease.			
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 2015 Accomplishments:*** Developed Rapid Human Diagnostic Devices (RHDD) in collaboration with industry partners and transitioned to Advanced Development. Tested vector (organisms that transmit disease) surveillance devices in field. Tested new vector control technologies with field applications and select best tools for military operations. ***FY 2016 Plans:*** Support projects to research and develop RHDDs for priority diseases and pathogens (infectious agents) that are usable at or near the point of need. Develop military relevant assays (i.e. panels differentiating diseases that have similar symptoms) to be	1.102	1.624	1.256

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
transitioned for the next-generation diagnostic system (NGDS) platform. Continue to test new vector control technologies in the field. ***FY 2017 Plans:*** Will conduct laboratory and field evaluations with commercial partners and outside of the continental United States (OCONUS) laboratories to evaluate rapid diagnostic assays (RHDDs) and Arthropods Vector Rapid Detection Device (AVRDDs) for infectious agents of military importance. The aim is to conduct initial validation studies required to ensure that the commercial assay meets military requirements and has the potential to obtain the requisite regulatory clearances from the FDA to facilitate military use. Will test new generation spatial repellant(s) in the field for efficacy against insect and other arthropod vectors. Will test bite-protection/ resistance capability of repellant treated fabrics.			
Accomplishments/Planned Programs Subtotals	17.882	18.719	16.762

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
814: *NEUROFIBROMATOSIS*	-	15.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurofibromatosis research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Neurofibromatosis Research Program	15.000	15.000
FY 2015 Accomplishments: Neurofibromatosis Research Program		
FY 2016 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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
840: *Combat Injury Mgmt*	-	28.559	30.572	19.131	-	19.131	19.907	20.263	20.660	20.983	-	-

Note

In Fiscal Year (FY) 2017 the Clinical and Rehabilitative Medicine funding will move to Project ET5.

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 (moves to project ET5 in FY17)
(6) Underbody Blast Injury Assessment

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through applied research conducted under Program Element (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 United States Army Institute of Surgical Research (USAISR), Joint Base San Antonio, TX; the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Damage Control Resuscitation	6.772	7.200	6.183
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 2015 Accomplishments:*** Continued 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. Continued to evaluate drugs and biologics (medical products derived from living organisms) to reduce traumatic bleeding caused by inflammation. Conducted 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:*** Continue research from FY15 to evaluate hemostatic drugs, biologics, devices and techniques in relevant traumatic bleeding shock models. Extend FY15 work, evaluate promising hemostatic devices designed to stop bleeding in body locations where tourniquets cannot be used; evaluations are done in manikins and normal human volunteers. Evaluate preclinical safety of emerging platelet storage technologies with respect to preserving platelet hemostatic function and preventing an adverse inflammation response. ***FY 2017 Plans:*** Will evaluate existing drugs, devices, and techniques to stop severe bleeding in relevant hemorrhagic shock models and in humans. Will validate small volume resuscitative therapies, i.e., medicinal products that protect blood-deprived tissues from further damage and restore normal cell function. Smaller volume resuscitative products permit the medic to carry more products in aid bag, which increases availability for use at the point of injury in far forward areas.			
Title: Combat Trauma Therapies	4.232	3.508	5.467
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 2015 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Performed analysis supporting development of a predictive model to estimate dental casualties for Soldiers entering a theater of operations. Continued 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, evaluate therapies to reduce fibrosis (development of excessive connective tissue after injury) during recovery from large volume muscle loss injury and improve muscle functionality. Perform small clinical studies to characterize effects of traumatic and burn injuries on vital organ preservation, scarring, and need for pain-relieving drugs. Field an information product on a predictive model to estimate dental casualties for Soldiers entering a theater of operations. ***FY 2017 Plans:*** Will pre-clinically validate combined-agent (a bacteria-killing protein in combination with a chemical that disperses bacterial colonies) antibacterial wound treatments in a large animal contaminated facial, mouth wound model. As follow on to the FY16 work, will evaluate therapies that reduce excessive connective tissue formation following traumatic muscle injury to determine their effect on remaining muscle and surgical repair. Will perform clinical studies to determine factors that impede wound healing. Will perform clinical studies to determine the burden of excessive scarring from burn injuries.			
Title: Traumatic Brain Injury (TBI) ***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 TBI. ***FY 2015 Accomplishments:*** Continued pivotal clinical 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 2016 Plans:*** Examine promising therapies to protect brain cells following TBI using relevant animal models of penetrating and concussive TBI. Perform studies to establish drug protocols targeting the sub-acute (within the first few days following TBI) and chronic TBI recovery phases. Continue research from FY15 to evaluate effectiveness (therapeutic effect or benefit) of different drug combinations to protect brain cells following TBI. ***FY 2017 Plans:*** Will begin pre-clinical and early clinical studies of post-TBI hyperthermia (TBI-induced fever). Will begin pre-clinical and early clinical studies of potential neuro-regenerative mechanisms (mechanisms to restore damaged brain tissue). Will validate	3.563	4.062	4.192

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
neuroprotection therapies (therapies to protect brain tissue from further damage following a TBI event) using validated small animal model of polytrauma (multiple traumatic injuries).			
Title: Combat Critical Care Engineering ***Description:*** This effort supports development of diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation, 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 2015 Accomplishments:*** Translated 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. Continued research on ventilation strategies to improve brain status in casualties with TBI. Performed studies to identify means to improve critical care nursing practice in theater hospitals. ***FY 2016 Plans:*** 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. Conclude work on ventilation strategies and transition to advanced development. Start clinical studies to support development of combat nursing clinical practice guidelines for en-route care and for management of sepsis (whole-body inflammation caused by an infection) in the burn intensive care unit. Perform translational studies of promising technologies to treat single and multiple organ failure due to trauma. ***FY 2017 Plans:*** Will use an animal model of survivable lung injury to test effectiveness of various therapeutic approaches. Will validate the FDA-approved Resuscitation Burn Decision Support System for other indications. Will continue work from FY16 to develop clinical practice guidelines for en-route nursing care and for identification and management of sepsis. Will perform clinical studies to determine best practice to prevent pressure ulcer development during evacuation.	2.871	3.692	3.289
Title: Clinical and Rehabilitative Medicine ***Description:*** This effort supports clinical studies to advance treatment and restoration strategies of traumatically-injured tissues, to include skin, nerve, bone and ocular tissue to ultimately restore function and appearance. 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. In FY17 the Clinical and Rehabilitative Medicine funding will move to project ET5.	10.575	11.554	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Conducted preclinical studies on drug delivery, diagnostic, tissue repair, and/or treatment strategies for traumatic eye injury and evaluated the preclinical safety and efficacy of promising strategies to facilitate clinical transition. Further developed novel drug delivery, diagnostic, reconstructive, and regenerative strategies including novel biological materials and cell-based therapies for clinical transition; utilized and refined cell-based therapies (including stem cells) and tissue scaffolds to restore soft and bone tissue form and function; performed preclinical safety and efficacy studies; built 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 (head, neck, face and jaw), genital and abdominal body regions. ***FY 2016 Plans:*** 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. Further advance novel drug delivery, diagnostic, reconstructive, and regenerative strategies including novel biological materials and cell-based therapies (i.e. stem cells) toward clinical translation; utilize and refine the combination of cell-based therapies and tissue scaffolds to restore soft and bone tissue form and function; enhance promising approaches from FY2015 by advancing to preclinical safety and efficacy studies to enable 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 regions. Evaluate improved monitoring technologies for tissue rejection during hand and face transplant procedures for advancement 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. This effort concludes at the end of FY16. ***FY 2015 Accomplishments:*** Continued 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:*** 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 Program Objective Memorandum (POM).	0.546	0.556	-
Accomplishments/Planned Programs Subtotals	28.559	30.572	19.131

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
945: *BREAST CANCER STAMP PROCEEDS*	-	0.536	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2015	FY 2016	FY 2017
Title: Breast Cancer Stamp Proceeds	0.536	-	-
Description: This is a Congressional Interest Item.			
FY 2015 Accomplishments: Breast Cancer Stamp Proceeds			
Accomplishments/Planned Programs Subtotals	0.536	-	-

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	16.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurotoxin Exposure Treatment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program	16.000	16.000
FY 2015 Accomplishments: Neurotoxin Exposure Treatment Parkinsons Research Program		
FY 2016 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 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) ET5 / *Adv Tech Dev in Clinical & Rehabilitative Medicine*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	0.000	0.000	11.656	-	11.656	11.731	11.923	12.162	12.403	-	-

Note

In Fiscal Year (FY) 2017 the Clinical and Rehabilitative Medicine funding will move from Project 840 to Project ET5.

A. Mission Description and Budget Item Justification

Project ET5 conducts validation studies on safety and effectiveness of drugs, biologics (medical products derived from living organisms), medical devices, and medical procedures intended to minimize 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, nerve, vascular and bone tissue in battle-injured casualties.

Research conducted in this project focuses on Clinical and Rehabilitative Medicine

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through applied research conducted under Program Element (PE) 0602787, Project ET4, are further matured under this Project.

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 Institute of Surgical Research (USAISR), Joint Base San Antonio, TX; the Armed Forces Institute of Regenerative Medicine (AFIRM), and Multiple Institutions across the United States.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Clinical and Rehabilitative Medicine	-	-	11.656
Description: This effort supports clinical studies to advance treatment and restoration strategies of traumatically-injured tissues, to include skin, nerve, bone and ocular (eye) tissue to ultimately restore function and appearance. 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, facial reconstruction and vision restoration.			
FY 2017 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 conduct early human			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** ET5 / *Adv Tech Dev in Clinical & Rehabilitative Medicine*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
clinical trials to ensure the safety of an ocular bandage. Will further advance novel drug delivery, diagnostic, reconstructive, and regenerative strategies including the combination of novel biological materials and cell-based therapies (e.g. stem cells) to restore soft (e.g. skin, muscle, nerve, vascular) and bone tissue form and function toward clinical translation; will enhance promising approaches from FY 2016 by performing preclinical safety and efficacy evaluation of candidate strategies for burns, scarless wound healing, bone and soft tissue repair for application to the eyes, extremities, face, genitalia and abdominal body regions. Will continue to advance improved monitoring technologies for tissue rejection during hand and face transplant procedures and improved vascular technologies that reduce the requirement for vein harvest.			
Accomplishments/Planned Programs Subtotals	-	-	11.656

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 2017 Army										Date: February 2016		
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
FH4: *Force Health Protection - Adv Tech Dev*	-	1.626	1.268	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Starting in Fiscal Year (FY) 2017 the FH4 funding and research will be merged into Project MM3.

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 Department of Defense (DoD) 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 United States Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD; the United States Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and the Naval Health Research Center (NHRC), San Diego, CA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Health Research	1.626	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 (indicator of a process, event, condition or change within the body), objective physiologic markers, physiological) modeling, and validated algorithms to evaluate the health effects of military service, including deployments, and methods to detect a Warfighters			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
exposure to environmental contamination and/or toxic substances, e.g. toxic industrial chemicals (TIC). Starting in FY17 effort will be merged into project MM3. ***FY 2015 Accomplishments:*** Assessed modifiable behaviors and those resilience factors that protect Warfighters from adverse mental or physical health outcomes. Assessed the economic burden of negative coping behaviors such as alcohol and tobacco use. This effort provided screening factors to assess military Family well-being and resilience. ***FY 2016 Plans:*** Advance and deliver innovative tools, approaches, and models for detecting and measuring a Warfighters' exposure to potentially toxic substances during operations. Provide dose-response links between operational exposures and neurological and physical health / well-being. Provide models for predicting the likelihood of neurological or physical injury as a result of operational exposure(s) to TICs. 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	1.626	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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Advanced Technology Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Military Burn Trauma Research Program	8.000	8.000
FY 2015 Accomplishments: Military Burn Trauma Research Program		
FY 2016 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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
MM3: *Warfighter Medical Protection & Performance*	-	17.394	19.025	20.816	-	20.816	21.367	21.729	22.160	22.470	-	-

Note

Starting in Fiscal Year (FY) 2017 the FH4 funding and research will be merged into Project MM3.

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 2015	FY 2016	FY 2017
Title: Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring)	1.641	2.736	5.753
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--Warfighter and Small Unit in FY2014-2016 and also supports capability demonstrations in the area of decreasing Warfighter physical burden in FY2014-2016.			
FY 2015 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Performed field-studies to demonstrate the efficacy of nutritional interventions for optimizing Warfighter recovery from physical and mental injury. Validated algorithms and mathematical models capable of predicting cognitive status and monitoring recovery and healing from physical injury. ***FY 2016 Plans:*** Verify that nutritional approaches enhance recovery of brain function after injury. Demonstrate dining hall interventions that improve Warfighter diet quality. Validate models that can accurately predict recovery and safe return-to-duty. ***FY 2017 Plans:*** Will assess the impact of nutritionally optimized ration items on body composition and physiological status in Warfighters. Will determine the effectiveness of nutritional interventions (e.g. zinc, Omega-3 polyunsaturated fatty acids, etc.) for accelerating recovery from impact-acceleration head injury. Will begin modeling of cognitive performance with caffeine consumption based on reaction time data from laboratory studies. Will characterize intra-individual responsiveness under operationally relevant sleep-loss conditions. Assess physiological metrics (or biomarkers) that are associated with resilience and long term military career success.			
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 Warfighter protection and sustainment across the operational spectrum. This effort provides the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimize physical and cognitive performance during cold-weather and hot-humid operations. ***FY 2015 Accomplishments:*** Conducted a feasibility study to determine saliva biomarker panel to distinguish levels of dehydration in exertional exercise to prevent heat injury. Validated organ damage biomarkers correlation to clinical measures in heat stroke patients. Determined efficacy of drug treatments for heat injury and heat stroke recovery. Provided strategies for localized heating to optimize hand and finger dexterity for specific military tasks. Exploited 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. Evaluated the efficacy of new pharmaceuticals to prevent acute mountain sickness and improve work performance at high altitude. ***FY 2016 Plans:*** Validate biomarkers of heat injured organ damage to clinical outcome measures. Validate effectiveness of interventions including targeted drug treatments for recovery from heat injury. Transition altitude sickness, acclimatization and task performance models to physiological status monitoring system(s) for end-user field validation studies. Refine localized heating strategies to improve	2.278	1.759	4.024

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
hand dexterity and develop a militarily-relevant dexterity assessment method for cold weather operations and provide policy guidance for validated intervention strategies. ***FY 2017 Plans:*** Will provide evidence-based practice recommendations; continue to validate more specific biomarkers of physiological adaptation, and mathematical models for optimizing health and performance against combinations of environmental threats. Will increase finger blood flow, fine-motor dexterity and thermal comfort using facial heating during exposure to cold air for integration into a microclimate heating prototype. Will validate a tool for modernizing dexterity assessment. The assessment instrument will capture many embedded cognitive and sensory components of dexterity such as problem solving, planning, attention, vision, tactile sensation, and proprioception (sense of how our bodies are positioned).			
Title: Injury Prevention and Reduction ***Description:*** This effort supports and validates injury prediction tools and return-to-duty assessments for brain, spine, and chest injury from blast, blunt, and ballistic impact. This effort also addresses need for validated aeromedical standards and strategies to enable aircrew to effectively fight, navigate, & land under a range of degraded visual environments and provide aeromedical return to duty guidelines after neurosensory injury (deficits in the nervous system control of the senses: vision, hearing, taste, smell, and touch). ***FY 2015 Accomplishments:*** Provided medical standards for protection against hearing and vestibular (sensory system supporting movement and sense of balance, located in the inner ear) injuries and ensured compatibility with military operations and maintenance of Warfighter situational awareness. Developed and validated improved sensory system injury countermeasures. Developed and validated computational models to predict the effects of the primary blast wave on the face and eyes. Developed 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:*** Work with combat developers to provide active and passive hearing protection standards. Refine and validate model(s) for predicting effects of hearing loss on speech intelligibility with hearing protection. Refine standards for improved sensory system countermeasures to be used by aircrew in degraded visual environments. 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. ***FY 2017 Plans:*** Will validate objective assessment criteria for the prediction of central and peripheral acoustic and hearing-balance sensory nerve injury. Will validate metrics that predict the type and severity of blast induced eye and visual pathway injuries. Will develop and validate methodology and standards to guide the design of Warfighter eye protection compatible with modern military systems in	3.637	4.101	4.842

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
aviation and enable optimal visual performance. Disseminate top clinical factors (disease/injuries) that impact aircrew performance and provide recommendations to update policy papers. Will monitor and quantify the long-term effects of neurosensory injury on military occupational performance and the long term consequences of retaining Warfighters with previous neurosensory injuries. Will continue surveillance and documentation of best practices to improve and transition an updated neurosensory performance return to duty toolkit.			
Title: Psychological Health and Resilience	9.838	10.429	5.082
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 individual PTSD symptoms, 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.			
FY 2015 Accomplishments: Provided guidance on the use of sleep measures to aid in the diagnosis, prognosis, and monitoring of recovery from a concussive event. Determined the utility of neurocognitive assessment tools (computerized tests that assess different aspects of cognitive functioning such as ANAM, DANA, ImPact, AXON, etc.) in conjunction with physiological data from other sources, such as blood biomarkers, for assessment of post-concussive symptoms. Validated algorithms that predict concussion injury and incorporated these into currently available blast-wave concussion sensor systems. Evaluated the efficacy of bright light therapy for PTSD treatment. Determined the gender-relevant signatures of PTSD and the changes in biomarker levels associated with PTSD onset during deployment.			
FY 2016 Plans: Continue to validate previously developed strategies to reduce vulnerability to concussive injury during blast and impact exposures and promote recovery from concussion. Initiate investigation into the correlation of detailed PTSD symptomatology/ behavioral data with DNA, protein and food breakdown products (genomic, proteomic, and metabolic) biomarkers for stratification of PTSD into subtypes (each PTSD patient may not have the exact same list of symptoms so those that exhibit similar symptoms would be a categorical subtypes). 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. 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 Systems Biology Enterprise.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will continue to expand the Systems Biology Enterprise PTSD biomarker research to identify the impact of treatment upon PTSD disease biomarkers and will begin relating biomarker change to specific interventions toward development of prescriptive intervention regimen. Will continue human research funding of randomized controlled trials of pharmacologic PTSD intervention (Rilouzal). Will continue animal model research focused upon identification of molecular level intervention targets for PTSD treatment and matching with available Food and Drug Administration (FDA) approved drugs (for off label use or Investigational New Drug (IND) consideration). Will produce a prototype mathematical model for concussion risk prediction (links likelihood of concussion to an impact or blast exposure) based on animal study data, data from high school and collegiate athletes, input from breacher blast-exposure studies and in-theater measurements.			
Title: Health Research ***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 and physical health. Dosimetry tools may include new technologies, human biomarkers objective physiologic markers, physiological modeling, and validated algorithms to evaluate the health effects of military service, including deployments, and methods to detect a Warfighters exposure to environmental contamination and/or toxic substances, e.g. toxic industrial chemicals. The funding for this research effort was previously in project FH4 and moved to project MM3 in FY17. ***FY 2017 Plans:*** Will quantify dose-response relationships to operationally-relevant exposures in military personnel population specifically to permethrin (synthetic chemical, an insecticide and insect repellent) and polycyclic aromatic compounds (created when products like coal, oil, gas, and garbage are burned but the burning process is not complete). Will provide model parameters for assessment of real-time personal dose levels to operationally relevant exposures among the high risk military job population subgroups. Will document the specific patterns of health outcomes following exposure to permethrin and other operationally relevant chemicals.	-	-	1.115
Accomplishments/Planned Programs Subtotals	17.394	19.025	20.816

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603003A *I Aviation Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	99.762	103.136	94.280	-	94.280	100.731	100.699	102.706	118.032	-	-
313: *Adv Rotarywing Veh Tech*	-	70.043	73.076	80.948	-	80.948	87.882	88.707	90.476	105.558	-	-
436: *Rotarywing MEP Integ*	-	7.744	8.444	8.385	-	8.385	6.758	5.847	5.962	6.081	-	-
447: *ACFT Demo Engines*	-	7.975	8.216	4.947	-	4.947	6.091	6.145	6.268	6.393	-	-
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	14.000	13.400	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 Science and Technology (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 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 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603003A *I Aviation Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	102.950	89.736	94.280	-	94.280
Current President's Budget	99.762	103.136	94.280	-	94.280
Total Adjustments	-3.188	13.400	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	13.400			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.188	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Future Vertical Lift Research*	14.000	10.000
Congressional Add Subtotals for Project: BA7	14.000	10.000
Congressional Add Totals for all Projects	14.000	10.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
313: *Adv Rotarywing Veh Tech*	-	70.043	73.076	80.948	-	80.948	87.882	88.707	90.476	105.558	-	-

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 Science and Technology focus areas and the Army Modernization Strategy.

Work in this project is performed by the Aviation Development Directorate of the 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 Executive Office Aviation (PEO Aviation) and PEO Intelligence, Electronic Warfare, and Sensors (PEO IEW&S).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Aircraft & Occupant Survivability Systems	8.784	6.371	9.073
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 2015 Accomplishments: Integrated for flight demonstration purposes route planner software, common processing hardware, displays, and sensors onto a relevant aircraft platform; conducted system ground testing and a series of flight tests that quantified the capability of the hardware/software to process data from threat sensors and display appropriate adjustments to the route plan; completed development and demonstration of a common software/hardware interface to rapidly integrate survivability technologies onto aviation platforms; and demonstrated 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:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Complete full scale demonstration of Combat Tempered Platform Technology. Conduct platform system trades of vehicle hardening and aircraft/occupant protection technologies with threat detection and route optimization for complex visual environments to optimize the total survivability of FVL concepts and mature integrated technology solution through analysis and incremental tests. ***FY 2017 Plans:*** Will continue platform system trades to develop an integrated platform solution optimized for improved survivability effectiveness, operational availability, weight, and cost. Will mature integrated technology solutions that encompass susceptibility reduction, vulnerability reduction, operational durability, and reparability. Will provide initial concepts for aircraft integration and system level demonstrations. Will continue to incorporate aircraft dynamic radar cross-section (RCS) signature information in real time route planner to fully exploit modern threat radar signal processing; will integrate open systems architecture compliant route planner software in a UH-60 Blackhawk and AH-64 Apache aircraft; will demonstrate route planner software in appropriate threat environment. Demonstration will include human-in-the-loop for assessing route planner aural detection algorithms and assessments using simulated radar threat systems.			
Title: Rotors & Vehicle Management Systems ***Description:*** This effort demonstrates the performance benefits of advanced rotors through the assessment 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 2015 Accomplishments:*** Matured advanced Vehicle Management System (VMS) technologies. Demonstrated, 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 FVL fleet. ***FY 2016 Plans:*** Demonstrate integrated Rotors and Vehicle Management Technologies developed in PE 0602211A to reduce rotor loads, reduce hub and airframe drag, improve performance and validate high-fidelity computational models of complete rotorcraft for aerodynamics and structural dynamics in whirl stands and wind tunnels. Conduct flight test demonstration of dual-lift control. ***FY 2017 Plans:*** Will complete system trades and begin development of modernized Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL), enabling integration and flight demonstration of cutting-edge vehicle management and flight control concepts and architectures for advanced rotorcraft configurations and operation in complex environments. Will integrate and demonstrate	4.292	1.505	4.098

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
efficient, low drag rotor and hub designs and technologies that mitigate the interactional aerodynamics issue affecting high speed operation.			
Title: Platform Design & Structures Systems	46.985	57.810	55.476
Description: Provide demonstration of advanced vertical lift aircraft system configurations that address FVL capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed, range, payload, and reduced operating costs, facilitating preliminary detailed system design of multiple 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 2015 Accomplishments:*** Completed detailed design of Joint Multi-Role technology demonstrator concepts; matured final design drawings; provided cost/weight analyses; conducted critical system design review; began component and subsystem fabrication and test; updated analytical tools; conducted the Joint Common Architecture (JCA) demonstration; refined the objective Mission Equipment Package (MEP) definition; defined an Architecture Centric Virtual Integration Process (ACVIP) for avionics architecture development; and completed version 1 of the JCA standard. ***FY 2016 Plans:*** Continue execution of the following for the JMR TD Program: Air Vehicle demonstration efforts, JCA standard validation and implementation demonstrations, and 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; continue 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 (RFI) to refine the scope of the implementation demonstrations; continue 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. ***FY 2017 Plans:*** Continue execution of the JMR TD air vehicle demonstration including air vehicle fabrication and assembly; subsystem, system, and full scale ground testing; and first flights. Continue execution of MSAD including the Architecture Implementation Process			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Demo (AIPD) and initial efforts of the Capstone Demo to prove and develop the standards, processes, methods, and strategies required to produce an efficient, effective, and enduring open system architecture in future aircraft.			
Title: Rotorcraft Drive Systems ***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 2015 Accomplishments:*** Completed final assembly of the full-scale drive system demonstrator hardware for UH-60 Blackhawk configurations; conducted full-scale testing to include endurance testing for reliability and over torque testing to validate material design parameters; and evaluated loss of lubrication capabilities through testing. ***FY 2017 Plans:*** Will mature and demonstrate design of advanced multi-speed drive train for advanced aircraft configurations under the Next Generation Rotorcraft Transmission program. Maturation will enable greater aircraft speeds in platforms such as Future Vertical Lift.	6.701	-	1.013
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 2015 Accomplishments:*** Matured engine adaptive controls to optimize performance, component life, and maintenance schedule based on engine health; matured planetary gear failure detection technology, multifunctional aircraft sensor technology (to reduce number of sensors and system weight), and a drive system intermediate rating methodology; demonstrated technologies for assessing structural integrity of a primarily composite airframe; verified the integrity of composite repairs, and predicted the remaining useful life; and demonstrated in-flight real-time, automated methods to sense rotor system track and balance and make adjustments. ***FY 2016 Plans:*** Mature wireless sensors for on-component processing of part health and usage history; demonstrate methodologies to allow for probability of failure predictions based on vehicle current state and anticipated mission; mature technologies to enable lighter weight designs through loads monitoring of critical components; mature and demonstrate technologies for component self	3.281	3.378	3.785

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
assessment, usage tracking and embedded history; and mature embedded multifunctional sensors with built-in processing and communications. Conduct developmental testing of system health and fault recognition algorithms, sensors and structural global health models. ***FY 2017 Plans:*** Will complete demonstration of technologies and methodologies to enable more efficient designs and reduce the maintenance burden for future and current fleet vertical lift aircraft. Demonstrations will improve system components' reliability, inevitably improving overall system reliability. Will complete demonstration of on-engine, adaptive engine controls to optimize performance, component life and maintenance schedule based on engine health. Will complete demonstration of in-flight, real-time, automated methods to adjust rotor system track and balance to reduce aircraft vibration and loads. Will complete demonstration of improved failure detection within a planetary system, a reduced size and weight impact of advanced sensor technologies, and a methodology to allow operations above maximum continuous rating for limited periods of time. Will complete demonstration of an autonomous condition assessment process for a composite airframe, and provide decision support for repair decisions with a repair integrity assessment approach. Will optimize a comprehensive integrated aircraft wide electrical system capability for diagnostics, fault isolation, and generate trendable health indicators. Will improve the reliability criteria for design tools, methodologies, and materials to facilitate the optimization of future rotorcraft designs.			
Title: Survivability for Degraded Visual Environment (DVE) Operations ***Description:*** Develop and mature advanced sensor cueing and flight controls to provide ability to maintain terrain and obstacle situational awareness during all DVEs 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), Program Element (PE) 0603710A, 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:*** Conduct the first major milestone event of the DVE Mitigation (DVE-M) Demonstration Program, the DVE-M 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 (take-off, en-route, landing) and numerous obstacle fields will be presented to the flight crew in order to assess overall DVE System performance, system capability and pilot workload. ***FY 2017 Plans:***	-	4.012	7.503

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will conduct second flight trial at NATO DVE Flight Trials event at Manching, GE. Test events to develop DVE knowledge in other critical environments such as rain, snow, and fog. Complex computing will leverage ongoing adjacent projects, particularly the Joint Common Architecture demonstration (JCA Demo); Will mature a government SIL that can test configurations prior to aircraft integration. Will optimize integration of 3D aural and haptic cues with visual cues; will optimize distribution of visual cues between Panel Mounted Displays and Helmet Mounted Displays; will integrate cueing with sensors and flight controls for holistic DVE pilotage capability.			
Accomplishments/Planned Programs Subtotals	70.043	73.076	80.948

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
436: *Rotarywing MEP Integ*	-	7.744	8.444	8.385	-	8.385	6.758	5.847	5.962	6.081	-	-

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 Science and Technology focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Unmanned and Optionally Manned Systems	7.744	8.444	8.385
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 2015 Accomplishments: Completed implementation of aiding and autonomy algorithms into simulation; demonstrated task and mission effectiveness of interface devices and concepts, and aiding and autonomy algorithms; optimized approach for full integration of selected devices, concepts, and algorithms; and demonstrated a hierarchical structure of nested crew aiding and autonomy functions and evaluated			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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:*** Demonstrate advanced autonomous behaviors in a virtual battle space to be integrated into a simulation facility to evaluate Manned/Unmanned Teaming (MUM-T). Integrate close proximity flight in a simulated environment and mature technology in preparation for a simulation demonstration. Mature and demonstrate data fusion technologies of both on and off board sensors in a simulation environment. Demonstrate advanced decision aiding technologies to aid an airborne mission commander to control both his or her own ship and a team of unmanned systems. Implement Future Airborne Capability Environment (FACE) conformance requirements to allow for ease of portability. ***FY 2017 Plans:*** Will mature advanced autonomous behaviors for UAS, such as sensor guided flight. Plan to transition technology to Program Management (PM) UAS. This increased autonomy enables the UAS to perform functions that manned operators had to complete manually. Will demonstrate the implementation of autonomous multi-UAS reconnaissance mission planning and execution. Will continue to mature and demonstrate human machine interface and decision aiding to support MUM-T and allow the pilot to perform mission planning and control of multiple UAS aircraft, and the mission.			
Accomplishments/Planned Programs Subtotals	7.744	8.444	8.385

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
447: *ACFT Demo Engines*	-	7.975	8.216	4.947	-	4.947	6.091	6.145	6.268	6.393	-	-

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 Science and Technology focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Future Affordable Turbine Engine (FATE)	7.975	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 is as follows, respectively: compressor subsystem, combustor subsystem, turbine subsystem, and mechanical systems. Work in this project is coordinated with efforts in Program Element (PE) 0602211A, Project 47A.

FY 2015 Accomplishments:

Completed assembly/instrumentation for first engine test. This initial, full engine, system level test validated the mechanical integrity of the advanced FATE architecture and provided data for an initial integrated performance assessment; initiated redesigned component tests in support of final goal engine build; and used results from first engine test to establish optimized component flow areas and variable geometry schedules.

FY 2016 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Complete fabrication of redesigned engine components and complete assembly, instrumentation, and testing of the final performance demonstration engine. This full engine system level test validates the horsepower to weight ratio and specific fuel consumption goals of the advanced FATE architecture.			
Title: Alternative Concept Engine (ACE) ***Description:*** This effort demonstrates alternative, adaptive, and intelligent engine technologies to provide improved / mission-optimized performance, readiness, and affordability across an expanding engine envelope for increased operational capability for Army Aviation platforms. The alternative concept engine technology demonstrations planned for this effort are applicable to current and future platforms including Unmanned Aerial Systems (UAS). Work in this project is coordinated with efforts in PE 0602211A, project 47A. ***FY 2017 Plans:*** Will provide preliminary design and perform detailed design efforts supporting planned engine level demonstration of alternative concept engine technologies. Effort will build on knowledge gained under previous project A47A design activities and other Government agency research. Research included investigation of innovative/adaptive engine component technologies such as variable speed power turbine.	-	-	4.947
Accomplishments/Planned Programs Subtotals	7.975	8.216	4.947

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	14.000	13.400	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Aviation advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Helicopter Seat Improvements ***Description:*** Program increase ***FY 2016 Plans:*** This Congressional Add supports research for helicopter seat improvements.	-	3.400	-
Accomplishments/Planned Programs Subtotals	-	3.400	-

	FY 2015	FY 2016
Congressional Add: Future Vertical Lift Research ***FY 2015 Accomplishments:*** This Congressional Add supported research for Future Vertical Lift technologies and concepts in support of the Joint Multi-Role Tech Demo Program. ***FY 2016 Plans:*** This Congressional Add supports research for Future Vertical Lift technologies and concepts in support of the Joint Multi-Role Tech Demo Program.	14.000	10.000
Congressional Adds Subtotals	14.000	10.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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)*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603004A *I Weapons and Munitions Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	72.176	82.663	68.714	-	68.714	76.822	72.837	75.512	69.520	-	-
232: *Advanced Lethality & Survivability Demo*	-	38.685	40.797	46.051	-	46.051	47.741	41.586	40.244	39.787	-	-
43A: *ADV WEAPONRY TECH DEMO*	-	15.000	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
L96: *High Energy Laser Technology Demo*	-	14.908	12.526	17.728	-	17.728	24.075	26.226	30.143	24.505	-	-
L97: *Smoke And Obscurants Advanced Technology*	-	3.583	4.340	4.935	-	4.935	5.006	5.025	5.125	5.228	-	-

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 Army Space and Missile Defense Command (SMDC), Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603004A *I Weapons and Munitions Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	72.908	57.663	63.457	-	63.457
Current President's Budget	72.176	82.663	68.714	-	68.714
Total Adjustments	-0.732	25.000	5.257	-	5.257
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	25.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.948	-			
• SBIR/STTR Transfer	-1.680	-			
• Adjustments to Budget Years	-	-	5.257	-	5.257

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 43A: *ADV WEAPONRY TECH DEMO*		
Congressional Add: *Program Increase*	15.000	25.000
Congressional Add Subtotals for Project: 43A	15.000	25.000
Congressional Add Totals for all Projects	15.000	25.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
232: *Advanced Lethality & Survivability Demo*	-	38.685	40.797	46.051	-	46.051	47.741	41.586	40.244	39.787	-	-

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 2015	FY 2016	FY 2017
Title: Ground Based Networked Munitions Technologies	0.992	1.004	1.300
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 2015 Accomplishments:*** Integrated and demonstrated technologies for multi-purpose networked munitions. ***FY 2016 Plans:*** Develop area denial munition technologies including networked munition level architecture and advanced methods for precision delivery/location of remote effects. ***FY 2017 Plans:*** Will mature the Networked Munition modular architecture for use in future Programs of Record; Demonstrate technologies for non-kinetic energy vehicle stopping.			
Title: Extended Area Protection and Survivability (EAPS)	2.940	-	-
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).			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Optimized and demonstrated an integrated Counter Unmanned Aerial Systems (C-UAS) capability, comprised of algorithms, fire control and command guided interceptor munitions.			
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 Department of Defense (DoD) cluster munitions policy. ***FY 2015 Accomplishments:*** Matured the design and demonstrated performance against the expanded target set that now includes tracked and light wheeled tactical vehicles; exploited emerging breakthroughs in warhead technologies that enabled defeat of the expanded target sets at a reduced cost (e.g. number of rounds fired to service a target). ***FY 2016 Plans:*** 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 Technical Readiness Level (TRL) 6 demonstration. ***FY 2017 Plans:*** Will validate the systems beginning to end capability as well as the system's ability to improve effectiveness against the desired target sets; mature and demonstrate various component designs in a system level solution. The effort will continue to improve and mature a variety of integrated unitary and submunition system concepts to mitigate the gap that will emerge with the loss of cluster munitions. Concepts such as a unitary projectile geared towards medium armor targets, a full bore submunition with a highly reliable triple function fuze, a concept that increases the size and fuze volume of the DPICM bomblet and incorporates high reliability fuzing while maintaining the traditional lethal mechanisms of DPICM. In Fiscal Year (FY) 2017 the efforts will optimize the concept of bomblet/system design and component space allocation to accommodate system level development and demonstrating concept performance through modeling and simulation. Efforts will mature system level designs of unitary solutions and improve initial system level performance. Efforts will continue to mature designs and exploit alternate technologies to mitigate risk; Develop evaluation criteria to assess concept performance; Integrate component technologies into system level solution that are effective against target sets.	2.915	3.000	8.500
Title: Medium Caliber Weapon Systems	9.990	9.967	16.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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, ability to fire a suite of ammunition from non-lethal to lethal, and escalation of force capability in one system. ***FY 2015 Accomplishments:*** Optimized 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, finalized and optimized a prototype turret and drive system to support the XM813 30mm weapon system; optimized and matured 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); performed the integration of these technologies within the BFV and demonstrated improved accuracy and lethality performance at a system level. Additionally, finalized 50mm fuze improvements and performed a fuze shoot off and demonstration to down select and optimize the burst point accuracy of the 50mm PABM munition. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will validate PABM fuze technology and warhead lethality data, iterating and improving as necessary; using a commercially developed barrel, demonstrate PABM and AP effectiveness against personnel and materiel targets; design and fabricate 50mm weapon and ammunition handling system (AHS) prototypes; exploit advances in advanced Fire Control hardware to improve system performance; mature Fire Control software.			
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 2015 Accomplishments:***	0.585	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Optimized next generation proximity sensor (NGPS) sub-system to meet improved performance requirements; demonstrated and validated NGPS design in an artillery platform to achieve a TRL 6.			
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 caliber (indirect fire) weapons. ***FY 2015 Accomplishments:*** Performed appropriate test series on mature propellant and explosive formulations to facilitate certification at the Energetic Material Qualification Board (EMQB) level and enabled transition of new materials to munitions qualification programs. ***FY 2016 Plans:*** 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.	2.924	2.000	-
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 Program Element (PE) 0602601A, PE 0602618A, PE 0603004A, PE 0603005A, PE 0603270A, and PE 0603313A. ***FY 2015 Accomplishments:*** Matured and integrated 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:*** 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. ***FY 2017 Plans:*** Will develop and bench test critical mature subcomponents as well as use of existing performance and simulation models to validate Hard Kill modularity as a capability. Will determine subsystem integration requirements and optimize interface	2.958	5.967	6.250

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
specifications to support a Modular APS Framework (MAF) compliant Hard Kill component. Will mature modularity of subsystem components.			
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 2015 Accomplishments:*** Matured components, built hardware and verified 81mm precision design via a live system test; verified GPS and fuze setter technology and candidate designs with tests. ***FY 2016 Plans:*** 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.	1.424	1.004	-
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 2015 Accomplishments:*** Matured, integrated and demonstrated component technologies in an extended range guided 40mm projectile to 600 meters (threshold)/1000 meters (objective); demonstrated improved probability of hit at an increased range; provided a low cost integrated guidance navigation and control system with optimized airframe, canards, tail fin, and propulsion system; optimized fuze and warhead design for enhanced lethality; demonstrated the ability of the projectile to guide to hit targets at ranges between 600 to 1000 meters.	2.849	-	-
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 2015 Accomplishments:*** Adapted the system to be compatible with the 81mm precision mortar cartridge; prepared for an integrated demonstration.	1.874	-	-
Title: Enhanced Sniper Technologies	1.424	3.011	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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 2015 Accomplishments:*** Validated 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:*** 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 Accomplishments:*** Matured component technologies associated with longer range artillery capabilities to include weapon system components like cannon tube, breech and mount. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will demonstrate and optimize initial long range artillery subsystems components and prototypes including cannon tube, breech and mount; and mature component designs of secondary weapon subsystems such as scavenge systems, diagnostics, and muzzle brakes.	2.034	7.015	1.686
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 Accomplishments:***	1.700	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Matured technologies for neutralization of targets in defilade; matured and demonstrated advanced explosives/fragmentation warhead designs that increased lethal zone for air burst munitions.			
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 Accomplishments:*** Integrated and optimized critical guidance subsystems; demonstrated airframe and actuator performance through flight testing in order to verify the maneuverability of the projectile. ***FY 2016 Plans:*** Demonstrate image navigation guidance technology with algorithms and associated optics integrated in a projectile through a series of captive flight tests; demonstrate guidance and control system in a dynamic test to verify the ability to maneuver in flight. ***FY 2017 Plans:*** Will fully integrate the optics, image processing, navigation and control components into a guidance system for testing on candidate airframes; demonstrate baseline performance initially in day-time / favorable weather; demonstrate full system survivability in extreme environmental conditions.	1.998	2.500	2.000
Title: Guided Enhanced Fragmentation Mortar Munition ***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 Accomplishments:*** Built and tested fully integrated 120mm precision guided mortar systems to verify designs and demonstrated functionality at nominal and environmental extreme conditions.	2.078	-	-
Title: Counter-Unmanned Aviation System (C-UAS) Technology ***Description:*** This effort matures and demonstrates modular C-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:***	-	2.000	2.700

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will continue the maturation and optimization of technologies for UAS tracking and defeating to include the integration of precision fire control mechanisms and weapons systems. Will validate the technologies at the subsystem level and evaluate results of the UAS defeat mechanisms.			
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:*** 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. ***FY 2017 Plans:*** Will demonstrate designs of extended range rocket assisted projectiles fires with currently fielded weapon systems; optimize next generation rocket assisted projectile designs to increase lethality and range when fired with extended range cannon systems; optimize projectiles for use with advanced navigation, flight control, and guidance.	-	3.329	2.800
Title: Fuze and Power Technology for Munitions ***Description:*** This effort matures and demonstrates innovative fuze and power technologies for enhanced environment and target sensing/classification, warhead initiation schemes, and advanced fuze setting. These technologies will provide enhanced lethality combined effects on targets and advanced initiation schemes for the next generation munitions. ***FY 2017 Plans:*** Will mature and demonstrate airburst fuze technology systems for increased accuracy in multi-mode medium caliber rounds; demonstrate low-cost, in-line safety and arming systems for advanced warhead initiation schemes; improve multi-point initiation systems applicable to Insensitive Munitions; optimize next generation fuze setting methodologies to more efficiently transfer and store power and data to smart indirect fire projectiles. These technologies will continue to support the Joint Munitions Program Technical Coordinating Group (TCG-5 and TCG-10) and the Joint Fuze Technology Program (JFTP).	-	-	1.800
Title: Advanced Small Arms Ballistic System	-	-	1.915

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort matures and demonstrates advanced small arms ballistic calculations output from advanced sensor input and optimized architecture for rifles integrated with optic and precision-optical wind sensing. ***FY 2017 Plans:*** Will mature and demonstrate optimized architecture for the precision-optical wind sensing; mature technologies to improve and increase probability of hit, exploiting advanced sensor data including downrange wind sensing, to provide ballistic corrections supporting PM Individual-Weapons platforms.			
Title: Enhanced Tactical Multi-Purpose (ETMP) Hand Grenade ***Description:*** This effort develops a multi-purpose selectable lethal hand grenade that produces either fragmentation or blast overpressure effects. ***FY 2017 Plans:*** Will optimize and refine the design of the subsystems (mode selector, fuze, warhead) based on the results of testing completed to date; integrate all the components into a system and conduct laboratory assessments leading up to a TRL 5 demonstration.	-	-	1.100
Accomplishments/Planned Programs Subtotals	38.685	40.797	46.051

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
43A: *ADV WEAPONRY TECH DEMO*	-	15.000	25.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Advanced Weaponry Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	15.000	25.000
FY 2015 Accomplishments: Advanced weaponry technology demonstrations		
FY 2016 Plans: Advanced weaponry technology demonstrations		
Congressional Adds Subtotals	15.000	25.000

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
L96: *High Energy Laser Technology Demo*	-	14.908	12.526	17.728	-	17.728	24.075	26.226	30.143	24.505	-	-

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, 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 Army Space and Missile Defense Command (SMDC)/Army Forces Strategic Command, Technical Center, Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Laser System Ruggedization	5.890	5.059	4.216
Description: This effort ruggedizes laser systems for integration on Army platforms. Ruggedization includes modifications of the laser system to withstand vibration, temperature, and contamination environments expected on various Army 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 Program Element (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 2015 Accomplishments: Continued additional ruggedization of a 50kW class laser device for integration on the HEL Mobile Demonstration (MD) platform; continued ruggedization of thermal management technology that can cool the 50 kW laser device; and initiated power generation function ruggedization for recharging the power storage modules.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Continue ruggedization of the thermal management subsystem and power management subsystem; ruggedize available power storage hardware received from the U.S. Army 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. ***FY 2017 Plans:*** Will complete the ruggedization and preparation of platform to accept the 50 kW-class laser from Project 042; develop and integrate prime power and thermal management subsystems to support the 50 kW risk reduction testing in FY 2018 and optimize the command and control subsystem to manage the new laser, power, and thermal management subsystems.			
Title: High Energy Laser Mobile Demonstrations (HEL MD) ***Description:*** This effort integrates a commercial-off-the-shelf (COTS) 10kW laser subsystem and demonstrated that performance. The 50 kW-class laser from Project 042 will be integrated into the existing mobile laser demonstrator platform that includes the ruggedized beam control system (BCS) built under the High Energy Laser Technical Demonstration 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 system in a relevant environment. ***FY 2015 Accomplishments:*** Began subsystem demonstration and performance validation for the ruggedized thermal management technology that cools the 50 kW laser device; began subsystem demonstration and performance validation for the ruggedized battle management function that provides controls for the 50kW laser and other subsystems; and began planning for the integrated 50kW class demonstration, to include objective definition, demonstration reference missions, and long-lead purchases. ***FY 2016 Plans:*** Continue coordination activities for 50kW class laser demonstration and data collection events with range, the Laser Clearing House, and the Federal Aviation Authority (FAA) organizations; begin modifications of interfaces and integration of thermal management and power management subsystems; begin performance validation of integrated thermal management and power management subsystems for the 50 kW class demonstration; and begin fabrication of interfaces and integration of laser subsystem components. ***FY 2017 Plans:*** Will begin integration of the ruggedized 50 kW class laser subsystems into an Army platform and perform functional verifications to validate system operation; coordinate with the national test range(s) and procure targets for a system risk reduction	9.018	7.467	13.512

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
demonstration; demonstrate the 50 kW class configuration in the laboratory to verify the system meets the performance metrics prior to beginning integration on the Army platform.			
Accomplishments/Planned Programs Subtotals	14.908	12.526	17.728

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
L97: *Smoke And Obscurants Advanced Technology*	-	3.583	4.340	4.935	-	4.935	5.006	5.025	5.125	5.228	-	-

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 Project is related to, and fully coordinated with, Program Element (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 2015	FY 2016	FY 2017
Title: Obscurant Enabling Technologies	0.697	0.836	0.851
Description: This effort demonstrates the dissemination of new and advanced obscurants. ***FY 2015 Accomplishments:*** . Conducted initial dissemination studies on artillery/mortar delivered low hazard visual obscurant. Demonstrated low hazard visual smoke grenade. ***FY 2016 Plans:*** Continue dissemination studies of artillery/mortar delivered low hazard visual obscurant. ***FY 2017 Plans:*** Will develop techniques for dissemination of new microwave obscurants and explore new microwave obscurant applications.			
Title: Forensic Analysis of Explosives	1.313	1.577	2.096

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort demonstrates improved point and stand-off detection of explosives and home made explosive (HME) precursors. ***FY 2015 Accomplishments:*** Integrated and demonstrated 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:*** Optimize and mature the CFIS device for unambiguous biometric identification of an individual linking explosive residue identified and found in latent fingerprints using Raman Chemical Imaging. ***FY 2017 Plans:*** Will evaluate prototype CFIS standalone instruments to ensure they are fully integrated and will meet the fingerprinting and chemical identification requirements for the Common Analytical Lab System (CALS). Additionally will advance Ultraviolet-Visible Near Infrared (UV-Vis-NIR) multispectral imaging for improved discrimination of target materials and substrates.			
Title: Detection Mechanisms for Contaminants ***Description:*** This effort demonstrates improved point and standoff detection of a wide range of hazardous materials. ***FY 2015 Accomplishments:*** Demonstrated unambiguous detection of explosives and chemical agents in a unified and integrated system based on ion mobility spectrometry. ***FY 2016 Plans:*** Expand number of explosive materials detected in the Chemical Explosives Detector (CED) variant of the Joint Chemical Detector (JCD) while retaining Chemical Warfare Agent (CWA) and Toxic Industrial Chemical (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. ***FY 2017 Plans:*** Will identify up to four on-board calibrants in order to improve the real time detection of the CED by an order of magnitude. Will determine mobility values of the calibrants and target molecules used as detection parameters for algorithms in ion mobility spectra. Will establish dependence of detection parameters on water vapor and make a final recommendation to JPM-CA of most stable calibrant. Will Implement new detection parameters in software. Will demonstrate improved ionization of explosives	1.573	1.927	1.988

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
using up to four chlorine based dopants. Will optimize and mature CED probe design to enhance the detection performance on explosives and other low volatility threats.			
Accomplishments/Planned Programs Subtotals	3.583	4.340	4.935

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603005A *I Combat Vehicle and Automotive Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	143.606	135.571	122.132	-	122.132	126.724	126.189	130.573	133.397	-	-
221: *Combat Veh Survivablty*	-	51.694	55.476	63.269	-	63.269	64.465	63.389	64.133	64.059	-	-
441: *Combat Vehicle Mobilty*	-	40.681	43.381	39.067	-	39.067	38.613	39.105	42.328	44.566	-	-
497: *Combat Vehicle Electro*	-	6.926	6.660	7.118	-	7.118	7.153	7.202	7.345	7.492	-	-
515: *Robotic Ground Systems*	-	6.805	7.554	12.678	-	12.678	16.493	16.493	16.767	17.280	-	-
533: *Ground Vehicle Demonstrations*	-	17.500	22.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
53D: *NAC Demonstration Initiatives (CA)*	-	20.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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, PE 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), 0602784 (Military Engineering Technology), 0603001A (Warfighter Advanced Technology), 0603004A (Weapons and Munitions Advanced Technology), 0603005 (Combat Vehicle and Automotive Advanced Technology), 0603125A (Combating Terrorism Technology Development), 0603270A (Electronic Warfare Technology), 0603313A (Missile and Rocket Advanced Technology), 0603734 (Military Engineering Advanced Technology), 0604115A (Technology Maturation Initiatives), 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603005A *I Combat Vehicle and Automotive Advanced Technology*

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

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	147.485	113.071	118.252	-	118.252
Current President's Budget	143.606	135.571	122.132	-	122.132
Total Adjustments	-3.879	22.500	3.880	-	3.880
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	22.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.565	-			
• SBIR/STTR Transfer	-3.314	-			
• Adjustments to Budget Years	-	-	3.880	-	3.880

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 533: *Ground Vehicle Demonstrations*		
Congressional Add: *Program Increase*	17.500	22.500
Congressional Add Subtotals for Project: 533	17.500	22.500
Project: 53D: *NAC Demonstration Initiatives (CA)*		
Congressional Add: *Alternative Energy Research*	20.000	-
Congressional Add Subtotals for Project: 53D	20.000	-
Congressional Add Totals for all Projects	37.500	22.500

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
221: *Combat Veh Survivablty*	-	51.694	55.476	63.269	-	63.269	64.465	63.389	64.133	64.059	-	-

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 Science and Technology 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 2015	FY 2016	FY 2017
Title: Vision Protection:	4.120	2.959	5.000
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 reduces 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 Program Elements (PEs) 0602120A, 0602705A, 0602712A, and 0602786A.			
FY 2015 Accomplishments: Continued vulnerability studies to determine the energy levels required to make pixels, columns and the entire focal plane of an electro-optical (day-camera) ineffective. Matured concepts for integrating protection materials into the optical path of electro-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
optical (day-camera) sensors, and evaluated the effects of sensor exposure to pulsed-laser threats on the survivability of the sensors to continue the fire control mission. ***FY 2016 Plans:*** Mature optical power-limiting materials to improve protection of camera sensors from laser energy. Evaluate the power-limiting materials protection capability against low-powered continuous wave and short-pulsed laser threats. Integrate the power-limiting material onto a current fire-control sensor and determine the improved survivability of the sensor against near term laser threats. ***FY 2017 Plans:*** Will begin vulnerability evaluation of current systems against ultra-short pulse laser threats; will evaluate high energy laser threats to determine their threat parameters for testing sensors against the threats; using the threat parameters will improve the experiment and performance validation methodology for sensors and protection concepts against high energy laser threat weapons; and will fabricate components of the ultra-short pulse laser protection concepts that will be integrated into current systems for performance demonstrations.			
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 2015 Accomplishments:*** Evaluated the performance differences between different transparent armor solutions and determined if additional testing is required to ensure consistent performance.	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 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:***	-	8.673	6.679

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Begin armor integration approaches to help achieve an overall ground vehicle armor subsystem weight reduction of 10-15%. 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 include environmental testing followed by ballistic testing of advanced armor components. Mature advanced passive armor system design for integration of the armor technology components and attachment schemes. Mature advanced explosive reactive armor system design for integration of the armor component technologies. Mature weight optimization methods for holistic vehicle lightweighting that supports and complements the vehicle armor systems. ***FY 2017 Plans:*** Will complete environmental and ballistic performance testing of the advanced passive (B-kit) and explosive reactive armor (C-kit) technologies; will complete the demonstration of advanced passive (B-kit) and explosive reactive armor (C-kit) attachment schemes; will leverage the demonstration results to define the design approach for follow-on integration and testing of the B-kits and C-kits.			
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 PEs 0602601A and 0602618A. ***FY 2015 Accomplishments:*** Continued integration and demonstration of occupant protection components such as seats, restraints and energy absorbing materials into subsystem demonstrators and OCP vehicle demonstrators. Continued analysis of performance of OCP subsystems and demonstrators; began subsystem and integrated OCP vehicle live-fire testing to simulate under-body blast events and identified and documented a rigorous analytical approach to balance protection with mobility/weight goals; continued development and refinement of occupant-centric standards, guidelines and procedures/processes. ***FY 2016 Plans:*** Mature passive and active levels of occupant-centric protection technologies for combat vehicle survivability. Optimize combat vehicle survivability demonstrator designs using modeling and simulation to include the integration of a lightweight structure design, and occupant protection component technologies. Conduct optimization to balance weight, mobility and performance goals. Verify occupant-centric design guidelines and procedures/processes. Evaluate the performance of the initial Warrior Injury Assessment Manikin Project (WIAMan) test device in a simulated test environment. ***FY 2017 Plans:***	13.315	9.957	5.934

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will validate the design of advanced flooring, advanced seating, lightweight hulls and structures, and active blast technologies that minimize weight impact while maximizing performance capability provided through modeling and simulation and component technology performance testing in both the laboratory and in blast tests; will use knowledge gained through testing of the initial WIAMan test device to mature and fabricate a next generation WIAMan test device; conduct WIAMan device testing based on the test certification procedures developed in PE 0602601A to inform updates to the WIAMan test capability requirements documentation and materiel solution design specifications.			
Title: Blast Mitigation:	1.799	4.312	9.633
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 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 2015 Accomplishments: Integrated advanced passive and active technologies such as active blast countermeasures, energy absorbing materials and floor designs to mitigate the effects of underbody blast threats; conducted impact and blast tests to evaluate the integration methods for exterior and interior blast mitigation technologies onto components, and sub-systems; characterized 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: 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. Demonstrate the CVP concepts' performance using modeling and simulation along with sub-system level blast tests. Validate integration methods for blast mitigation technologies onto a combat vehicle platform. Exploit technologies to increase neutralization effectiveness rates against anti-tank mines while maintaining host platform mobility and reliability characteristics.			
FY 2017 Plans: Will complete the integration analysis of advanced seats and restraints, advanced flooring, lightweight hulls, and active blast technologies to identify the optimized integrated design approach; will integrate the optimized technologies into the subsystem demonstrator design and leverage the design approach to maximize performance while minimizing subsystem weight; will conduct			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
modeling and simulation on the subsystem design to verify performance prior to subsystem fabrication; will improve technologies to increase neutralization effectiveness rates against anti-tank mines based on the exploitation previously conducted.			
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 M&S, sensor systems, software, chemical agents, fire-resistant materials and hardware components. This effort is done in coordination with efforts in PE 0602601A. ***FY 2015 Accomplishments:*** Conducted system-level evaluation of common crew Automated Fire Extinguishing System (AFES) technologies and utilized the analysis to develop component specifications for common crew AFES; continued to investigate integration opportunities of common crew AFES to enable AFES commonality across vehicle fleet; and demonstrated technologies to mitigate injuries and improve damage mitigation due to thermal events. ***FY 2016 Plans:*** Improve designs and technologies to minimize vehicle and crew vulnerabilities to fires. Evaluate next generation materials, components and system level technologies to address emerging military ground vehicle thermal threats. Validate AFES designs using M&S and testing to improve integration for current and new vehicle configurations. ***FY 2017 Plans:*** Will evaluate fire protection technologies through modeling and simulation and laboratory testing; will complete validation of AFES designs and a common fire extinguisher; will begin concept evaluation of crew compartment protection through the use of advanced fire protection technologies.	2.063	2.643	2.903
Title: Hit Avoidance Architecture: ***Description:*** This effort matures and demonstrates the Army's 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. ***FY 2015 Accomplishments:*** Continued APS Common Architecture maturation to include an APS common controller. Integrated and fabricated software and hardware for the common controller, enabling integration of active protection components that accommodated varying performance and vehicle needs. Began integration with Hit Avoidance Technologies and conducted hardware-in-the-loop	4.500	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
analyses to validate common controller meets APS interface requirements. Conducted soft-kill countermeasure environmental and live-fire assessments.			
Title: Hit Avoidance Technologies:	24.945	26.932	29.924
Description: This effort matures, integrates and demonstrates hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) APS components and integrated systems to verify the APS Common Architecture and reduce integrating risk on current systems. 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, 0603313A, and 0604115A. ***FY 2015 Accomplishments:*** Matured and integrated 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. Verified the soft-kill countermeasure is compliant with the APS Common Architecture interface standards. Matured and integrated 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. Enhanced 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:*** Continue maturation of the modular APS common architecture, and maturation of the modular APS common controller. Continue software and hardware maturation for the APS common controller, enabling integration of active protection components that accommodate varying performance and vehicle needs. Enhance soft-kill and hard-kill simulation and laboratory capability to exercise and test software and hardware components against design requirements and determine trade space for APS configurations. 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. Conduct virtual and physical demonstrations of a modular architecture APS soft-kill configuration defeat capability against anti-tank guided missiles at the subsystem level. ***FY 2017 Plans:*** Will continue the design and build of the soft-kill and hard-kill modular APS common controller; will complete integration of a soft-kill APS configuration on a demonstrator platform to conduct performance and safety testing of the soft-kill demonstrator against anti-tank guided missiles in various environmental conditions; will conduct hard-kill sensor and countermeasure component testing to validate component performance; will complete integrated hard-kill and soft-kill APS configuration laboratory simulation and component hardware-in-the-loop testing to verify component and system-level performance; will conduct integrated subsystem			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
virtual and physical testing to evaluate integrated system performance; will begin the design of the hard-kill and soft-kill APS configuration to be integrated onto a demonstrator.			
Title: System Design Optimization for Lightweighting: ***Description:*** This effort will focus on optimization of platform design to reduce weight in both traditional and novel methods. This effort will demonstrate best practices in cost-conscious, multi-material design for components to reduce ground vehicle weight, as well as demonstrate holistic weight reduction with informed system and component-level design decisions. This will be accomplished by using and evaluating design tools, advanced materials, manufacturing processes and assembly technologies to design lightweight systems, develop lightweight components and enhance the ability to use novel approaches for lightweighting. This effort leverages lessons learned from prior and ongoing individual component efforts within industry, academia and DoD. This effort is done in coordination with efforts in PEs 0602601A, 0602618A, 0603005A, and 0708045A. ***FY 2017 Plans:*** Will use the Computer Aided-Design for Fabrication of Advanced Materials (CADFAM) tools to develop new or re-engineer existing components such as floors, engine housing, turret with geometric and loading constraints out of advanced materials (e.g. composites) in order to save weight while maintaining or increasing performance. Will mature non-structural lightweight techniques and implement into a lightweighting process; will begin to apply to components to optimize their design for lightweighting.	-	-	3.196
Accomplishments/Planned Programs Subtotals	51.694	55.476	63.269

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
441: *Combat Vehicle Mobilty*	-	40.681	43.381	39.067	-	39.067	38.613	39.105	42.328	44.566	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates advanced mobility and onboard electrical power 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 Science and Technology 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 2015	FY 2016	FY 2017
Title: Onboard Vehicle Electric Power Component Development:	4.278	4.401	4.701
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 Program Element (PE) 0602601A.			
FY 2015 Accomplishments: Evaluated combat vehicle performance with integrated OBVP technologies that verify they provide adequate onboard electrical power to enable future communications, networking, IED jamming and sensors; implemented OBVP and hybrid component control approaches to minimize vehicle performance impacts while generating significant electrical power.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Mature and demonstrate 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. 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. ***FY 2017 Plans:*** Will fabricate and evaluate at a subsystem level, the integrated starter generator (ISG), inverter power conversion box and control strategy for an advanced OBVP system that provides 10 times more electrical power onboard combat vehicles than is available today. Will begin to integrate the components into a system integration laboratory (SIL) for system optimization testing and initial performance and reliability evaluation.			
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 PE 0602601A. ***FY 2015 Accomplishments:*** Fabricated, installed and tested an external suspension system for a 60-70 ton combat application to evaluate system durability and reliability as well as vehicle performance characteristics; molded high capacity, lightweight track compounds for heavy (60-70 ton) combat vehicle systems and performed vehicle testing to demonstrate the durability and rolling resistance reductions of these compounds; modeled suspension control architectures for system control of vehicle dynamics, ride and handling. ***FY 2016 Plans:*** Improve elastomer materials and road wheels to demonstrate improved combat vehicle track system durability. Continue fabrication, integration and optimization of external suspension unit system for 60-70 ton combat vehicle application. Mature suspension control architectures for system control of vehicle dynamics, ride height and handling. Characterize combat vehicle external suspension unit functionality, durability and system performance relative to performance metrics. Execute track and suspension maturation efforts in support of the Combat Vehicle Prototyping program. ***FY 2017 Plans:*** Will integrate improved elastomer components and lessons learned from previous track system evaluations to create an advanced track system design for a medium combat vehicle application that reduces system weight while increasing durability. Will design and build an external suspension unit based on results of previous system characterizations to increase durability, provide ride height control and improve ride quality performance for medium combat vehicles. Will begin the integration of advanced track and	2.672	5.004	4.576

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
suspension for a medium combat vehicle running gear solution to provide superior off-road performance at a reduced weight and improved durability to currently fielded solutions			
Title: Combat Vehicle Subsystem Demonstrations	13.671	15.031	5.200
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, and 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 Accomplishments: Matured, integrated and evaluated 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. Analyzed the influence of emerging ground vehicle subsystem technologies on future integrated combat vehicle designs and concepts. Conducted modeling, analysis and trade studies for next-generation ground vehicle subsystems. Assessed developmental and existing critical technology areas such as mobility, survivability and vehicle structures for optimal platform configuration. Conducted laboratory assessment of multiple vehicle powertrain subsystems and configurations such as engines and transmissions including both conventional and hybrid powertrain approaches.			
FY 2016 Plans: 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. Optimize engine fuel efficiency and increase commonality of engine components to reduce engine logistical and life cycle costs. Develop novel future combat vehicle concepts for the Combat Vehicle Prototyping (CVP) program leveraging leap-ahead technologies and technology concepts. 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.			
FY 2017 Plans: Will continue to mature novel future combat vehicle concepts leveraging advanced technologies and technology concepts to include requirements excursions to mature innovative combat vehicle design approaches. Will continue to conduct capability			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
analyses and trade studies on the integration of vehicle mobility and occupant protection technologies into combat vehicle concepts, in order to evaluate and optimize concept platform configurations.			
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 2015 Accomplishments:*** Optimized 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; leveraged power brick battery design and testing to create concepts for modular, standardized new high energy, high voltage advanced batteries for mobility applications; and generated common performance specifications for power brick and standardized high voltage battery systems. ***FY 2016 Plans:*** Mature standardize low voltage battery systems to improve fuel efficiency and support vehicle lightweighting. Mature control electronics and battery management system for advanced, standardized, military specific batteries to improve durability and reliability. Optimize advanced, standardized, military specific battery system for increased energy density and reliability. ***FY 2017 Plans:*** Will leverage the cell-level durability and performance testing in PE 0602601A to mature the advanced Lithium-ion battery system-level design to meet military vehicle form factor (6T) in order to improve energy storage capacity while reducing battery system weight on platforms. Will leverage ongoing battery cell level development to begin battery module (system-level) integration and evaluation focusing on interconnects, packaging design and control strategies.	3.627	2.926	3.050
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	4.632

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Demonstrated a second generation power brick and mission module based electromagnetic armor module. Demonstrated multi-hit defeat with fast re-charge time capabilities in a lab environment with an electrical surrogate load. Conducted 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:*** 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%. Demonstrate and validate pulse power system and electromagnetic armor module in relevant environments. Begin integrated demonstration of pulse power and electromagnetic armor systems, including durability and environmental testing, Validate ballistic performance of the integrated pulse power and electro-magnetic armor system. ***FY 2017 Plans:*** Will complete testing of the integrated pulse power and electromagnetic armor system. Will complete durability and environmental evaluations of the integrated system to demonstrate overall performance in relevant environments. Will complete verification of the ballistic performance of the system. Will complete electromagnetic interference testing to evaluate the ability of the system to operate with other vehicle equipment. Will conduct testing of the pulse power recharge capability and ballistic multi-hit performance of the system.			
Title: Non-Primary Power Systems: ***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 2015 Accomplishments:*** Demonstrated a JP-8 fueled small power system integrated onto an unmanned ground system. Integrated and demonstrated acoustic improvements of high power rotary engines for APU use. Performed testing on high power small engines for rotary APU use. Demonstrated the improvements of an integrated APU and Battery system to meet engine off power needs, such as power	2.646	3.096	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
demands for silent watch, vehicle starting and communications and surveillance equipment. Integrated a fuel cell power system onto a mobile platform to demonstrate silent mobility. ***FY 2016 Plans:*** 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. 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 Technologies: ***Description:*** This effort matures 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 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. This effort is executed in coordination with PE 0604115A. ***FY 2015 Accomplishments:*** Matured and modeled 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:*** Mature combat vehicle mechanical automatic transmission design and increase transmission efficiency by targeting the optimal efficiency through all vehicle operating ranges. Optimize powertrain system mobility and steering performance by delivering increased engine power to the vehicle track system while reducing heat rejection. Validate model of advanced powertrain system. Mature transmission quality, reliability and durability to reduce lifecycle costs. ***FY 2017 Plans:*** Will conclude single-cylinder engine component optimization of a unique high power density, low heat rejection, fuel efficient opposed piston engine that will dramatically improve the power density and reduce fuel consumption for combat vehicles. Will begin maturation of multi-cylinder engine components by exploiting the single-cylinder engine component optimization. Will mature advanced engine control strategies to optimize fuel efficiency and enable precise control of the new combat engine. Will fabricate proof of concept hardware and conduct component level testing of a combat vehicle mechanical automatic transmission that will increase propulsion system efficiency by targeting the optimal efficiency through all vehicle operating ranges. Will mature the	5.607	5.000	12.808

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
control strategy for the combat vehicle transmission that will optimize the gearing ratios for desired torque parameters and ensure transmission ride quality, reliability and durability to reduce powertrain lifecycle costs.			
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 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 2015 Accomplishments:*** Conducted demonstrations of waste water treatment and recycling technologies in a field environment. Demonstrated expanded in-line water quality and process monitoring capability to address pathogens and toxins such as giardia, cryptosporidium, and pesticides. Characterized selected alternative fuels and fuel additives to improve performance and diversify energy sources; evaluated candidate long life coolants designed to reduce the overall logistics burden and meet emerging requirements of military ground systems; and evaluated fluid distribution composite hose technologies to improve logistical burdens of deploying fuel and water pipeline systems. ***FY 2016 Plans:*** Perform modeling and analysis of waste water treatment and recycling technologies to assess the scalability of technologies and optimize system designs. Evaluate and qualify synthetic fuels made from non-petroleum sources against performance requirements for use in military ground systems. Mature and demonstrate fuel sensor technologies and a portable fuel analyzer for contaminate detection. 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. ***FY 2017 Plans:*** Will demonstrate optimized waste water treatment and recycling technologies to support sustainability logistics basing. Will continue to validate physical property characteristics and demonstrate performance of select synthetic fuel blends made from non-petroleum sources to determine suitability for military ground systems. Will assess performance of gear oils used in limited slip differentials and transfer cases, and will mature and demonstrate hydraulic fluid formulations to increase vehicle fuel efficiency and reduce maintenance burden.	4.680	4.100	4.100
Accomplishments/Planned Programs Subtotals	40.681	43.381	39.067

C. Other Program Funding Summary ($ in Millions)

N/A

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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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
497: *Combat Vehicle Electro*	-	6.926	6.660	7.118	-	7.118	7.153	7.202	7.345	7.492	-	-

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 the Vehicle Integration for C4ISR/EW Interoperability (VICTORY), 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 autonomy architectures that enable the ease of integration of autonomous subsystem technologies into future and existing tactical and combat vehicle architectures. 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 Science and Technology 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 2015	FY 2016	FY 2017
Title: Vehicle Electronics Integration Technologies:	3.503	4.508	3.532
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 SWaP concerns for vehicle electronics. This effort is coordinated with efforts in Program Element (PE) 0602601A.			
FY 2015 Accomplishments: Further matured and began implementation of next generation military ground vehicle electronics and electrical power open architectures; conducted market/trade analysis and integrated applicable high and low voltage vehicle power components,			

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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 2015	FY 2016	FY 2017
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:*** Mature and demonstrate vehicle electronics architecture to facilitate rapid integration of card-based communication equipment into combat and tactical systems. Continue all maturation and integration activities of the next generation power and data architecture and corresponding system design in a System Integration Laboratory (SiL). Verify and validate the next generation power and data architecture through testing traced to power, network and SIL designs and requirements. 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. Exploit the existing VICTORY data architecture to demonstrate future combat vehicle functions and components. ***FY 2017 Plans:*** Will provide an integrated vehicle electronics architectural depiction of the Vehicle Electronics & Architecture (VEA) Mobile Demonstrator that incorporates the use of open power, data, and network interface standards. Will exploit the VEA Research System Integration Laboratory (SIL) technology demonstration findings to optimize performance specifications for open power, data, and network interface requirements, standards, and architectural design patterns for future tactical and combat vehicles. Will continue to exploit VICTORY (Vehicular Integration for C4ISR/EW Interoperability) data architecture to mature data interface standards for future combat vehicle functions and components. Will provide one-wire architectural depictions, vehicle security engineering improvements, and power design concepts for Radio Frequency (RF) Convergence SIL demonstrator to improve C4ISR modularity, maintainability, and mission pack configurability.			
Title: Vehicle Electronics Architecture and Standards: ***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. 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 0603005A. ***FY 2015 Accomplishments:*** Completed 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. Matured and demonstrated current VICTORY	3.423	2.152	2.174

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
interfaces (1.6 vs. 1.7) to support next generation open vehicle architectures in preparation for a data and computing architecture demonstration in Fiscal Year (FY) 2016. ***FY 2016 Plans:*** Continue to mature and validate the VICTORY specification through demonstration in the VICTORY SIL. 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. 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. ***FY 2017 Plans:*** Will continue to optimize the VICTORY specification by exploiting VICTORY SIL technology demonstration results for application in vehicle system level demonstration that matures and demonstrates implementations of electronic, data, and power standards that enable better interoperability and fault tolerance technology. Will continue to mature and demonstrate integration of Modular Active Protection System (MAPS) using standard interfaces to improve MAPS interoperability with the other vehicle electronic subsystems.			
Title: Autonomous Vehicle Architecture: ***Description:*** This project matures, integrates and demonstrates an improved, optimized autonomy-enabled distribution architecture that eases integration of new and emerging technologies across the full spectrum of operational and tactical supply movement operations. This project addresses systems integration challenges by providing the appropriate fault tolerant architecture design artifacts that will allow ease of integration for autonomy enablement kits, autonomy enablement software, and end-to-end sustainment and tactical ground resupply capability through use of open systems interfaces. This effort is coordinated with efforts in PEs 0602120A, and 0602601A. ***FY 2017 Plans:*** Will exploit and optimize the Autonomous Mobility Applique System (AMAS) fault-tolerant architecture to gain better understanding of system of system impacts and system level requirements for an end-to-end autonomous vehicle architecture design implementation. Will provide and refine a reference autonomous vehicle architecture, and initial integration & demonstration of behavior algorithm software modules within the end-to-end autonomous vehicle architecture.	-	-	1.412
Accomplishments/Planned Programs Subtotals	6.926	6.660	7.118

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
515: *Robotic Ground Systems*	-	6.805	7.554	12.678	-	12.678	16.493	16.493	16.767	17.280	-	-

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 Science and Technology 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 2015	FY 2016	FY 2017
Title: Unmanned Ground Systems Technology:	6.805	7.554	12.678
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 Program Elements (PEs) 0602120A, 0602601A, 0602784A, 0603001A, and 0603734A			
FY 2015 Accomplishments: Matured and integrated autonomy-enabling technologies to include: drive-by-wire systems, vehicle active safety technologies, mission packages, and related software, algorithms and control interfaces. Validated emerging safety methodologies and tactics, techniques and procedures. Matured and integrated higher level intelligent behaviors to increase Soldier safety,			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
operational efficiency, effectiveness, and manned/unmanned teaming. Further integrated 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:*** Mature, integrate and demonstrate advanced scalable autonomous technologies onto tactical vehicles to automate driving tasks and reduce logistics support requirements. 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. Mature and demonstrate platform autonomy in increasingly complex environments and mission applications ranging from urban terrain to cross country maneuvers. ***FY 2017 Plans:*** Will continue to mature and integrate state-of-the-art autonomous technologies such as Light Detection and Ranging (LIDAR), Global Positioning System (GPS), and cameras into advanced autonomy-enabled tactical vehicles and material handling equipment (MHE) to demonstrate the reduction of the logistics support and manpower requirements. Will mature and verify scalable autonomous software and behavior algorithms agnostic of the platform and autonomous vehicle loading/unloading operations to improve the effectiveness of unit resupply and sustainment operations. Will mature and demonstrate modeling & simulation (M&S) tools to support the design, development, testing, and evaluation of autonomous vehicles in tactical terrain and weather conditions. Will demonstrate hardware-in-the-loop / software–in-the-loop integrations of physics-based simulations of initial development increment of autonomous vehicle technologies. Will mature and demonstrate initial increment prototype hardware and software capability.			
Accomplishments/Planned Programs Subtotals	6.805	7.554	12.678

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
533: *Ground Vehicle Demonstrations*	-	17.500	22.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	17.500	22.500
FY 2015 Accomplishments: Continued to mature transparent armor with improved resistance to delamination from heating elements and thermal loading. Developed advanced membrane technologies to support gray water treatment and reverse osmosis pretreatment. Demonstrated integrated Warfighter's needs discovered during the Autonomous Mobility Applique' System (AMAS) Joint Capabilities Technology Demonstration (JCTD) Operational Evaluation. Developed conceptual and detailed designs for modular chassis connection methods. Designed and integrated a tablet-based system with enhanced situational awareness and a collaborate planning capability into two vehicle platforms, and conducted a demonstration of the ability of the platforms to enable a nine-man squad to operate in two separate vehicles with no loss of tempo. Developed and optimized the methodology to support the modification of the North Atlantic Treaty Organization Reference Mobility Model to be used for unmanned vehicles. Optimized a vehicle paint layering system to maximize corrosion resistance, chip and abrasion resistance, and durability while improving environmental and emissions compliance. Developed an improved vehicle coating formulation to provide a chemical agent resistant coating system with increased flexibility and improved adhesion.		
FY 2016 Plans: Program increase		
Congressional Adds Subtotals	17.500	22.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
53D: *NAC Demonstration Initiatives (CA)*	-	20.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Alternative Energy Research	20.000	-
FY 2015 Accomplishments: Developed a high efficiency 30 kiloWatt import/export power inverter that is small and lighter than currently existing inverters. Developed an integrated automotive fuel cell and hydrogen storage system onto an existing military ground vehicle to demonstrate long range silent operation as well as power available at a Forward Operating Base. Developed a roll-up/roll-away vehicle based alternating current power system to demonstrate the capability to assemble a vehicle based power supply for austere contingency bases. Matured a common military electronic controller to ensure it meets military environmental requirements. Developed and integrated a multi-fuel engine controller on a commercial engine to demonstrate automotive performance gains in fuel consumption and consistency in engine torque. Developed an electrically driven compressor module to run off 28Volts of direct current, providing on demand variable speed to increase efficiency over current engine driven compressors. Improved the autonomous convoy modeling, simulation, and analysis capability, and the ability to assess the impact of autonomy on operational energy.		
Congressional Adds Subtotals	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 2017 Army											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	6.664	5.554	3.904	-	3.904	14.026	20.164	23.262	27.367	-	-
592: *Space Application Tech*	-	6.664	5.554	3.904	-	3.904	14.026	20.164	23.262	27.367	-	-

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, Department of Defense (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 United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL.

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	6.880	5.554	3.904	-	3.904
Current President's Budget	6.664	5.554	3.904	-	3.904
Total Adjustments	-0.216	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.216	-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
592: *Space Application Tech*	-	6.664	5.554	3.904	-	3.904	14.026	20.164	23.262	27.367	-	-

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 lightweight 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, Department of Defense (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 Project is performed by the United States 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 2015	FY 2016	FY 2017
Title: Payload Technology Development	6.664	5.554	3.904
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) and the Army Cyber Center of Excellence.			
FY 2015 Accomplishments: Conducted low cost launch vehicle engine and rocket stage performance validation; demonstrated suborbital launch, to include rocket and supporting range equipment; validated functionality of space-based mission command for imaging spacecraft architecture, affordable launch technical control, and affordable launch fire control.			
FY 2016 Plans: 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 onboard payloads; and mature Software Defined Radio (SDR) and imagery payloads based on lessons learned from earlier on-orbit demonstrations.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will mature small satellite components and integrate into a system-level demonstrator to support the Army's Warfighter Information Network – Tactical (WIN-T); continue to demonstrate small satellite payload performance through analysis and Hardware In The Loop assessments; mature architecture and software to support processing of tag, track, and locate payloads.			
Accomplishments/Planned Programs Subtotals	6.664	5.554	3.904

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603007A *I Manpower, Personnel and Training Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.677	12.636	14.417	-	14.417	14.695	15.123	15.422	15.730	-	-
792: *Personnel Performance & Training*	-	11.677	12.636	14.417	-	14.417	14.695	15.123	15.422	15.730	-	-

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 PE support the Army Science and Technology Soldier portfolio.

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

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	13.574	12.636	14.417	-	14.417
Current President's Budget	11.677	12.636	14.417	-	14.417
Total Adjustments	-1.897	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.500	-			
• SBIR/STTR Transfer	-0.397	-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
792: *Personnel Performance & Training*	-	11.677	12.636	14.417	-	14.417	14.695	15.123	15.422	15.730	-	-

A. Mission Description and Budget Item Justification

This Project 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 Project 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 Project 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 Project support the Army Science and Technology Soldier portfolio.

Work in this Project complements and is fully coordinated with and Program Element (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 Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Personnel Assessment	4.653	5.348	6.000
Description: This effort 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 2015 Accomplishments: Validated 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; identified strategies for conducting classification analyses. Initiated			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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:*** Continuing 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; conducting classification analyses to aid person-job match. ***FY 2017 Plans:*** Will validate expanded enlisted screens and non-cognitive assessments as predictors for success in military occupational specialties (MOS) and in-service assignments (e.g., Recruiters, Instructors). This research is on-going validation of non-cognitive assessments for valued Army outcomes (e.g., attrition, performance) across a Soldier's first term of enlistment.			
Title: Personnel Readiness, Performance, and Conduct ***Description:*** This effort 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 2015 Accomplishments:*** Initiated research to prevent sexual harassment and assault through more effective training and mentoring methods. Initiated research on valid measures of command climates of dignity, respect, and inclusion. Validated Army instructor methods and techniques to improve instructor skills. ***FY 2016 Plans:*** Developing measures of conduct and performance as indicators of unit climate of dignity, respect, and inclusion; designing and developing measures of collective performance; developing methods and measures to identify and develop high quality Army instructors; developing training methods that allow Soldiers to better use and control highly automated training systems. ***FY 2017 Plans:*** Will mature research to develop training and leader development methods to develop unit climate of dignity, respect, and inclusion and unit resilience (e.g., prepare Leaders to assess, enhance, and sustain individual and unit resilience); will mature research to develop measures and strategies to optimize small unit performance and individual training performance (e.g., how best to obtain optimal performance while using highly automated training systems).	7.024	7.288	8.417
Accomplishments/Planned Programs Subtotals	11.677	12.636	14.417

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603008A *I Electronic Warfare Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	43.416	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
TR1: *TAC C4 Technology Int*	-	28.801	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
TR2: *Secure Tactical Information Integration*	-	14.615	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Efforts in this Program Element (PE) were transferred to PE 0603794A beginning in Fiscal Year (FY) 2016 for the purposes of correctly identifying the efforts as Command, Control and Communications Advanced Technology. Project TR1 efforts were transferred to PE 0603794A Project EL4 and Project TR2 efforts were transferred to PE 0603794A Project EL5.

A. Mission Description and Budget Item Justification

This 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 complementary 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 2017 Army					Date: February 2016
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	44.851	0.000	0.000	-	0.000
Current President's Budget	43.416	0.000	0.000	-	0.000
Total Adjustments	-1.435	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.435	-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
TR1: *TAC C4 Technology Int*	-	28.801	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Efforts in this Project were transferred to Program Element (PE) 0603794A Project EL4 beginning in Fiscal Year (FY) 2016.

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 2015	FY 2016	FY 2017
Title: Antenna and Hardware Technologies	1.771	-	-
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 complements this effort. This effort transitioned to PE 0603794A Project EL4 in FY16.			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Designed, fabricated and evaluated 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; developed 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 complements this effort. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2015 Accomplishments:*** Matured 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; demonstrated, in a lab environment, a subset of communication systems components in an integrated package using the matured specification and API; investigated 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 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 2015 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; conducted 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; performed risk mitigation and TRL assessment of Army S&T programs and best of industry efforts maturing in the FY15 timeframe; supported the associated programmed increments of Warfighter Information Network-Tactical (WIN-T) and Nett Warrior Programs of Record.	8.578	-	-
Title: Communication Networking Technologies	7.962	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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 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/Project TR2 complements this effort. This effort transitioned to PE 0603794A Project EL4 in FY16. ***FY 2015 Accomplishments:*** Completed 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, demonstrated SATCOM spectrum monitoring and control, and integrated RF signal modulation techniques to enable improved SATCOM performance against jamming; completed implementation of signals management module software; completed modifications to Soldier Radio Waveform (SRW) and radio operating environment to support frequency hopping at timeslot boundaries using parameters chosen by the software; integrated, tested, and demonstrated 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 2015 Accomplishments:*** Completed integration of decision software tools and processes for configuring tactical network components with existing network monitoring tools and demonstrated the capability to visualize the function and health of the multi-tiered network; demonstrated reduced cycle times to automatically generate network configurations and anomaly corrections.	2.692	-	-
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.	4.798	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Conducted evaluation of multiple WPAN design solutions for performance, reliability and security; developed specification and architecture of WPAN hardware interfaces and software; established studies for WPAN standards for security and interface development; performed lab, RF chamber, and field electromagnetic compatibility, low probability of intercept and low probability of detection validation; conducted field evaluations of selected design(s) on multiple Soldier Systems.			
Accomplishments/Planned Programs Subtotals	28.801	-	-

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
TR2: *Secure Tactical Information Integration*	-	14.615	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Efforts in this Project were transferred to Program Element (PE) 0603794A Project EL5 beginning in Fiscal Year (FY) 2016.

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 2015	FY 2016	FY 2017
Title: Tactical Defensive Cyber (formerly named Information Assurance)	14.615	-	-
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 0602782A/H92, 0602783A/Y10 and 0603008A/TR1 complement this effort. This effort transitioned to PE 0603794A Project EL5 in FY16.			
FY 2015 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Matured and coded software algorithms to differentiate between stealthy attacks and software coding errors to reduce the vulnerability in software applications; demonstrated dynamic moving target defense internet protocol (IP) and port network hopping techniques; demonstrated software to dynamically modify operating systems and applications to make it more difficult for an adversary to exploit Army networks; demonstrated moving target defense capability management software tools; demonstrated integration of IP and port hopping with existing protection capabilities; encoded and demonstrated user behavior and operating system anomaly sensors, and anomaly based learning algorithms to provide protection against zero day malware; demonstrated ability to leverage tactical systems to augment local cyber situational awareness; demonstrated dissemination and correlation of offensive and defensive cyber data within the intelligence enterprise to enable tactical defensive cyber operations; investigated 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; matured, fabricated and demonstrated an anti-tamper key loader for devices that use subscriber identity modules and smart cards; designed and instantiated security architectures for multi-functional waveforms and converged communications and electronic warfare transceivers.			
Accomplishments/Planned Programs Subtotals	14.615	-	-

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 2017 Army											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	7.492	7.502	8.074	-	8.074	8.650	8.686	8.858	9.035	-	-
B18: *DB18*	-	7.492	7.502	8.074	-	8.074	8.650	8.686	8.858	9.035	-	-

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	7.492	7.502	8.074	-	8.074
Current President's Budget	7.492	7.502	8.074	-	8.074
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603015A *I Next Generation Training & Simulation Systems*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	16.103	17.425	18.969	-	18.969	19.053	22.177	22.595	23.022	-	-
S28: *Immersive Learning Environments*	-	2.632	3.121	3.254	-	3.254	3.100	4.153	4.236	4.321	-	-
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.543	9.213	6.172	-	6.172	6.274	7.302	7.463	7.627	-	-
S31: *Modeling And Simulation Infrastructure Technology*	-	4.928	5.091	9.543	-	9.543	9.679	10.722	10.896	11.074	-	-

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 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 2017 Army					Date: February 2016
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	16.740	17.425	17.719	-	17.719
Current President's Budget	16.103	17.425	18.969	-	18.969
Total Adjustments	-0.637	0.000	1.250	-	1.250
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.637	-			
• Adjustments to Budget Years	-	-	1.250	-	1.250

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
S28: *Immersive Learning Environments*	-	2.632	3.121	3.254	-	3.254	3.100	4.153	4.236	4.321	-	-

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 Project support the Army science and technology Soldier/Squad 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 Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Immersive Techniques for Training Applications	2.632	3.121	3.254
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 2015 Accomplishments: Investigated visual perception technologies and effects and used findings to incorporate more natural human perception/ performance in virtual training environments; and demonstrated how technologies that capture the essence of high performing instructors can be used to improve virtual classroom instruction.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Mature collaborative virtual environments through the incorporation of live objects to enhance user's immersion experience and improve user's performance; and 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. ***FY 2017 Plans:*** Will demonstrate methodologies for extending multi-user redirected walking to support four or more simultaneous users; expand the advancement of new techniques and platforms for capturing real world data, including three-dimensional geometry, imagery, environmental sensor readings, and data from social networks, as applied to generating narrative systems for training; advance new approaches for creating rich, mixed reality environments by effectively combining virtual world and real world elements; determine how near-term mixed reality environment capabilities can inform future Army requirements related to immersive training; and integrate emerging commercial off the shelf (COTS) technologies with advanced research capabilities to lower the cost and increase the quality of realistic and effective virtual humans.			
Accomplishments/Planned Programs Subtotals	2.632	3.121	3.254

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.543	9.213	6.172	-	6.172	6.274	7.302	7.463	7.627	-	-

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 Project support the Army science and technology Soldier/Squad 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 Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Embedded Techniques	7.543	8.013	4.872
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 2015 Accomplishments: Matured component design of algorithms for course of action embedded training on current and future command and control systems; matured 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 validated component			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
technology maturity in relevant simulation environments. This effort develops virtual, mixed and augmented technologies for dismounted Soldier training. ***FY 2016 Plans:*** Complete Fiscal Year (FY) 2015 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; and mature, demonstrate and assess effectiveness of augmented reality training systems for dismounted Soldier training. ***FY 2017 Plans:*** Will mature virtual, mixed and augmented reality components. Components include, but are not limited to, sensors, communication devices, software algorithms, and vision systems, like helmet mounted displays. Matured components will be integrated to demonstrate the state of the art in augmented reality training systems for dismounted Soldiers.			
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 Accomplishments:*** Identified 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:*** 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. ***FY 2017 Plans:*** Will mature validated measurement techniques for assessing training effectiveness in simulated and live environments; conduct demonstrations with augmented reality training simulations for individual training applications, and identify gaps in measurement technologies.	1.000	1.200	1.300
Accomplishments/Planned Programs Subtotals	8.543	9.213	6.172

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
S31: *Modeling And Simulation Infrastructure Technology*	-	4.928	5.091	9.543	-	9.543	9.679	10.722	10.896	11.074	-	-

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 the Department of Defense (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 Project support the Army science and technology Soldier/Squad 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 Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Advanced Distributed Simulation Environments	4.928	5.091	7.543
Description: This effort matures and demonstrates M&S technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and SoS architecture, technology tradeoffs, etc. This research transitions to the U.S Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).			
FY 2015 Accomplishments: Matured and demonstrated SoS simulation architecture technologies for integrating Army and DoD simulation and training programs; demonstrated 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; matured and demonstrated M&S as a cloud-based service that supports training and mission rehearsal simulations across geographically distributed areas; advanced and refined simulation and training technologies in			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
support of the Army next generation training initiatives; and matured and transitioned M&S hardware and software solutions targeted towards PEO STRI simulation needs. ***FY 2016 Plans:*** 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; and demonstrate potential of current training simulation technologies for use in areas such as cyber training in support of PEO STRI simulation technology gaps. ***FY 2017 Plans:*** Will mature and demonstrate future simulation architecture in support of the convergence of virtual, constructive, and gaming technologies into a single synthetic environment; refine and demonstrate authoring tools that support a variety of user types ranging from simulation expert to exercise developer to the “player”; demonstrate computational and performance capabilities that are required to represent a synthetic force at various levels in real time; and refine data distribution methodologies in support of use of simulation in traditional, hybrid cloud and cloud computing environments.			
Title: Early Human Systems Integration Demonstrations ***Description:*** This effort will mature and demonstrate state of the art methods, tools and techniques to integrate human systems integration (HSI) early in the science and technology (S&T) and requirements analysis process to ensure effective and efficient design and development of future Soldier systems. The goal of this effort is to demonstrate the effect early HSI can have on developing the most effective, efficient, and affordable design and on predicting and improving total system performance. This effort is coordinated with the U.S. Army Human Systems Integration Directorate, G1. ***FY 2017 Plans:*** Will identify gaps in available assessment tools and develop methodologies required to support HSI in the early concept development phases of Joint Capabilities Integration and Development System (JCIDS) process; and conduct initial HSI assessment(s) to determine how developed methodologies influence requirements development and early system design.	-	-	2.000
Accomplishments/Planned Programs Subtotals	4.928	5.091	9.543

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	-	14.483	11.912	11.910	-	11.910	11.911	11.930	12.167	12.410	-	-
B84: *DB84*	-	2.540	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
DB1: *DDB1*	-	11.943	11.912	11.910	-	11.910	11.911	11.930	12.167	12.410	-	-

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	14.483	11.912	11.910	-	11.910
Current President's Budget	14.483	11.912	11.910	-	11.910
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
B84: *DB84*	-	2.540	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
DB1: *DDB1*	-	11.943	11.912	11.910	-	11.910	11.911	11.930	12.167	12.410	-	-

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603125A *I Combating Terrorism - Technology Development*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	23.334	33.520	27.686	-	27.686	24.906	25.199	25.701	26.215	-	-
DF5: *Agile Integration & Demonstration*	-	23.334	27.520	27.686	-	27.686	24.906	25.199	25.701	26.215	-	-
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	0.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE)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; and field demonstrations and red-teaming to stress and assess emerging systems in key areas for gaining or maintaining overmatch earlier in the life-cycle, thus improving systems by reducing vulnerabilities and providing a more holistic understanding of employment risks in operationally-representative environments and against potential threats.

This PE supports the Command, Control, Communications and Intelligence (C3I), Ground, Lethality, and Soldier/Squad Portfolios.

Work in this PE 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), 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603270A (Electronic Warfare Technology), and PE 0603710A (Night Vision 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 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 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A *I Combating Terrorism - Technology Development*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	24.257	27.520	27.686	-	27.686
Current President's Budget	23.334	33.520	27.686	-	27.686
Total Adjustments	-0.923	6.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	6.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.923	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: DW4: *Energy Technologies (Congressional Adds (CAs))*		
Congressional Add: *Force Protection Radar Development*	-	6.000
Congressional Add Subtotals for Project: DW4	-	6.000
Congressional Add Totals for all Projects	-	6.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
DF5: *Agile Integration & Demonstration*	-	23.334	27.520	27.686	-	27.686	24.906	25.199	25.701	26.215	-	-

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 (DOE)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; and red-teaming to stress and assess emerging systems in key areas for gaining or maintaining overmatch earlier in the life-cycle, thus improving systems by reducing vulnerabilities and 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, Lethality, and Soldier/Squad Portfolios.

Work in this project is complementary to and is fully coordinated with Program Element (PE) 0602105A (Materials Technology), PE 0602270A (Electronic Warfare Technology), PE 0602303A (Missile Technology), PE 0602618A (Ballistics Technology), PE 0602705A (Electronics and Electronic Devices), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603270A (Electronic Warfare Technology), and PE 0603710A (Night Vision 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 2015	FY 2016	FY 2017
Title: Rapidly Deployable Technologies	5.060	5.060	-
Description: This effort conducts live, virtual, and hybrid scenario-based experiments to stress and assess emerging technology systems that are targeted to support expeditionary units, improving technology design, development, and ultimate employment. These technologies must be readily transportable; require minimal set up, take down, and operational effort; and must be easily adaptable across a variety of missions, environments, and threats. This effort is coordinated with PE 0602618A (Ballistics Technology)/Project H80 (Survivability and Lethality Technology).			
FY 2015 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Increased focus on active defense measures for small expeditionary units based on critical threats associated with one or two high-priority operational environments, including coastal and urban terrains; developed and integrated critical measures of success into the Warfighter Technology Tradespace Methodology to include assessing systems' means to adapt, as well as new measures specific select new theaters; expanded quantitative protocols for field-based experiments; implemented narrative-based modeling and assessment tool for Warfighter feedback on technologies to expose and eliminate barriers affecting technology acceptance and use; conducted a series of experiments using live and virtual scenarios and coordinated demonstrations to identify, expose, and mitigate system vulnerabilities; leveraged ongoing activities with units such as Special Operations Teams in CENTCOM Area of Responsibility to conduct in-country assessments and garner feedback on performance of high-priority systems. ***FY 2016 Plans:*** Incorporate Army G-2 and Army Training and Doctine Command (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. Integrate Pacific Command (PACOM), Africa Command (AFRICOM), Southern Command (SOUTHCOM) and/or the Central Command (CENTCOM)-based scenarios into experiments and target specific environments of interest (e.g., wooded, marine, urban, contested and congested radio frequency (RF)). 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. Expand and refine quantitative measures of success for the Warfighter Technology Tradespace Methodology, and assess systems' performance across technical, user, supportability, and adaptability factors. 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 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 PE 0602618A (Ballistics Technology)/Project H80 (Survivability and Lethality Technology).	8.198	12.298	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Utilized stakeholder analysis, operational scenarios and findings from technology vulnerability assessments to identify high-priority developmental systems that support Army acquisition programs within areas such as intelligence, surveillance, and reconnaissance (ISR), electronic warfare, and/or communications. Conducted in-depth, phased assessments that incorporated 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. Recommended means to harden systems against vulnerabilities and reduce risks arising from operational and logistics contexts. ***FY 2016 Plans:*** 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. Design and conduct a series of in-depth, phased assessments that incorporate near-peer threats and field experiments with experienced Warfighters; 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. 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	5.000	5.000	5.000
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, improvised explosive device (IED) detect and defeat technologies, advanced situational awareness and future network integration technologies. This effort is coordinated with PE 0603005A. ***FY 2015 Accomplishments:*** Conducted analysis of vehicle architecture and power systems. Evaluated Government and contractor developed platform architectures and conducted trades studies, analysis and interface testing to ensure common power architecture designs meet known future vehicle power requirements. Updated VICTORY architecture standards to drive next generation combat platform data and electrical architectures to enable affordable future upgrade capability for the combat fleet. Investigated advanced			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
capability in integrated platform power management and electrical power generation and distribution while reducing parasitic thermal burdens on the vehicle system. ***FY 2016 Plans:*** Analyze the next generation power and data architecture and the corresponding system design's interface with vehicle subsystems, specifically powertrain subsystems. Demonstrate electronic control communication between powertrain system components. Mature the engine controls architecture to optimize engine power density, fuel efficiency and heat rejection. 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. ***FY 2017 Plans:*** Will model and develop a powertrain controls architecture and algorithm to improve powertrain efficiencies and minimize parasitic losses. Will mature and demonstrate the feasibility of realizing a high voltage power electronics architecture to save Size, Weight, and Power (SWaP) and enhance interoperability among system of systems architecture. Will optimize thermal properties of power components leveraging the Vehicle Electronics & Architecture (VEA) Mobile Demonstrator (VMD) effort in coordination with PE 0603005A. Will continue to optimize the performance specification requirements for the next generation power architecture as it applies to combat vehicles and future tactical 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 DOE 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 PE 0602601A. ***FY 2015 Accomplishments:*** Supported 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; conducted 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 demonstrated advanced manufacturing techniques to reduce platform structural weight and drive down associated costs; and leveraged significant investments in commercial trucking industry to demonstrate fuel efficient and active safety technologies for Army tactical vehicles. ***FY 2016 Plans:***	5.076	5.162	5.249

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Complete demonstration of lightweight structures and materials using advanced manufacturing techniques. Develop advanced lubricants to help mitigate frictional losses in powertrain to increase vehicle efficiency. Develop the capability to model advanced chemistry batteries and batteries in extreme temperature conditions. Investigate autonomy-enabled technologies and vehicle electrification to leverage common military and industry investments. ***FY 2017 Plans:*** Will continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Will provide the capability to model and simulate advanced chemistry batteries and batteries in extreme temperature conditions to improve characterizing battery life cycle estimations. Will mature, and demonstrate friction and wear reduction technologies to increase powertrain and vehicle efficiencies. Will provide tire efficiency optimization to improve vehicle fuel efficiency. Will exploit autonomy-enabled technologies and vehicle electrification to leverage dual use technology maturation.Will continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Will provide the capability to model and simulate advanced chemistry batteries and batteries in extreme temperature conditions to improve characterizing battery life cycle estimations. Will mature, and demonstrate friction and wear reduction technologies to increase powertrain and vehicle efficiencies. Will provide tire efficiency optimization to improve vehicle fuel efficiency. Will exploit autonomy-enabled technologies and vehicle electrification to leverage dual use technology maturation.			
Title: Red Teaming Field Demonstration ***Description:*** This effort conducts field demonstrations of emerging technologies using realistic environments, scenarios, warfighters, and adaptive adversaries to uncover potential vulnerabilities in systems and identify fixes and improvements earlier in the development cycle. Demonstrated technologies include candidates being developed by the Science and Technology Enterprise as well as those by other Services/Agencies, Academia, and Industry. Some technologies undergoing System Intensive Analysis may be selected to undergo field demonstrations as well. (This effort builds upon the work previously completed in Rapidly Deployable Technologies and Technology Systems Adaptive Red Teaming.) ***FY 2017 Plans:*** Will conduct a series of live/virtual/hybrid, multi-day, operationally relevant field demonstrations shaped by threat-informed challenges and areas of overmatch concern (e.g., unmanned aerial systems, jamming environments); stress the performance limits of selected emerging systems integrated into increasingly complex scenarios and provide feedback to developers through structured Red, Blue, and White Cell assessments that provide options to reduce or mitigate vulnerabilities; potential technical areas of interest include human performance, advanced weapons, autonomous systems, and electronic warfare.	-	-	8.718
Title: Red Teaming Systems Intensive Analysis	-	-	5.107

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort conducts detailed analysis (from concepts to employment to interoperability) for selected technologies with planned or recent transitions to high-priority emerging programs of record associated with contested and congested environments. The intent is to identify and mitigate any identified vulnerabilities as early as possible. Some technologies may be selected to undergo Red Teaming Field Demonstrations to further understand vulnerabilities. ***FY 2017 Plans:*** Will conduct intensive analysis for several key emerging systems and concepts based on intelligence, requirements, acquisition, and science and technology community stakeholder input for individual, intensive assessment and feedback to uncover vulnerabilities and potential risks pertaining to systems integration, interoperability, adaptability, user technology acceptance, and performance in contested environments; potential technical areas of interest include human performance, advanced weapons, autonomous systems, and electronic warfare.			
Title: Red Teaming Vulnerability Exercises ***Description:*** This effort conducts in-depth assessments of emerging threats and technologies to anticipate future challenges in contested and congested environments, inform threat concepts, adapt system development practices and maintain overmatch capability. This venue allows analysis in areas that would be too dangerous or too expensive to assess during a live demonstration, as well as supports a future “what if” assessment. ***FY 2017 Plans:*** Will explore alternatives in plans, concepts, operations, and organizations in the context of the operational environment and from the perspective of partners and adversaries; expand hierarchical task analysis methodologies, virtual discovery experiment approach, and implement identified adaptability metrics into structured assessments; tailor or extend assessment frameworks to capture data for analysis and feedback, and provide means to mitigate findings with the goal of informing current or future acquisition programs early in the development lifecycle; potential technical areas of interest include human performance, advanced weapons, autonomous systems, and electronic warfare.	-	-	3.612
Accomplishments/Planned Programs Subtotals	23.334	27.520	27.686

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / *Combating Terrorism - Technology Development*	Project (Number/Name) DW4 / *Energy Technologies (Congressional Adds (CAs))*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	0.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This project contains Congressional add funding.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Force Protection Radar Development	-	6.000
FY 2016 Plans: This is a Congressional interest item.		
Congressional Adds Subtotals	-	6.000

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603130A *I TRACTOR NAIL*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	3.440	2.381	2.340	-	2.340	2.381	2.397	2.445	2.494	-	-
DS8: *Tractor Nail*	-	3.440	2.381	2.340	-	2.340	2.381	2.397	2.445	2.494	-	-

Note

Not Applicable for this Item

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	3.440	2.381	2.340	-	2.340
Current President's Budget	3.440	2.381	2.340	-	2.340
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	2.406	2.431	2.470	-	2.470	2.515	2.529	2.580	2.632	-	-
DS9: *Tractor Eggs*	-	2.406	2.431	2.470	-	2.470	2.515	2.529	2.580	2.632	-	-

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	2.406	2.431	2.470	-	2.470
Current President's Budget	2.406	2.431	2.470	-	2.470
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603270A *I Electronic Warfare Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	27.238	32.874	27.893	-	27.893	25.767	27.703	28.725	29.260	-	-
K12: *EW Demonstrations (CA)*	-	0.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
K15: *Advanced Comm Ecm Demo*	-	10.383	7.435	8.103	-	8.103	9.769	11.397	12.094	12.296	-	-
K16: *Non-Commo Ecm Tech Dem*	-	16.855	19.439	19.790	-	19.790	15.998	16.306	16.631	16.964	-	-

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 United States 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 complementary 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 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 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	R-1 Program Element (Number/Name) PE 0603270A *I Electronic Warfare Technology*	

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	26.046	26.874	27.393	-	27.393
Current President's Budget	27.238	32.874	27.893	-	27.893
Total Adjustments	1.192	6.000	0.500	-	0.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	6.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.000	-			
• SBIR/STTR Transfer	-0.808	-			
• Adjustments to Budget Years	-	-	0.500	-	0.500

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: K12: *EW Demonstrations (CA)*		
Congressional Add: *Program Increase*	-	6.000
Congressional Add Subtotals for Project: K12	-	6.000
Congressional Add Totals for all Projects	-	6.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / *Electronic Warfare Technology*	Project (Number/Name) K12 / *EW Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
K12: *EW Demonstrations (CA)*	-	0.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Electronic Warfare Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	-	6.000
FY 2016 Plans: Program Increase		
Congressional Adds Subtotals	-	6.000

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
K15: *Advanced Comm Ecm Demo*	-	10.383	7.435	8.103	-	8.103	9.769	11.397	12.094	12.296	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates sensor and software technologies to locate and identify modern tactical enemy and blue force (friendly) radio frequency (RF) communications, radars and computer networks and nodes. This project enables uninterrupted air and ground based intelligence collection and long range targeting operations in a hostile electromagnetic and cyber environment, and enables communications countermeasures (CM) and counter-countermeasures (CCM) to first intercept, identify and locate tactical communications; then degrade threat-computer networks and their components.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Soldier/Squad, Ground Maneuver and Air 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 2015	FY 2016	FY 2017
Title: Offensive Operations	6.905	5.000	5.575
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 Program Element (PE) 0603270A/Project K16 and PE 0602270A/Project 906 complements this effort.			
FY 2015 Accomplishments: Matured techniques to enable tagging, tracking and locating missions for combined cyber/EW signals and entities of interest; matured and demonstrated joint cyber/EW architecture for combined mission operation; integrated and matured cyber/EW and			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
signals intelligence capability into an airborne platform and assessed utility of conducting missions with all three capabilities simultaneously. ***FY 2016 Plans:*** 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 acquisition programs. ***FY 2017 Plans:*** Will mature interface definitions and data transfer protocol for the inclusion of tactical cyber capability on a single board computer in a common RF chassis as part of an open, modular converged RF architecture to employ multiple electronic support and electronic attack techniques simultaneously; continue to mature and integrate advanced techniques against SOIs onto representative software defined radio platforms and demonstrate the effectiveness of tactical cyber capabilities.			
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 2015 Accomplishments:*** Developed methods to efficiently cue collocated Electro Optical (EO) /Infrared (IR) sensors with an RF direction finding capability; matured hardware platform that enables an RF direction finding cueing of a collocated EO/IR sensor and conducted validation assessments of system performance; finalized methods to export data to the Distributed Common Ground Station – Army (DCGS-A); demonstrated capability to supply data to the intelligence enterprise in a relevant environment to provide tactically relevant data to the Soldier. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will design, mature, fabricate and program a circuit card to employ viable EW techniques to counter identified UAS threats and integrate it into an open, modular converged RF architecture and demonstrate the effectiveness of the capability in a	3.478	2.435	2.528

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
laboratory environment; assess requirement to coordinate data exchange between national and tactical assets to achieve desired, coordinated effects on designated threat systems.			
Accomplishments/Planned Programs Subtotals	10.383	7.435	8.103

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
K16: *Non-Commo Ecm Tech Dem*	-	16.855	19.439	19.790	-	19.790	15.998	16.306	16.631	16.964	-	-

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 2015	FY 2016	FY 2017
Title: Distributed Aperture Infrared Countermeasures (DAIRCM) Technologies	3.911	3.278	3.326
Description: This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against EO/IR and RF guided threats.			
FY 2015 Accomplishments: Matured and fabricated a brassboard wideband RF warning sensor capable of detecting and identifying modern radar threat systems to airborne platforms; conducted lab testing of brassboard RF warning sensor to evaluate sensor capabilities using RF simulation hardware and software to determine effectiveness against emerging threats and documented limitations in performance to enable the development of additionally required functionality.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will finish requirements and interface definitions for integration of a 2 channel digital RF receiver on a single circuit card assembly for use in modern radar warning receivers, capable of identifying advanced radar threat systems into an open, modular, converged RF architecture; demonstrate system functionality in a representative hardware platform.			
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 Program element (PE) 0602270A/Project 906, and PE 0603270A/Project K15 complements this effort. ***FY 2015 Accomplishments:*** Matured 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; designed, encoded and matured 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:*** 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. ***FY 2017 Plans:*** Will use converged RF architecture to mature and integrate EW techniques to determine the utility of sharing data between components, such as software defined radios, sensors, electronic support and countermeasures to identify, geo-locate and neutralize RF threats for platform survivability, and demonstrate in a relevant environment; assess types of data that can be collected from different components to improve platform survivability.	4.835	4.911	4.964
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 0603772A/Project 243 and 0602270A/Project 906 complements this effort.	3.234	3.500	3.500

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Extended capability to conduct hardware in the loop testing of a family of threat systems in a laboratory environment; assessed current and emerging red force interference/jamming sources and characterized their performance and conducted modeling and simulation and hardware in the loop testing to determine the extent of potentially harmful effects on blue force EW/C4ISR sensors; generated candidate countermeasure techniques to neutralize these threat systems. ***FY 2016 Plans:*** 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; continue to demonstrate hardware in the loop testing to provide robust assessments and measurements using realistic threat and blue force systems ***FY 2017 Plans:*** Will utilize current capability to simulate real world effects of red force jamming in complex (multi-path) environments; conduct hardware in the loop analysis of prioritized emerging threat interference techniques; replicate potential interactions on emerging blue force systems, (i.e. communication, radar) to understand and mitigate the electromagnetic interference caused by these effects; develop, mature and assess advanced signal/data processing algorithms and cancellation techniques to mitigate the effects of the threat; begin hardware in the loop analysis of the effectiveness of these techniques against red force jamming.			
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 complements this effort. ***FY 2015 Accomplishments:*** Matured sensor based threat detection, classification, tracking, warning and electronic countermeasure techniques in support of the APS science and technology program; conducted modeling and simulation (M&S) of potential electronic APS capabilities to evaluate and document potential system performance in operational scenarios. ***FY 2016 Plans:*** 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	4.125	7.000	7.250

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will complete sensor design, fabrication, and physical interface designs and begin integration onto a demonstration platform; conduct live fire data collection utilizing the sensor that has been integrated into the MAPS framework; characterize data collected to assess sensor performance within the MAPS framework; continue to assist in the development of MAPS framework interface definitions, protocols and requirements.			
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 0603794A /project EL4 complements this effort. ***FY 2015 Accomplishments:*** Extended existing RF simulation M&S capabilities to accurately depict the interaction between EW systems and selected signals of interest (SOI); extended the M&S capability to enable new EW techniques and threat SOI to be rapidly and accurately developed within the model environment to analyze the interaction between EW systems and various targets; validated the extended models and simulations to ensure accuracy and performance. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will continue to improve RF M&S capabilities to accurately model complex urban environments, system performance in those environments and interactions with relevant SOIs common to urban environment; optimize methods to conduct M&S of complex environments with multiple geographically dispersed SOIs and blue force systems in a timely manner with sufficient fidelity to provide validated performance estimates to system developers.	0.750	0.750	0.750
Accomplishments/Planned Programs Subtotals	16.855	19.439	19.790

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603313A *I Missile and Rocket Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	78.302	104.449	52.190	-	52.190	58.142	56.688	59.300	60.486	-	-
206: *Missile Simulation*	-	1.703	1.731	2.435	-	2.435	2.475	2.488	2.574	2.625	-	-
263: *Future Msl Tech Integr(FMTI)*	-	31.198	27.572	23.282	-	23.282	30.021	31.521	30.174	44.608	-	-
704: *Advanced Missile Demo*	-	10.401	20.146	26.473	-	26.473	25.646	22.679	26.552	13.253	-	-
NA6: *Missile and Rocket Initiatives (CA)*	-	35.000	55.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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. 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 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603313A *I Missile and Rocket Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	79.934	49.449	52.190	-	52.190
Current President's Budget	78.302	104.449	52.190	-	52.190
Total Adjustments	-1.632	55.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	55.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.632	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: NA6: *Missile and Rocket Initiatives (CA)*		
Congressional Add: *Program Increase*	35.000	55.000
Congressional Add Subtotals for Project: NA6	35.000	55.000
Congressional Add Totals for all Projects	35.000	55.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
206: *Missile Simulation*	-	1.703	1.731	2.435	-	2.435	2.475	2.488	2.574	2.625	-	-

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 2015	FY 2016	FY 2017
Title: Missile Simulation	1.703	1.731	2.435
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 2015 Accomplishments: Designed a radio frequency scene generation algorithm and began hardware/software integration into hardware-in-the-loop to support testing of advanced millimeter wave (MMW) sensors. Designed an integrated, cohesive sensor development modeling and simulation environment to significantly reduce seeker design and development timeline. Completed 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: 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. Mature a modeling and simulation environment to significantly reduce seeker algorithm design and development timelines. 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.			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will complete the maturation and demonstration of a modeling and simulation environment to significantly reduce seeker algorithm design and development timelines; complete the maturation of 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; develop novel methods to address deficiencies in Electro-Optical/Infrared (EO/IR) real-time high-bandwidth sensor stimulation for Hardware in the loop, which will meet future needs of large format & high bandwidth/high fidelity sensor systems; and will continue 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	1.703	1.731	2.435

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
263: *Future Msl Tech Integr(FMTI)*	-	31.198	27.572	23.282	-	23.282	30.021	31.521	30.174	44.608	-	-

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 portfolios.

This Project matures technologies from Program Element (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 2015	FY 2016	FY 2017
Title: Technical Fire Control Technology	2.532	-	-
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 0603313A 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 2015 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Continued refinements and enhancements of Technical Fire Control nodes for Counter RAM, UAS, and Cruise Missile interceptors based on current threat analysis. Used 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, 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 2015 Accomplishments:*** Completed Critical Design Reviews for alternative components for Guided interceptors to defeat RAM, UAS and Cruise Missile. Tested form-factor components in HWIL to provide pre-flight predictions and reduce risk. Updated and refined the system simulation based on performance demonstrated in HWIL pre-flight predictions.	7.142	-	-
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 HWIL tests of multiple hit-to-kill interceptors. The technologies demonstrated will be applicable to the IFPC. ***FY 2015 Accomplishments:*** Continued integration and testing, and analysis of HTK components; began fabrication and testing of the active seeker for HTK to provide a Fire Control independent solution.	6.636	-	-
Title: Low Cost Tactical Extended Range Missile	5.200	9.638	10.962

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. This effort supports the Army need for developing capability enablers in the area of Extended Range Precision Fires. ***FY 2015 Accomplishments:*** Conducted trade studies through simulation to determine subsystem requirements for delivery of enhanced lethal effects to long range targets; evaluated the target sets at various ranges and matched payload technologies with the threat sets; matched propulsion technologies with range and missile size; evaluated emerging navigation technologies for GPS challenged environments; evaluated requirements for compatibility with both current and future long range launch systems. ***FY 2016 Plans:*** Complete 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. ***FY 2017 Plans:*** Will continue to refine and update the long range fires missile system simulation to reflect the emerging navigation, propulsion, and payload technologies. This system simulation will be used to assess improved missile performance provided by these technologies and guide their continued development; continue to refine navigation system concept designs that leverage emerging navigation technologies being developed under PE 0602303A; and continue development and maturation of novel motor technology for long range precision fires - complete preliminary design, conduct design review, and originate static motor testing to assess performance for extended range missile capability.			
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 hardkill APS portion and modeling and simulation efforts will be addressed by AMRDEC. This effort supports the Army's 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	2.993	6.000	6.250

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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 Accomplishments:*** Began 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:*** 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. ***FY 2017 Plans:*** Will continue analysis of APScountermeasure and fire control sensor alternatives with modeling and simulation; continue maturation and adaptation of a hard-kill countermeasure and fire control sensor in support of developing improved survivability equipment.			
Title: Hunter Killer Missile Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, 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. Critical subsystem technology development transitions to 0603313A/263 Low Cost Extended Range Missile and 0603313A/704 Low Cost Extended Range Air Defense efforts for further maturation. ***FY 2015 Accomplishments:*** Conducted trade studies to determine subsystem requirements. Identified critical components and begin designing and maturation of those critical components such as propulsion, datalink, and tracker. Began development of system-level modeling and simulation necessary to mature and evaluate concepts for prediction of system capability across a broad spectrum of missions. Evaluated fire control requirements and identified key technologies. ***FY 2016 Plans:*** Complete 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	6.695	7.803	4.024

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
predictions; mature key critical subsystem technologies in support of identified system requirements such as propulsion and navigation; mature maneuverable airframe guidance and controls algorithms. ***FY 2017 Plans:*** Will continue to advance development of system-level modeling and simulation to mature and evaluate concepts for system performance predictions; continue to mature key critical subsystem technologies in support of identified system requirements, and begin to integrate subsystems and perform laboratory evaluations and testing in relevant environments to inform requirements for further maturation of concepts.			
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:*** 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. ***FY 2017 Plans:*** Will investigate and evaluate current system capabilities that support emerging requirements for close combat missile systems; perform detailed system designs and effectiveness analyses to shape critical component development that enable increased performance while ensuring affordability for future expeditionary and maneuvering capabilities.	-	4.131	2.046
Accomplishments/Planned Programs Subtotals	31.198	27.572	23.282

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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)*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
704: *Advanced Missile Demo*	-	10.401	20.146	26.473	-	26.473	25.646	22.679	26.552	13.253	-	-

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 Program element (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 2015	FY 2016	FY 2017
Title: Counter Rockets, Artillery, Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missile Tracking and Fire Control	5.180	7.254	8.038
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. 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 2015 Accomplishments: Demonstrated and assessed 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, and Cruise Missile), scenarios and multiple engagements utilizing simulations and HWIL.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. ***FY 2017 Plans:*** Will develop a surrogate demonstration launcher; begin integration of digital data link technology and ground station components; and begin integration of inertial and network alignment technology; will continue to coordinate integration of a mobile multi-purpose detect, decide, and defeat expeditionary technology; and continue to mature software algorithms and perform platform integration of cueing and tracking sensor capability.			
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 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). ***FY 2015 Accomplishments:*** Completed initial design of a medium- to long-range interceptor including identification of critical interceptor technology and component performance requirements. Began development of interceptor component technologies to include propulsion, seeker, guidance, navigation and controls and begin development of an interceptor simulation. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will continue component development and maturation for low-cost air defense interceptor system; complete static testing and evaluation of solid rocket motor design; continue development of secure digital data link, flight termination system, and control actuation system; complete development, fabrication, and integration of guidance electronics unit (GEU); and begin subsystem test and evaluation; Complete hardware-in-the-loop simulation tools and apparatus required to test interceptor navigation instrumentation, data link components, and control system technologies; and evaluate navigation instruments for eventual flight demonstration testing.	5.221	6.087	9.184
Title: Seeker and Guidance Technology for Air Defense	-	6.805	7.601

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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, UAS, and Cruise Missile threats with secondary capabilities against LCR, SRBM, and TASMS. ***FY 2016 Plans:*** Mature active seeker for the Hit-to-Kill interceptor for utilization against RAM threats in the Counter RAM, 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. ***FY 2017 Plans:*** Will complete development and fabrication of low-cost air defense interceptor seeker and integrate with guidance electronics unit in software integration facility for calibration and testing on flight motion simulator HWIL; continue maturation of guidance algorithms, and navigation technology implementation for accurate mid-course and terminal homing guidance at extended ranges; begin calibration, test, and evaluation of integrated subsystems on flight motion simulator in HWIL.			
Title: Multi-role Missile Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, HWIL development and test, and flight demonstration of critical technology that supports an open systems architecture to enable modular designs of guided and unguided missiles for smaller and lighter missile options with multi-role engagement capabilities reducing the life cycle cost for missiles. Critical component technologies include advanced propulsion, payload (lethal and non-lethal), seekers, fire control, datalink, guidance and controls, and maneuverable airframes. This effort matures and demonstrates technology from PE 0602303A, Multi-Role Missile Technology. ***FY 2017 Plans:*** Will continue maturation of component technology development from PE 0602303A (Multi-Role Missile Technology), perform laboratory testing and simulation evaluations; integrate modular missile technology subsystem; and perform ground launched, unguided/ballistic flight test to verify mechanical and electrical integrity.	-	-	1.650
Accomplishments/Planned Programs Subtotals	10.401	20.146	26.473

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
NA6: *Missile and Rocket Initiatives (CA)*	-	35.000	55.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2015	FY 2016
Congressional Add: Program Increase	35.000	55.000
FY 2015 Accomplishments: Program increase for missile and rocket advanced technology development		
FY 2016 Plans: Program increase for missile and rocket advanced technology development		
Congressional Adds Subtotals	35.000	55.000

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 2017 Army											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.105	10.999	11.107	-	11.107	11.311	11.385	11.611	11.843	-	-
B92: *DB92*	-	11.105	10.999	11.107	-	11.107	11.311	11.385	11.611	11.843	-	-

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	11.105	10.999	11.107	-	11.107
Current President's Budget	11.105	10.999	11.107	-	11.107
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603461A *I High Performance Computing Modernization Program*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	214.614	222.159	177.190	-	177.190	182.338	183.339	186.373	190.100	-	-
DS7: *High Performance Computing Modernization Program*	-	174.614	177.159	177.190	-	177.190	182.338	183.339	186.373	190.100	-	-
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	40.000	45.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

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

Work in this Program Element (PE) supports the Army Science and Technology 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 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603461A *I High Performance Computing Modernization Program*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	221.518	177.159	177.190	-	177.190
Current President's Budget	214.614	222.159	177.190	-	177.190
Total Adjustments	-6.904	45.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	45.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.904	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*		
Congressional Add: *Congressional Increase*	40.000	45.000
Congressional Add Subtotals for Project: DW5	40.000	45.000
Congressional Add Totals for all Projects	40.000	45.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
DS7: *High Performance Computing Modernization Program*	-	174.614	177.159	177.190	-	177.190	182.338	183.339	186.373	190.100	-	-

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) addresses the supercomputing requirements of Department of Defense (DoD) scientists and engineers by (1) demonstrating and maturing the most advanced, leading-edge computational architectures and exploiting the resulting systems by employing complementary specialized expertise; (2) demonstrating and maturing the Defense Research and Engineering Network (DREN) which investigates, demonstrates, and matures leading-edge digital networking and security technologies to securely deliver computational capabilities to the distributed DoD Research, Development, Test, and Evaluation (RDTE) community; and (3) leveraging specialized expertise from DoD, other federal departments/agencies, industry, and academia to demonstrate and mature leading-edge software application codes. DoD Supercomputing Resource Centers (DSRCs) provide extensive computational capabilities and demonstrate and mature emerging technologies that address the supercomputing requirements of the DoD RDTE community in the areas of hardware, software, and programming environments. All HPCMP sites are interconnected to each other, the DoD High Performance Computing (HPC) RDTE community, and other major defense sites via DREN, a research network which investigates, demonstrates, and 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 as they employ HPCMP advanced capabilities. The HPCMP's software application effort (a) optimizes, enhances, demonstrates, and matures critical DoD physics-based and engineering software to allow scientists and engineers to execute calculations with precision and efficiency on leading-edge supercomputers, (b) demonstrates and matures immersive collaborative programming environments to improve science and engineering workflows, and (c) demonstrates and matures leading-edge computational technology from academia and industry. These synergistic activities collectively demonstrate and mature horizontal technologies that are exploited throughout the DoD RDTE 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 Science and Technology 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 2015	FY 2016	FY 2017
Title: Department of Defense (DoD) Supercomputing Resource Centers (DSRCs)	93.242	94.538	94.555
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 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
DoD RDTE community to effectively and efficiently investigate, demonstrate, and mature a broad range of technologies through advanced computational methods. ***FY 2015 Accomplishments:*** Refined and exploited the advanced capabilities of 14 previously demonstrated supercomputers (culminating in the ability to complete 7,900 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 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 several 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; matured 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); matured the ability to interactively prepare and 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); matured software and hardware-based methods for sharing memory across computational nodes to provide scientists and engineers large blocks of contiguous memory (e.g. trillions of bytes) for use cases that require large matrices; demonstrated graphical user interface (GUI) access to supercomputers without requiring software to be added to the client machine to allow scientists and engineers located at sites with prohibitive security practices to apply supercomputing to DoD use cases; demonstrated the ability to use both general-purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) to expand the breadth of DoD use cases that can be addressed by supercomputing; investigated the energy required to address representative DoD use cases through experimentation and a sophisticated modeling of supercomputer hardware and application software 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.); investigated (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:*** Refining and exploiting the advanced capabilities of 20 (or more) previously demonstrated supercomputers (culminating in the ability to complete 16,900 trillion floating point operations per second) 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,			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
networking, and systems, (10) environmental quality, and (11) integrated modeling and test environments; demonstrating 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; maturing graphical user interface (GUI) access to supercomputers without requiring software to be added to the client machine to allow scientists and engineers located at sites with prohibitive security practices to apply supercomputing to DoD use cases; maturing the ability to use both general-purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) to expand the breadth of DoD use cases that can be addressed by supercomputing; investigating 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) to expand the breadth of DoD use cases that can be addressed by supercomputing. ***FY 2017 Plans:*** Will refine and exploit the advanced capabilities of 23 (or more) previously demonstrated supercomputers (culminating in the ability to complete 36,400 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 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 and 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. 2017) processor, memory, disk I/O, interconnect, and OS capabilities (culminating in the ability to complete 11,000 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 GUI access to supercomputers without requiring software to be added to the client machine to allow scientists and engineers at sites with prohibitive security practices to apply supercomputing to DoD use cases; will further mature the ability to use both general-purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) to expand the breadth of DoD use cases that can be addressed by supercomputing; will mature 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) to expand the breadth of DoD use cases that can be addressed by supercomputing.			
Title: Defense Research and Engineering Network (DREN) ***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 RDTE 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	30.247	30.397	30.402

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017

and its contract entities as they employ HPCMP advanced capabilities; employs complementary specialized expertise to mature and exploit this environment.

FY 2015 Accomplishments:

Refined and exploited DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDTE communities; refined and exploited the HPCMP's Defense Information System 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; demonstrated the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated) networking communities-of-interest (COIs); matured 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 RDTE use cases; matured the ability to observe the security profile of DREN III using a cloud of over 100 sensors to support the HPCMP's DISA-accredited Level 3 computer network defense capability; investigated 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; investigated (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; demonstrated (in collaboration with the DoD CIO's Office, U.S. Cyber Command, the National Security Agency [NSA], the DISA, and ARL DoD enterprise information system continuous monitoring (ISCM) capability to ingest robust, diverse host-based and network-based near-real-time information to provide a persistent situational awareness (SA); demonstrated (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:

Refining and exploiting DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDTE communities; refining and exploiting 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; maturing the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated) networking communities-of-interest (COIs); demonstrating 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; demonstrating (in coordination with White House, OSTP, the NSF, and ARL) the ability to employ SDNs to allow traditional Internet protocol (IP) and experimental protocol networks to coexist

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
within a common DoD networking infrastructure; maturing (in collaboration with the DoD CIO's Office, U.S. Cyber Command, the NSA, DISA, and ARL) a DoD enterprise ISCM capability to ingest robust, diverse host-based and network-based near-real-time information to provide a persistent SA. ***FY 2017 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 RDTE communities with specific efforts targeted at the unique requirements of the T&E community; will initiate strategic technical planning for DREN IV, a follow-on to DREN III, with next-generation technical capabilities and significantly increased bandwidths to support 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 as they utilize HPCMP advanced capabilities; will mature the advanced network technologies and complex cybersecurity mechanisms required to implement logically-separated networked communities-of-interest (COIs) at multiple classification levels; will continue to 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 capabilities and (2) active experimentation for novel, adaptive cybersecurity detection and intervention methods; will continue to demonstrate 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 an information system continuous monitoring (ISCM) capability to ingest robust, diverse, host-based and network-based near-real-time information to provide a persistent situational awareness (SA); will improve cybersecurity methods to aid in the detection of insider threats.			
Title: Software Applications ***Description:*** This effort optimizes, enhances, demonstrates, and matures software applications to provide for the adaptation of widely used applications and algorithms to address (RDTE 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); High Performance Computing Applications Software Initiative (HASI) projects address the need to mature and refine critical DoD software that can take advantage of new and emerging hardware advances; the Frontier initiative represents and supports the DoD's highest-priority, highest-impact computational work, both from a technical and mission-relevance standpoint; the Productivity, Enhancement, Technology Transfer, and Training (PETTT) initiative (1) optimizes and enhances critical DoD physics-based and engineering software to allow scientists and engineers to execute scientific calculations with precision and efficiency on leading-edge supercomputers, (2)	51.125	52.224	52.233

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017

demonstrates and matures immersive collaborative programming environments to improve science and engineering workflows, and (3) demonstrates and matures leading-edge computational technology from academia and industry.

FY 2015 Accomplishments:

Matured jet engine propulsion portion of fixed-wing aircraft model to account for engine dynamics under cruise flight conditions; matured 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); investigated coupled-physics model for conducting analyses of alternatives (AoAs) for fixed-wing aircraft concept designs; matured RF electromagnetics (EM) model to increase dynamic range of features sizes (i.e. minute details on a large platform) 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); matured 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); matured 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; demonstrated 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 to virtually test vehicle mobility across a wide range of scenarios; further 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); investigated, demonstrated, and matured computational models via PETTT to address critical DoD HPC RDT&E needs.

FY 2016 Plans:

Maturing jet engine propulsion portion of fixed-wing aircraft model to account for engine dynamics under transient flight conditions (i.e. complex maneuvers); maturing rotorcraft model to address the intricate maneuvers required to analyze the JMR Helicopter (an anticipated replacement for over 4,000 medium-lift helicopters); maturing coupled-physics model for conducting 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; maturing RF 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); maturing multi-physics ship model to allow refined ship/shock analysis for underwater/surface explosions, capturing the effects of moderate and severe structural damage; maturing multi-physics ship model to allow detailed propeller analysis, capturing the effects of cavitation [i.e. the creation of voids/ bubbles]; maturing model for conducting AoAs for concept ship designs by incorporating cost as a design variable; maturing suite of computational models which couple (a) high-fidelity multi-body dynamics simulations for wheeled and tracked vehicles, (b) vehicle powertrain model (i.e. components necessary to generate power and deliver that power to the road/surface), (c)

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
a physics-based model of the surrounding environment to virtually test vehicle mobility across a wide range of scenarios and analyze (d) mobility performance from a driver perspective. Maturing model for examining personnel/platform blast protection (e.g. determining blast effects on (a) wheeled APCs and (b) vehicle occupants in support of OCP and WIAMAN blast experiments); investigating, demonstrating, and maturing computational models via PETTT to address critical DoD HPC RDT&E needs by improving the capability and scalability of software to address DoD critical problems in the areas of computational fluid dynamics, computational chemistry and materials, computational structural mechanics, and climate, weather and ocean modeling to optimize utilization of new and emerging hardware configurations.			
FY 2017 Plans: Will mature multi-disciplinary software technology in support of current and future defense programs. For fixed-wing aircraft, this includes, but is not limited to, analysis capabilities for coupled aerodynamics, structural dynamics, propulsion, and flight controls in support of flight certifications (e.g., air worthiness, store carriage and release, etc.) and mission planning for fielded and new systems and associated upgrades. Also, it will support Defense acquisition decisions associated with exploration and design analysis of future manned and unmanned aerial vehicle concepts. For rotorcraft, exemplars include aeromechanics analysis associated with maneuvers, airframe-propulsion system integration, and weapons carriage and release, as well as infrared suppression analysis, chaff trajectory prediction, and debris ingestion analysis. These capabilities are being deployed in support of the Future Vertical Lift (FVL) Program, as well as for sustainment of existing rotorcraft-based programs and associated upgrades, such as the Improved Turbine Engine Program (ITEP). Will mature capability for automated mesh generation for advanced aircraft and for hydrodynamic (steering and resistance) assessments for advanced submarines. Will mature conceptual and early modeling capabilities in sync with detailed design and analyses representations to realize full-lifecycle management of systems and platforms; will further mature computational electromagnetics capabilities to assist in design and evaluation of next generation radar for aircraft, ships, and ground-based platforms; will demonstrate capability for assessment of electromagnetic hazards on ordnance, will optimize computation methods for electronic warfare assessments and evaluation of multiple antenna systems on a single platform; will further mature multi-physics ship model to allow 1) refined ship and shock analysis for underwater/ surface explosions, capturing the effects of moderate and severe structural damage; 2) detailed propeller analysis, capturing the effects of cavitation, i.e., the creation of voids and bubbles; will further mature model for conducting analyses of alternatives (AoAs) for concept ship designs by incorporating cost as a design variable. Will further optimize suite of computational models which couple (a) high-fidelity multi-body dynamics simulations for wheeled and tracked vehicles, (b) a vehicle powertrain model (i.e. components necessary to generate power and deliver that power to a surface), (c) a physics-based model of the surrounding environment to virtually test vehicle mobility across a wide range of scenarios, and (d) mobility performance analysis from a driver perspective; will further mature model for examining personnel/platform blast protection, e.g. determining blast effects on both wheeled APCs and vehicle occupants in support of OCP and WIAMAN blast experiments. Frontier projects will advance and mature DoD's highest-priority, highest-impact computational efforts, including simulation of hypersonic vehicles, simulation of stratified turbulence to enable predictive modeling of vehicles, sensors, and weapons operating in the ocean and			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
atmosphere, simulation and studies to support development of the Navy's electromagnetic railgun launcher technologies, and three-dimensional simulations of complex engine sprays under real engine conditions. The PETTT initiative will optimize and enhance critical DoD physics-based and engineering software to allow scientists and engineers to execute scientific calculations with precision and efficiency on leading-edge supercomputers. New programming languages, algorithms, computational techniques, workflow environments, and data management and analysis techniques will be used to efficiently leverage the power of next generation supercomputers.			
Accomplishments/Planned Programs Subtotals	174.614	177.159	177.190

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	40.000	45.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 (RDTE) 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 Department of Defense (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 Computing 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 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. 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 Software Application 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 Science and Technology 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 2015	FY 2016
Congressional Add: Congressional Increase	40.000	45.000
FY 2015 Accomplishments: Congressional increase for the High Performance Computing Modernization Program.		
FY 2016 Plans: Congressional increase for the High Performance Computing Modernization Program.		
Congressional Adds Subtotals	40.000	45.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603606A *I Landmine Warfare and Barrier Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	12.795	13.966	17.451	-	17.451	18.659	18.644	18.972	19.352	-	-
608: *Countermine & Bar Dev*	-	12.795	11.981	15.465	-	15.465	16.674	16.658	16.986	17.326	-	-
683: *Area Denial Sensors*	-	0.000	1.985	1.986	-	1.986	1.985	1.986	1.986	2.026	-	-

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 as well as 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 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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	13.070	13.993	17.451	-	17.451
Current President's Budget	12.795	13.966	17.451	-	17.451
Total Adjustments	-0.275	-0.027	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.275	-			
• Adjustments to Budget Years	-	-0.027	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
608: *Countermine & Bar Dev*	-	12.795	11.981	15.465	-	15.465	16.674	16.658	16.986	17.326	-	-

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 in both mounted and dismounted applications. 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 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 2015	FY 2016	FY 2017
Title: Ground Vehicle Explosive Hazard Detection	9.781	11.981	15.465
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) systems 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 of the systems to electromagnetic interference and improves the interoperability with electronic countermeasures, while continuing to improve detection rates and reduce false alarms. This project improves detection of explosive hazards when emplaced along the sides of roads. It also matures technologies to increase standoff detection and defeat distances, both in roads and off routes, enabling faster rates of advance and safer operations for early entry and route clearance missions.			
FY 2015 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Demonstrated a digital GPR array in a militarily relevant environment and evaluated detection performance against buried threat devices with and without presence of electronic countermeasures; integrated ground vehicle based, forward looking Electro-Optical/Infrared (EO/IR) sensor on a military vehicle. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will integrate optimized forward looking EO/IR sensor suite with multi-step target detection algorithms and automated decision making tools to provide a robust vehicle mounted technology demonstrator; finalize forward looking EO/IR to down looking GPR sensor cueing architectures and software to fuse target nominations from the standoff and localization sensors into a GUI; integrate LIDAR sensor to image and identify side attack targets and threats onto vehicle testbed; and optimize 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 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 2015 Accomplishments:*** Demonstrated advanced handheld ground penetrating radar antenna and improved wideband metal detection coils and collected data in field conditions for development of improved target detection algorithms.	3.014	-	-
Accomplishments/Planned Programs Subtotals	12.795	11.981	15.465

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
683: *Area Denial Sensors*	-	0.000	1.985	1.986	-	1.986	1.985	1.986	1.986	2.026	-	-

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 doctrine. This project also fabricates components and system architectures, and it conducts evaluations 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 Command, Control, Communications and Intelligence portfolios.

Work in this Project is performed by the 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 2015	FY 2016	FY 2017
Title: Area Denial Sensors	-	1.985	1.986
Description: This effort matures and demonstrates 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 to meet requirements for man-in-the-loop command and control include deployable multi-mode sensors, fused sensor information, and local area network communications. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will mature and demonstrate a hand emplaced sensor system that captures relevant threat signatures to increase probability of detection and decrease false alarms; will optimize sensor fusion technologies to provide operator management of multiple remotely employed sensor nodes to provide situational awareness and area denial effects.			
Accomplishments/Planned Programs Subtotals	-	1.985	1.986

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603607A *I Joint Service Small Arms Program*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	7.055	5.105	5.839	-	5.839	5.787	5.874	5.990	6.110	-	-
627: *Jt Svc Sa Prog (JSSAP)*	-	7.055	5.105	5.839	-	5.839	5.787	5.874	5.990	6.110	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) 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 PE support the Army Science and Technology Lethality 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 Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Program Change Summary ($ in Millions)	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	7.318	5.105	5.839	-	5.839
Current President's Budget	7.055	5.105	5.839	-	5.839
Total Adjustments	-0.263	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.033	-			
• SBIR/STTR Transfer	-0.230	-			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
627: *Jt Svc Sa Prog (JSSAP)*	-	7.055	5.105	5.839	-	5.839	5.787	5.874	5.990	6.110	-	-

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 Project support the Lethality Science and Technology Portfolio.

Work in this Project is related to and fully integrated with the efforts funded in Program Element (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 Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Small Arms Weapons and Fire Control Integration	5.465	-	-
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 weapon systems (M4, M16, M249, M240) and developmental small arms systems to optimize affordability, target acquisition, fire control, weight, and lethality. Project technologies transition to Project Manager Soldier Weapons (PM SW). ***FY 2015 Accomplishments:*** Performed final developmental testing and assessments in a relevant environment; demonstrated compatibility with current M240 machine gun in actual system environments; achieved Technical Readiness Level (TRL) 6 for matured component technologies and transitioned Technical Data Package (TDP).			
Title: Advanced Small Unit (Squad) Small Arms Technology Demonstration	1.590	0.403	-
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.			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Demonstrated enabling technologies that double maximum effective range of door-breaching munition from 33m to 66m; doubled the maximum effective range to 2km for .50 caliber ammunition; increased probability of hit and hard target penetration; and doubled probability of hit for rifles from 0-600m. ***FY 2016 Plans:*** 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.			
Title: Small Arms Material and Process Technology Demonstration ***Description:*** This effort focuses on 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:*** 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.	-	1.696	-
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:*** 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 and provide the capability to achieve desired accuracy and incapacitating effects with volume fire. ***FY 2017 Plans:*** Will integrate and demonstrate weapon systems, fire control and ammunition technologies to support the Next Generation Squad Automatic Rifle (NGSAR) requirements for a lightweight medium machine gun (up to 1200 meters range) with increased lethality, reduced weight, and decreased detection.	-	2.152	2.362
Title: Precision Effects	-	0.854	1.582

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort focuses on 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:*** 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). ***FY 2017 Plans:*** Will integrate and demonstrate weapon systems, fire control and ammunition technologies to support the next generation weapon systems; address precision fire requirements for the squad (up to 600m range) and the Platoon (up to 2400m range) with increased lethality, reduced weight, and decreased weapon signature.			
Title: Small Arms Systems Integration and Demo ***Description:*** This effort addresses the maturation and demonstration of small arms component technologies resulting from PE 0602623A efforts and applied into advanced small arms technologies as to inform the user requirement process, address operational capability gaps and transition mature components and technology concepts. ***FY 2017 Plans:*** Will increase understanding of current lethality capabilities, gaps, and impacts on the Warfighter; assess small unit effectiveness on next generation leap ahead weapon systems supporting the Squad.	-	-	0.395
Title: Joint Service Small Arms Science and Technology Collaboration ***Description:*** This effort addresses the continued operations of the Joint Service Small Arms Program (JSSAP) office to coordinate and harmonize new Services' materiel requirements with potential joint applications, and to maintain awareness of the Services' efforts to improve Small Arms capabilities thus reducing duplication of ongoing and planned technology, acquisition and sustainment activities. ***FY 2017 Plans:*** Will provide intensive management of the Department of Defense (DoD) small arms tech base; harmonize emerging material requirements; focus technology development efforts on material solutions that will transition to the Project Managers for further	-	-	1.500

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
development and eventual fielding; conduct long range plans and optimize strategies for joint applications; influence international small arms activities.			
Accomplishments/Planned Programs Subtotals	7.055	5.105	5.839

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603710A *I Night Vision Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	46.056	40.929	44.468	-	44.468	40.635	46.500	47.872	40.108	-	-
K70: *Night Vision Adv Tech*	-	29.765	26.740	27.293	-	27.293	23.302	29.157	30.186	30.230	-	-
K86: *Night Vision, Abn Sys*	-	16.291	14.189	17.175	-	17.175	17.333	17.343	17.686	9.878	-	-

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 and to provide rapid wide area search. It also demonstrates technologies that provide the ability to perform multispectral aided target detection (AiTD), to integrate disparate sensor architectures, and to enable passive long range target identification (ID). Project K86 matures and evaluates sensors and algorithms designed to detect targets (vehicles and personnel) in camouflage, concealment and deception from airborne platforms. It provides pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions.

B. Program Change Summary ($ in Millions)	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	44.119	40.929	44.968	-	44.968
Current President's Budget	46.056	40.929	44.468	-	44.468
Total Adjustments	1.937	0.000	-0.500	-	-0.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	3.300	-			
• SBIR/STTR Transfer	-1.363	-			
• Adjustments to Budget Years	-	-	-0.500	-	-0.500

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
K70: *Night Vision Adv Tech*	-	29.765	26.740	27.293	-	27.293	23.302	29.157	30.186	30.230	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates high-performance integrated sensor technologies that increase target detection ranges, extend target identification ranges, 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 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 2015	FY 2016	FY 2017
Title: Weapon Sight Technology ***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 2015 Accomplishments:*** Improved sensor processing efficiency and demonstrated crew served weapon sight with increased range, identification capability and reduced Size, Weight, and Power (SWaP); leveraged new optical design and high performance uncooled infrared detector to complete design of next generation sniper weapon sight with reduced SWaP; began design studies of conformal head mounted composite waveguide displays with day/night usability and wireless interface for remote display of weapon sight imagery.	6.848	-	-
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 (SA) and target discrimination capabilities and to reduce TA timelines for dismounted Soldiers, combat vehicles, tactical robots, ground sensors and urban sensors against threats that are beyond the ranges of current technologies and discrimination capabilities, or that are partially obscured.	7.650	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Matured and validated algorithms for ground to air infrared search and track capabilities; optimized techniques, to include rotating camera(s), stacked prisms, and staring arrays, to improve 360 degree coverage and increase affordability; demonstrated high resolution target tracking and identification for target handoff and engagement.			
Title: Advanced Sensors for Precision	10.291	11.573	4.249
Description: This effort matures and demonstrates technologies that allow combat vehicle commanders and crewmen to detect, identify and locate threat targets more rapidly to enable fire control for platform weaponry. The effort leverages advanced Infrared (IR) imaging technology, three-dimensional (3D) imaging sensor techniques, emerging laser technologies and precise far target location technology to increase target detection range and reduce target acquisition timelines. This effort supports the Army's Active Protection System (APS) program, whose objective is to mature and demonstrate active protection technologies to reduce vehicle weight while reducing reliance on armor. This is accomplished through the use of other means such as sensing, early warning, Hostile Fire Detection (HFD), and active countermeasures to provide increased protection against current and emerging threats. Follow on work for Fiscal Year (FY) 2017 is also captured in “Advanced Wide Area Search Sensors”.			
FY 2015 Accomplishments: Validated low cost integrated uncooled IR sensors for SA and muzzle flash detection; improved design for active threat sensor detection of uncooled and cooled IR sensors; matured clutter rejection techniques for reduced false alarms and threat sensor point of origin determination; exploited existing and emerging laser technologies and determined limitations for suppression of threat night vision and electro-optic imaging sensors; began development of concept demonstrator hardware to demonstrate detection/suppression in a single waveband.			
FY 2016 Plans: Demonstrate uncooled IR camera for SA and muzzle flash detection and on the move performance of ground HFD and algorithms; optimize design for detection of hostile uncooled and cooled IR sensors prior to threat engagement; 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.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will mature and demonstrate a multi-function uncooled IR camera static system with real-time algorithms for HFD with reduced false alarms and local situational awareness on a technology demonstrator; exploit findings from static technology demonstrator to support on-the-move system support requirements.			
Title: Sensor Interoperability ***Description:*** This effort matures and demonstrates 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, reduced decision timelines, reduced soldier load, and reduced integration costs. ***FY 2015 Accomplishments:*** Modeled and simulated the sensor portion of the Computing Environment (CE); matured and evaluated sensor to network standards, including implementation specifications and guides; implemented standards, demonstrated, evaluated and refined interoperability of Electro-optic/Infrared (EO/IR), radar sensors, Chemical, Biological, Radioactive, Nuclear, Explosive (CBRNE) systems, biometric sensors; matured and demonstrated sensor imagery and metadata products as well as Dynamic, Distributed, Discover (D3) configuration capability. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will develop methods to enhance existing security to provide intrusion detection within an integrated sensor architecture (ISA) framework, which allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge, across the Enterprise and Tactical networks; mature methodologies for minimizing network bandwidth and demonstrate approaches; improve sensor planning and management techniques across the architecture to maximize sensor capabilities.	4.000	3.500	2.500
Title: Soldier System Architecture ***Description:*** This effort designs, develops and optimizes interfaces for Soldier sensors, optics, displays and electronic systems that will be incorporated into the larger Soldier system architecture to improve the individual Soldier's effectiveness and efficiency	0.976	1.018	1.005

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
while reducing burden and total operational costs. This effort is coordinated with Program Element (PE) 0603001A/Project J50, PE 0602716A/Project H70, PE 0602786A/Project H98, 060315A/Project S28, and 0603004A/Project 232. ***FY 2015 Accomplishments:*** Developed Measures of Effectiveness / Measures of Performance (MOE/MOP) for the sensor, optics, displays and electronic systems used by the individual Soldier and integrated these MOE/MOPs into the overall Soldier System Architecture. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will perform analyses of hardware components for sensors, optics, displays and electronic systems to inform reference architectures for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Soldier equipment as well as planned developmental technologies; will refine MOE/MOPs for the sensor, optics, displays and electronic systems.			
Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE) ***Description:*** This effort provides uncooled IR sensor technologies to improve the survivability for manned and unmanned ground vehicle systems by providing increased SA in all conditions and environments, to include DVE. Improvements in sensitivity and the development of signal processing techniques are needed to enable current uncooled IR sensors to penetrate obscurants that create DVE. The integration of improved sensors, signal processing algorithms, and data fusion techniques will enable mission capabilities to be maintained in DVE (e.g. smoke, dust, fog). This is a Joint effort with the Tank Automotive Research Development and Engineering Center under PE 0602601A, Project C05 and 0603005A, Project 221; and it is fully coordinated with PE 0602709A, Project H95. ***FY 2016 Plans:*** Assess 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; assess concepts for scalable, multi-function sensor capabilities that can be applied to tactical vehicles and combat platforms; explore industry approaches for automotive driving aids for automated personnel and obstacle detection with applicability to military environments. ***FY 2017 Plans:***	-	4.840	5.897

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Will demonstrate optical filtering and image processing enhancements in DVE to assess uncooled IR sensor performance; utilize industry approaches for automotive driving aids with applicability to military environments to begin integration of driving aids with sensor/image processing enhancements; validate a personnel/obstacle detection enhanced SA capability for convoy vehicles.			
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. The technologies provided through this effort address human factors/human dimension and provide lower weight, reduced cost, and improved performance for Soldier based sensor systems. ***FY 2016 Plans:*** Design head mounted High Definition (HD) color 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, automated boresighting reticle, and thru sight situational awareness technologies. ***FY 2017 Plans:*** Will demonstrate a see-through, wide field-of-view (FOV), HD color display that interfaces with current standard issue helmet mounts and Smart Battery packs; will integrate an Integrated Sensor Architecture (ISA) interface, which will provide rapid target acquisition during daytime operations by enabling the display to receive input from any dynamically discoverable sensor available on a network; will integrate an Intra Soldier Wireless (ISW) interface to provide heads-up situational awareness by enabling imagery to be wirelessly transferred from a weapon site to the display; will demonstrate the capability of displaying Mission Command Information on the display.	-	5.809	5.935
Title: Advanced Wide Area Search Sensors ***Description:*** This effort matures and demonstrates sensing capabilities that enable platforms to detect, identify, and react to the evolving asymmetric threat to maintain operational momentum. This effort allows combat vehicle commanders and crewmen to detect difficult or concealed small unit threats as well as to identify and apply countermeasures to enable maneuver or response. The effort leverages advanced IR imaging technology, multispectral laser technologies and precise far target location technology to increase target detection and reduce target acquisition timelines. This effort supports the Army's initiatives in new sensing modalities that integrate with existing on board systems for multi-function capabilities, with minimal weight, to enable protected mobility to increase protection against current and emerging threats. This work is a follow on of work from “Advanced Sensors for Precision” to provide an additional level of detail.	-	-	7.707

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2017 Plans: Will mature pre-shot threat detection/suppression imaging sensors and lasers, which identify and eliminate threats before they can engage friendly forces; conduct field demonstration; validate IR sensor jamming techniques; characterize expendable target assets for damage thresholds; assimilate threat information into a single database.			
Accomplishments/Planned Programs Subtotals	29.765	26.740	27.293

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
K86: *Night Vision, Abn Sys*	-	16.291	14.189	17.175	-	17.175	17.333	17.343	17.686	9.878	-	-

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, 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 Program Element (PE) 0602211A (Aviation Technology) PE 0603003A (Aviation Advanced Technology).

Work in this project is performed by the 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 2015	FY 2016	FY 2017
Title: Multifunction Imagers for Rotary Wing	9.692	9.982	-
Description: This effort matures and demonstrates multifunction sensor modules for increased pilotage performance in Degraded Visual Environments (DVE). Multifunction sensor modules provide a lower total life cycle cost than separate individual sensor systems by combining multiple capabilities in a single module. Work in this effort is coordinated with DVE efforts in PE 0602211A, Aviation Technology, Project 47A.			
FY 2015 Accomplishments: Fabricated a dual-purpose Infrared (IR) sensor with the dual speed Read Out Integrated Circuit (ROIC); continued integration of dual-purpose IR sensors with other low-light night vision technology; developed pilotage image processing algorithms in the dual purpose IR sensor; developed threat warning algorithms for use with IR sensor operating at 1000 Hertz frame rate; began flight testing to validate pilotage sensor and processing technologies for performance in degraded visual environments.			
FY 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Complete integration of dual-purpose pilotage and threat warning IR sensors with other low-light night vision technology; characterize performance of threat warning algorithms and pilotage sensors 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. Follow on work in Fiscal Year (FY) 2017 is captured under the title: "Sensors and Sensor Fusion for Rotorcraft DVE Mitigation".			
Title: Local Area ISR for Tactical Small Units ***Description:*** This effort matures and demonstrates sensors that enable simultaneous display of wide and narrow field-of-view (FOV) infrared imagery and image fusion of multiple spectral bands for enhanced situational awareness and the ability to image battlefield laser spot locations for improved targeting accuracy. ***FY 2015 Accomplishments:*** Conducted 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) IR camera; began 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:*** 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. ***FY 2017 Plans:*** Will mature and optimize upgrade designs for existing turret electronics and hardware to provide compatibility (command, control and data handling/processing) with the improved camera modules and associated new capabilities; demonstrate and validate performance of optical components for simultaneous wide and independently steerable narrow field of view capability in preparation for integration into the turret; optimize multi-spectral band fusion approaches for use with high definition 3-band camera module.	4.599	2.207	5.050
Title: Pilotage Sensor Fusion ***Description:*** This effort develops and matures sensor fusion techniques to produce synthetic scene representations that provide greater information content than scenes produced from existing single mode sensor solutions. This is accomplished through the fusion of active and/or passive sensor outputs and the maturation of associated real-time processing algorithms and architectures. ***FY 2015 Accomplishments:***	2.000	2.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Collected field data from multiple sensor modalities (e.g. passive/active infrared, radar, shortwave light detection and ranging) under DVE conditions; identified exploitable features associated with each modality; began development of algorithm approaches to produce synthetic scenes for presentation to the pilot. ***FY 2016 Plans:*** 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. Follow on work in FY17 is captured under the title: "Sensors and Sensor Fusion for Rotorcraft DVE Mitigation".			
Title: Sensors and Sensor Fusion for Rotorcraft Degraded Visual Environment (DVE) Mitigation ***Description:*** This effort leverages work previously accomplished under the "Multifunction Imagers for Rotary Wing" and "Pilotage Sensor Fusion" efforts and will mature sensing and processing approaches to improve pilotage in degraded visual environments. It develops Longwave Infrared (LWIR) imaging sensors capable of providing actionable imagery over a wide range of DVEs. It also demonstrates a distributed aperture sensing (DAS) approach in which sensing modules are placed around the airframe to enable 360 degree coverage and provide information on potential threats and obstacles for increased situational awareness. The effort implements DVE-specific multimodal fusion techniques to leverage the strengths and mitigate the weaknesses of multiple sensor modalities. Work in this effort is coordinated with DVE efforts in PE 060211A, Aviation Technology, Project 47A, and PE 0603003A, Aviation Advanced Technology, Project 313. ***FY 2017 Plans:*** Will mature and demonstrate fusion and DAS approaches utilizing Passive and Active IR, and RADAR sensing modalities; simulate the performance of multiple sensor combinations in DVEs; conduct airborne data collections with collocated Passive and Active IR and RADAR sensors in snow and whiteout degraded conditions; demonstrate baseline DAS scene rendering that combines data from all distributed sensors to form a 360 degree view around the aircraft; demonstrate fusion approaches that combine two and three dimensional sensor data; define the baseline approach for the implementation of sensor fusion and synthetic vision in a real-time environment; conduct trade studies to identify candidates for real-time computing hardware and architectures; exploit and leverage ongoing research in the area of digital read out integrated circuit (D-ROIC) technology to develop a D-ROIC longwave infrared camera to address DVE requirements.	-	-	12.125
Accomplishments/Planned Programs Subtotals	16.291	14.189	17.175

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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*

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603728A *I Environmental Quality Technology Demonstrations*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.311	14.727	11.137	-	11.137	10.382	10.570	10.773	10.989	-	-
002: *Environmental Compliance Technology*	-	3.122	3.278	3.262	-	3.262	2.190	2.336	2.431	2.480	-	-
025: *Pollution Prevention Technology*	-	0.000	1.489	1.489	-	1.489	1.488	1.489	1.489	1.519	-	-
03E: *Environmental Restoration Technology*	-	5.939	5.960	6.386	-	6.386	6.704	6.745	6.853	6.990	-	-
03F: *Environmental Quality Tech Demonstrations (CA)*	-	2.250	4.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 resources 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 matured and demonstrated by this program element improve the ability of the Army to achieve environmental restoration and compliance at its installations, at active or 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 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 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603728A *I Environmental Quality Technology Demonstrations*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	11.445	10.727	11.137	-	11.137
Current President's Budget	11.311	14.727	11.137	-	11.137
Total Adjustments	-0.134	4.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	4.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.134	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 03F: *Environmental Quality Tech Demonstrations (CA)*		
Congressional Add: *Program Increase*	2.250	4.000
Congressional Add Subtotals for Project: 03F	2.250	4.000
Congressional Add Totals for all Projects	2.250	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
002: *Environmental Compliance Technology*	-	3.122	3.278	3.262	-	3.262	2.190	2.336	2.431	2.480	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from Program Element (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, local, and host country environmental regulations and policy. Current and planned efforts enable the Army to efficiently characterize, 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 Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Sustainable Ranges and Lands	3.122	0.303	0.909
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 2015 Accomplishments: Developed and evaluated gray water treatment and reuse system (G-WTRS) designed to reduce water demand and sustainment cost at 600-3000 personnel contingency operating bases; performed pilot scale testing of G-WTRS prototype; conducted baseline flow, water quality, energy consumption, and maintenance testing; optimized G-WTRS design and operation based on pilot scale testing for maximal performance and energy efficiency; facilitated Army Evaluation Center certification of G-WTRS; matured 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; validated standalone models for power,			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
water, waste (solid, sanitary, and hazardous), and protection; matured 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:*** 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. ***FY 2017 Plans:*** Will exploit assessment methodologies that quantify the adaptive capacity of social-ecological systems to understand potential climate change drivers on the continental United Stated (CONUS) and outside of the continental United States (OCONUS) installation security, resilience, and sustainability.			
Title: Adaptive & Resilient Installations ***Description:*** This effort demonstrates sustainable, cost efficient and effective facilities while providing technologies and techniques for achieving resilient and sustainable installation and base operations. Demonstrates the applicability of using automated adaptive construction techniques to impact manpower and materials necessary for contingency construction through the maturation of a prototype additive construction system utilizing cementitious materials. ***FY 2016 Plans:*** 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. Assess the cementitious material requirements and characteristics required for automated additive construction that will be assessed utilizing a rudimentary pre development prototype system. ***FY 2017 Plans:*** Will complete software validations and transition contingency base planning modeling tools to the Army Facilities Components System and to the Joint Construction Management System. Will demonstrate an automated construction capability to print a custom-designed 500 square foot expeditionary structure within 24 hours that will reduce operational logistics demands and improve energy efficiency.	-	2.975	2.353
Accomplishments/Planned Programs Subtotals	3.122	3.278	3.262

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
025: *Pollution Prevention Technology*	-	0.000	1.489	1.489	-	1.489	1.488	1.489	1.489	1.519	-	-

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 more sustainable technologies for surface finishing processes, paints and coatings, cleaning solvents, refrigerants and fire suppressants.

Work in this Project supports the Army Science and Technology 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 Program Element (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, and the Tank Automotive Research, Development and Engineering Center, Warren, MI in conjunction with the Army Public Health Command, Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Pollution Prevention Technology	-	1.489	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 2016 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Conventional Ammunition: qualify lead-free primary explosive from full-scale production lot; Pyrotechnics: Conduct prototype testing for chromate- and lead-free gasless delay formulations in a relevant end item; Toxic Metal Reduction: Conduct firing tests for large caliber gun barrel with hexavalent chromium-free liner. ***FY 2017 Plans:*** Will formulate environmentally sustainable high explosive compositions from kilogram-scale batches of novel energetic materials; will demonstrate non-chromate sealers for use in depot-level maintenance processes; will evaluate commercially available refrigerants with low global warming potential against military-unique flammability and toxicity requirements.			
Accomplishments/Planned Programs Subtotals	-	1.489	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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
03E: *Environmental Restoration Technology*	-	5.939	5.960	6.386	-	6.386	6.704	6.745	6.853	6.990	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from Program Element (PE) 0602720A (Environmental Quality Technology), Projects 835 and 896 by addressing the management and mitigation of materials and chemicals released to the natural environment and the 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, assess, and remediate soil and water at installations, ranges, facilities, and during operations under 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 demonstrate technological feasibility and optimize performance and productivity of the risk mitigation techniques.

Work in this Project supports the Army Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Sustainable Ordnance Mitigation and Management	1.264	1.300	-
Description: This effort develops real time detection and discrimination methodologies for unique and emerging non-metallic unexploded ordinance (UXO).			
FY 2015 Accomplishments: Developed 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:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Validate algorithms for the detection and discrimination of intermediate electrically conductive material (IECM) munitions; and 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 materials. 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 2015 Accomplishments:*** Integrated 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; developed rapid hazard screening tools for new Army compounds. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will mature environmental lifecycle tool for use in developing new materials. Will demonstrate sensor technologies that are field-rugged and long-lasting for accurate assessment of contaminant presence in complex operating environments. Will provide algorithms for sensor systems to auto-populate Environmental Baseline forms as required by the Engineer Field Manual.	1.008	1.100	2.090
Title: Technologies for Sustainable and Green Operations and Acquisition ***Description:*** This effort exploits 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 2015 Accomplishments:*** Developed cost-effective, efficient, and integrative tools for remediation of contaminated wastewater from insensitive munitions production. Tools are transitioned 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:***	1.893	2.089	1.908

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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. Mature predictive models and computational tools to assess surface water characterization and contaminate potential in austere environments. ***FY 2017 Plans:*** Will validate novel treatment approaches with reactive membrane materials and mature an operational prototype effluent treatment system that will minimize water demand and minimize decontaminated waste.			
Title: Risk Prediction and Decision Technologies ***Description:*** This effort matures and provides integrated science and technology solutions to Army environmental challenges with a focus on predicting the environmental attributes of emerging chemicals and materials, predictions that inform acquisition lifecycle models in order to minimize impacts to the mission and to the Soldier. ***FY 2015 Accomplishments:*** Developed and demonstrated 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:*** Mature experimental protocols and characterization factors in new small arms formulations for environmental risk determination; mature and demonstrate software for interpreting life cycle impact assessment calculations using decision support tools. ***FY 2017 Plans:*** Will begin demonstration of fate and transport models of contaminant movement and persistence in the environment using a novel soils informatics approach. Will begin expansion of the environmental lifecycle assessment methodology beyond new materials to weapons system approaches.	1.774	1.471	2.388
Accomplishments/Planned Programs Subtotals	5.939	5.960	6.386

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
03F: *Environmental Quality Tech Demonstrations (CA)*	-	2.250	4.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2015	FY 2016
Congressional Add: Program Increase	2.250	4.000
FY 2015 Accomplishments: Program increase. Developed knowledge and tools that inform regulatory, liability risk, and management decisions related to the development and transition of advanced materials including engineered nanomaterials.		
FY 2016 Plans: Program increase.		
Congressional Adds Subtotals	2.250	4.000

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603734A *I Military Engineering Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	17.124	26.845	20.684	-	20.684	22.416	22.817	23.184	23.648	-	-
T08: *Combat Eng Systems*	-	17.124	20.145	20.684	-	20.684	22.416	22.817	23.184	23.648	-	-
T13: *Stationary Power & Energy Tech Demonstrations (CA)*	-	0.000	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	0.000	4.200	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 on 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; 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 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 Army Engineer Research and Development Center, Vicksburg, MS.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army	Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A *I Military Engineering Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	17.606	20.145	20.684	-	20.684
Current President's Budget	17.124	26.845	20.684	-	20.684
Total Adjustments	-0.482	6.700	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	6.700			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.482	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: T13: *Stationary Power & Energy Tech Demonstrations (CA)*		
Congressional Add: *Natural Gas Research*	-	2.500
Congressional Add Subtotals for Project: T13	-	2.500
Project: T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*		
Congressional Add: *Program Increase*	-	4.200
Congressional Add Subtotals for Project: T15	-	4.200
Congressional Add Totals for all Projects	-	6.700

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T08: *Combat Eng Systems*	-	17.124	20.145	20.684	-	20.684	22.416	22.817	23.184	23.648	-	-

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 Science and Technology 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 the Office of the Secretary of Defense (OSD) Program Element (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 Army Engineer Research and Development Center, Vicksburg, MS.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Title: Geo-Enabled Mission Command Enterprise	5.051	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 Department of Defense (DoD) and increases situational awareness of the operational environment in support of mission planning and operations. ***FY 2015 Accomplishments:*** Evaluated and matured 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:*** 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: Map-Based Planning Services (MBPS)	-	-	1.807
Description: This effort matures geospatially enabled, collaborative mission planning capabilities providing services, data, and information to Army planners, staffs, and leaders. These mission planning capabilities will allow collecting, processing, storing, displaying, and sharing of authoritative data and information in a geo-temporal context. Work will leverage a Standard Shareable Geospatial Foundation (SSGF) provided by the Army Geospatial Enterprise (AGE) and incorporate Geo-Enabled Mission Command tools and analytical capabilities. This effort continues work that was part of Geo-Enabled Mission Command Enterprise and matures work in PE 0602784 Project 855. ***FY 2017 Plans:*** Will conduct MBPS demonstrations of geospatially enabled, collaborative mission planning capabilities (strategic and operational force deployment and employment) within the AGE Node, a node with streamlined geospatial standards that provides services, data, information, and other outputs to Army organizations and activities (e.g. Army Geospatial Center, Army Mission Command Centers of Excellence, programs of record, and others).			
Title: GeoIntelligence - Enabling Technology Demonstration	-	-	0.750

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Description: This effort provides demonstration of analytic tools and algorithms that use multi-source (e.g. optical, lidar), multiplatform (e.g. satellite, light Unmanned Aerial Vehicle (UAV)), multi-temporal image sources to build urban tactical decision aids suitable for use on mobile devices to provide geospatial analysis to the Army, other Services, and DoD, in support of mission planning and operations (such as small units in an urban setting). This effort continues work that was part of Geo-Enabled Mission Command Enterprise. ***FY 2017 Plans:*** Will demonstrate tailored geospatial tools used to develop analytical products and capabilities that enhance Warfighter movement and situational awareness at the tactical level, to include rapid processing and searching of high volume multi-modal spatiotemporal datasets, a class of datasets critical for the development of analytic tools associated with geospatial intelligence, climate change, natural hazards, and critical infrastructures.			
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 0603005/221 and 0602601/C05 in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC). ***FY 2015 Accomplishments:*** Demonstrate live fire full-scale model benchmark tests for evaluation, and model validation under a range of soil and operational threat conditions.	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 2015 Accomplishments:*** Demonstrated simulation capability to enable rapid remote assessment of real-time structural capacity of infrastructure (airfields, ports, and roads), river, estuary, and near shore; demonstrated initial assessment of littoral environments for entry operations; demonstrated initial austere airfield point of debarkation (APOD) assessment geospatial overlay capability to the Instrument Set, Reconnaissance, and Surveying (ENFIRE) program; and demonstrated reduced-order hydrodynamic models for an operational littoral environment. ***FY 2016 Plans:***	4.629	4.886	6.319

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
Demonstrate technologies for planning and conducting anti-access/area denial entry operations with non-existent, damaged, or destroyed infrastructure. 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. ***FY 2017 Plans:*** Will demonstrate operationally-optimized terrain surfacing kits for application at seaports of debarkation. Will demonstrate decision support tools that allow exploitation of multimodal (e.g. infrared, hyperspectral, radar, Light Detection and Ranging (LiDAR)) sensor data for remote/standoff assessment of airfields and seaports. Will demonstrate optimized terrain surfacing kits for upgrade of air- and sea ports of debarkation (A/SPOD) as well as rapid- and scalable repair kits for airfield craters. Will mature and demonstrate decision support tools for remote assessment of infrastructure. Will mature data processing and engineering assessment algorithms using data from existing aerial and marine surveillance systems to provide refined tactical-level assessments of potential A/SPOD.			
Title: Adaptive Protection Demonstrations	6.944	7.754	6.808
Description: This effort demonstrates protection solutions for critical assets, including fixed and semi-fixed facilities. A focus will be on technologies to defeat new advanced weapons threats. Technologies 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 Accomplishments:*** Demonstrated the use of indigenous materials from areas of interest in protective construction for critical assets against effects of new advanced weapons threats; demonstrated initial force protection basing planning and protective construction for combat outposts to increase survivability of personnel and equipment against rocket and mortar attack; demonstrated 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 demonstrated capability to construct expedient protection solutions for combat outposts and evaluate manpower requirements. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will demonstrate improved standardized protective construction methods and preconfigured kits when compared to current systems. Will demonstrate developed overhead cover, revetments, and shelters for force protection basing. Will demonstrate			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
improved methods for structural hardening with logistics and cost savings compared to current cast-in-place capability. Will demonstrate linear sensor systems for perimeter security against enemy 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 for different Army missions in various geographic settings worldwide; provide input to and 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:*** Mature and demonstrate environmental scenario generation "tool-set one" based on a select set of missions within a geographical area and Army systems of interest; identify and craft initial operational scenarios and conduct functional decomposition to generate a subset of key missions for system(s) of interest in concert with Army collaborators and processes and 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. ***FY 2017 Plans:*** Will demonstrate a computational model builder with a simulation workflow manager to enable complex environmental simulations to assist with tradespace studies. Will demonstrate an initial tradespace analysis capability for sensors in a dense vegetation operational scenario. Will demonstrate an initial tradespace analysis capability for Army systems of interest, ground vehicles or watercraft.	-	5.000	5.000
Accomplishments/Planned Programs Subtotals	17.124	20.145	20.684

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T13 / *Stationary Power & Energy Tech Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T13: *Stationary Power & Energy Tech Demonstrations (CA)*	-	0.000	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

Congressional special interest projects to mature and demonstrate advanced military engineering and geospatial research and engineering technologies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Natural Gas Research	-	2.500
FY 2016 Plans: Program Increase for Natural Gas Research		
Congressional Adds Subtotals	-	2.500

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 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	0.000	4.200	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

These are Congressional Interest Items for Military Engineering Technology Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	-	4.200
FY 2016 Plans: Program Increase		
Congressional Adds Subtotals	-	4.200

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603772A *I Advanced Tactical Computer Science and Sensor Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	38.098	38.147	44.239	-	44.239	52.496	50.876	52.497	53.437	-	-
101: *Tactical Command and Control*	-	18.736	14.992	17.997	-	17.997	19.539	20.678	21.514	21.864	-	-
243: *Sensors And Signals Processing*	-	19.362	23.155	26.242	-	26.242	32.957	30.198	30.983	31.573	-	-

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 software, algorithms, services and devices to more effectively integrate MC across all echelons and enable more effective utilization of Warfighter resources including intelligent power management and distribution 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 complementary with 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 2017 Army					Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603772A *I Advanced Tactical Computer Science and Sensor Technology*		
B. Program Change Summary ($ in Millions)	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	39.149	38.163	40.239	-	40.239
Current President's Budget	38.098	38.147	44.239	-	44.239
Total Adjustments	-1.051	-0.016	4.000	-	4.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.051	-			
• Adjustments to Budget Years	-	-0.016	4.000	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
101: *Tactical Command and Control*	-	18.736	14.992	17.997	-	17.997	19.539	20.678	21.514	21.864	-	-

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 positioning, navigation, and timing (PNT) and power and energy resource information while keeping in mind the cognitive limit of the Soldier's use of software, algorithms and services optimized for expeditionary and uninterrupted mission command.

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 2015	FY 2016	FY 2017
Title: Integrated Mission Command (MC)	14.709	10.414	9.421
Description: This effort matures and demonstrates technologies to simplify MC software and hardware and reduce complexity in all battlefield environments, to include command post (CP), mounted, and dismounted operations. Work accomplished under Program Element (PE) 0602782A/Project 779 complements this effort.			
FY 2015 Accomplishments: Coded, integrated, and validated a Company level (dismounted, mounted, CP) MC suite to provide actionable intelligence and timely information sharing over a Company level low bandwidth tactical network; coded and integrated additional decision support and collaboration tools, including knowledge management and necessary database connections, that increased situational awareness/understanding, decreased tactical surprise and delivered pertinent mission information from dismounted to the CP; validated 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, coded, integrated, and validated an enhanced MC suite of collaborative software tools that allows for faster and more accurate target identification and handoff, real time alerts,			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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:*** 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; 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; demonstrate both CP and vehicle instantiations of the mission equipment package to examine strengths/weaknesses and trade-offs between the two; 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. ***FY 2017 Plans:*** Will mature, and demonstrate innovative designs for Army CPs that are quicker/easier to set up and tear down, may be moved more quickly, can be easily customized for unique mission needs, and facilitate the rapid deployment of forces away from well-established bases (expeditionary operations); evaluate, design, integrate and demonstrate computer server hardware that will simplify CP setup, minimize needed computer and network configuration, and provide higher computer reliability; mature and demonstrate computer software that will provide the commander with needed information regardless of the commander's location, (in a CP, in a vehicle, or dismounted); demonstrate enhanced software collaboration tools that enable commanders and staffs to share ideas and information when they are not collocated by using voice, gestures, text, and maps across multiple digital device types (phones, tablets, laptops, and computers); optimize and demonstrate mobile user interfaces and advanced modes of human-computer interaction that make it easier to understand the presented information to simplify decision making.			
Title: Battle Space Awareness and Positioning ***Description:*** This effort matures, demonstrates and performs modeling and simulation of position, navigation and timing (PNT) technologies to provide access to trusted PNT information in GPS denied or degraded environments. Work being accomplished under PE 0602782A/project 779 complements this effort. ***FY 2015 Accomplishments:*** Demonstrated 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; integrated 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; evaluated advanced anti-jam antennas and Military Code (M-Code) GPS	4.027	4.578	6.576

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
receivers integrated with multi-global navigation satellite system receivers; designed, coded, and developed interfaces, protocols and software for networked navigation devices to share information and enhance navigation solutions for network users. ***FY 2016 Plans:*** 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 pseudolites for both ground and airborne platforms and anti-jam antenna performance while reducing size, weight and cost for mounted and dismounted platforms. ***FY 2017 Plans:*** Will assess the performance of anti-jam antennas on various mounted platforms to understand the benefits and tradeoffs of each configuration; validate the design and integration of dismounted PNT systems to determine the best configuration for reduced size, weight, and power (SWaP) and optimal sensor placement, to include ranging sensors, vision navigation sensors, and velocimeters; in conjunction with the Air Force, demonstrate M-code receivers for mounted application to show the increased performance and operation in challenge/denied environments; demonstrate Blue Force Electronic Attack capabilities with M-code receivers and provide PNT solutions that support navigational warfare requirements for Army systems; improve the integration of PNT sensor processing from multiple sensors through advanced sensor fusion techniques to provide an accurate, robust, and difficult to jam system that can be implemented on different pseudolite platforms; mature pseudolite navigation technologies to increase performance by incorporating Military GPS User Equipment and additional navigation sensors; exploit advances in technologies to reduce SWAP for mounted PNT solutions including supporting hardware convergence efforts; demonstrate a PNT simulation architecture and framework to integrate and execute models in system of systems scenarios to analyze performance of PNT components when integrated into Army and other Service systems.			
Title: Advanced Intelligent Power Management & Distribution ***Description:*** This effort matures and demonstrates advanced power management and distribution technologies as well as validates and integrates designs in prognostics and diagnostic capabilities and novel power distribution. Work accomplished under PE 0602705A/project H11 complements this effort. ***FY 2017 Plans:*** Will conduct assessment of advanced renewable, alternative fuel, high fuel-efficiency power systems to improve performance of base power systems while further reducing logistics footprint; mature, code and demonstrate optimized software and algorithms as a status monitoring system to identify faults and errors in a power generation system to augment operational situational	-	-	2.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
awareness for the unit commander with increased and timely mission power and energy status; mature predictive-analysis modeling software to validate and demonstrate the capability to select and employ energy sources attached to a tactical power grid system during the planning and execution mission phases as an efficient and integrated system for managing operational power.			
Accomplishments/Planned Programs Subtotals	18.736	14.992	17.997

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 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
243: *Sensors And Signals Processing*	-	19.362	23.155	26.242	-	26.242	32.957	30.198	30.983	31.573	-	-

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 ground and aerial platforms and individuals, 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), multiple intelligence (Multi-Int) 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 2015	FY 2016	FY 2017
Title: Collaborative Intelligence, Surveillance and Reconnaissance (ISR) Sensors	10.160	9.059	3.318
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 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 Program Element (PE) 0602270/Project 906 complements this effort.			
FY 2015 Accomplishments: Conducted 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; established a software development process to mature new and alternative concepts for increasing the information content of radar data and tracks; conducted an assessment to determine an optimal design of a multi-static beamforming radar; assessed 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); developed requirements for doppler			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
resolution, search volume and update rate for improvements that are necessary for the system to perform a counter UAS mission; developed 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; researched 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:*** Examine methods for enriching meta-data from 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. ***FY 2017 Plans:*** Will complete analysis for enriching MTI track meta-data and information content; develop data manipulation and presentation techniques to enhance user acceptance of track based workflows; use modeling and simulation to analyze and improve algorithm performance, mature and demonstrate in a collaborative laboratory environment SIGINT and radar fusion utilizing Multi-Int algorithms developed and built on the initial processing exploitation and dissemination architecture to improve operator productivity and provide greater track confidence to the intelligence analyst.			
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 Accomplishments:*** Designed a stationary airborne MTI penetrating radar capability for use on a fixed wing, moving platform; conducted modeling and simulation to evaluate processing techniques that could be applied to the fixed wing MTI scenario. ***FY 2016 Plans:*** 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	2.769	5.157	4.425

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
and GMTI for optimized utility under anticipated operational conditions; identify techniques for waveform optimization to mitigate spectrum challenges. ***FY 2017 Plans:*** Will continue to mature modeling and simulation efforts of subsystem and system level hardware radar designs; continue to incrementally mature component and subsystems and integrate them into a system brassboard demonstrator; complete antenna design and begin element range assessments by collecting real and simulated data to assess progress with respect to integration of both hardware and software at the signal processor.			
Title: Advanced All Source Fusion ***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 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 complements this effort. ***FY 2015 Accomplishments:*** Developed software tools and analytics to produce intelligence products from big data sets (e.g., biometric databases); integrated Company Intelligence Support Team workflow tools, predictive analytics and data distribution services into the previously defined, network constrained environment; demonstrated integrated automated exploitation and fusion analysis tools, intelligence to SA transformation services, threat prediction software, and enterprise data feeds, quantified the improved ability of the end users to execute their missions and documented the performance of the capabilities being demonstrated. ***FY 2016 Plans:*** Develop integration specifications for a virtualized, automated, full spectrum analytic agent for big data sources; integrate and mature software and algorithms to visualize (e.g., location, orientation, field of view) and virtually task all collection assets, across echelons and classification domains, in synchronization with MC and title authority control systems; mature intelligence 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. ***FY 2017 Plans:*** Will mature and demonstrate in a relevant environment an initial processing exploitation and dissemination architecture and framework capable of supporting both air and ground platforms; encode and mature collaborative intelligence software for data fusion, analysis and dissemination services that extend across echelons (i.e., tactical to theater) and into the broader intelligence	6.433	6.939	4.055

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
enterprise; mature and demonstrate the application programming interfaces necessary for efficient intelligence data integration and alignment with the framework.			
Title: Multi-mode Air Defense Radar Demonstration ***Description:*** This effort matures 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 and area/base camp protection. Work being accomplished under PE 0602270A/project 906, 0602120A/project H16, 0602705A/projects EM8 and H94, 0602303A/project 214 and 0603270A/project K16 complements this effort. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will mature common hardware and software interface specifications for the scalable radar open system architecture; complete initial back end signal processor system integration; optimize modeling and simulation for real-time back-end processing to utilize in laboratory assessments/demonstrations and mature a software development kit/mode development kit (tools and well defined interfaces) to allow non-proprietary integration of radar capabilities and modes such as identification friend or foe, counter fire target acquisition and air defense artillery algorithms and techniques; mature software algorithms to classify (using both radar and electronic warfare data) and track unmanned aerial systems and demonstrate capability in a relevant environment during a maneuver and fires integration exercise.	-	2.000	7.644
Title: Degraded Visual Environment (DVE) – Air ***Description:*** This effort matures and demonstrates software and hardware for a millimeter wave radar system (conformal phased array radar) to provide obscurant penetration for terrain and object awareness while providing pilotage aids in all degraded visual environments. Work accomplished under PE 0603710A/project K86 and 0603003A/project 313 complements this effort. ***FY 2017 Plans:*** Will conduct radar trade space analysis and finalize existing radar selection for DVE radar application; mature software to provide capability for DVE operations (formation flight, all environments, 360 degrees of situational awareness), focusing on the cable/obstacle avoidance, terrain following/terrain avoidance, and Global Positioning System (GPS) denied navigation modalities; begin	-	-	4.800

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
radar integration efforts into a multiple sensor system (i.e., radar, light detection and ranging (LIDAR), electro-optic infrared) DVE demonstrator.			
Title: Intelligence Processing and Architecture Modernization ***Description:*** This effort will leverage Intelligence Community (IC) investments in software frameworks and exploits against threat signals of interest (SOIs) to develop a library of open, modular, and scalable software solutions to address identified capability gaps and to provide the commander electronic situational awareness while at the same time protecting his assets from enemy deception and jamming. Work accomplished under PE 0602270A/project 906 and 0603270A/project K15 complements this effort. ***FY 2017 Plans:*** Will optimize and demonstrate current high frequency (HF) exploit capabilities on the next generation RF converged architecture; adapt and mature software solutions to search, intercept, and direction find (DF) three priority SOIs identified within the Army SIGINT Modernization Plan.	-	-	2.000
Accomplishments/Planned Programs Subtotals	19.362	23.155	26.242

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 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603794A / *C3 Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	37.816	35.775	-	35.775	36.880	36.520	41.475	42.355	-	-
EL4: *Tactical Comms and Networking Technology Int*	-	0.000	23.229	19.769	-	19.769	20.822	17.805	22.390	22.888	-	-
EL5: *Secure Tactical Information Integration*	-	0.000	14.587	16.006	-	16.006	16.058	18.715	19.085	19.467	-	-

Note

Efforts in this Program Element (PE) were transferred from PE 0603008A beginning in Fiscal Year (FY) 2016 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 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 matures and integrates antennas, wireless networking devices, protocols, and software; network operations tools and techniques; and combines these with current fielded program of record networks and systems in a series of command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) network modernization demonstrations to measure their technology readiness levels (TRLs) up to TRL6 and assess them against currently fielded network architectures in an operationally relevant environment. Project EL5 matures information security devices, techniques, services, software and algorithms to protect tactical wired and wireless networks against modern network attacks; generates and distributes 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 complementary 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 2017 Army					Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603794A *I C3 Advanced Technology*		
B. Program Change Summary ($ in Millions)	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	0.000	37.816	38.775	-	38.775
Current President's Budget	0.000	37.816	35.775	-	35.775
Total Adjustments	0.000	0.000	-3.000	-	-3.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-3.000	-	-3.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
EL4: *Tactical Comms and Networking Technology Int*	-	0.000	23.229	19.769	-	19.769	20.822	17.805	22.390	22.888	-	-

Note

Efforts in this Project were transferred from Program Element (PE) 0603008A Project TR1 beginning in Fiscal Year (FY) 2016.

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 2015	FY 2016	FY 2017
Title: Antenna and Hardware Technologies	-	4.350	3.995
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 the number of antennas required on platforms by proving the capability to transmit and receive on multiple frequency bands. This effort also matures small form factor interference mitigation hardware for compatibility between communications and EW systems. Work accomplished under PE 0602782A/project H92 complements this effort. This effort transferred from PE 0603008A/project TR1 in FY16.			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
FY 2016 Plans: Perform extensive assessments and demonstrate distributed on-the-move satellite communications (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. ***FY 2017 Plans:*** Will develop and release for comment, to industry and other Government partners, a Government standard architecture for distributed SATCOM arrays to enable interoperability between various transceivers and antenna arrays; will fabricate a demonstrator of a digital intermediate frequency (digital IF) common hardware SATCOM terminal to facilitate flexibility and performance improvements, such as porting of SATCOM waveforms to the digital IF terminal.			
Title: RF Interoperability Through Convergence	-	3.000	4.144
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 0603270A/Project K16 complements this effort. This effort transferred from PE 0603008A/ Project TR1 in FY16. ***FY 2016 Plans:*** 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). ***FY 2017 Plans:*** Will leverage the radio reference architecture, specification and application program interfaces to begin software application development with commercial suppliers; begin in-house Army development of more sensitive application scenarios, such as applications that leverage coordinated control of communications and EW hardware resources to eliminate interference; mature			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
reference architecture for RF hardware/software convergence, addressing distribution of RF components across the vehicle; implement Vehicle Integration for C4ISR/EW Interoperability (VICTORY) authentication and authorization component types into the RF hardware/software convergence architecture; mature VICTORY compliant algorithms and complete development of a VICTORY compatible RF switch to direct RF signals between components, such as software defined radios, power amplifiers and antennas, based on radio provided information and other on-platform systems; provide a more realistic RF convergence demonstration, moving from a laboratory vehicle mock-up to an actual demonstrator vehicle, and with an expanded set of C4ISR applications.			
Title: C4ISR On-The-Move (OTM) ***Description:*** This effort provides a venue for the demonstration of new and emerging C4ISR technologies. This venue performs field based risk reduction (FBRR) and technical readiness assessments (TRAs) by evaluating the TRLs of candidate Army science and technology (S&T) and best of Industry efforts to support tactical network modernization. The yearly themes for the integrated capabilities event are determined by the maturity of the tech base programs across the Army S&T Command, Control, Communications, and Intelligence (C3I) portfolio. On an annual basis, those programs at or approaching TRL 6 will be solicited for participation based on their maturity to enter TRA in the FBRR environment located at Joint Base McGuire-Dix-Lakehurst (JB-MDL) (Fort Dix). Upon the completion of technology selection, themes will be developed that inform CERDEC Thrust Areas, Army Warfighting Challenges, TRADOC key technology imperatives, and the overall development of the Mission Command Network of 2025 and beyond. This effort transferred from PE 0603008A Project TR1 in FY16. ***FY 2016 Plans:*** 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. ***FY 2017 Plans:*** Will assess, mature, and demonstrate early operations-intelligence network convergence concepts in a real field environment, provide early performance feedback to S&T programs that require robust tactical networks; apply FBRR techniques to the integration of new technologies developed by Army S&T as well as adapting/adopting the best commercial products to provide rigorously evaluated systems for soldier assessment; assess and validate the performance of new S&T systems and provide data to determine the appropriate TRL to assure that leadership has the right information to make critical acquisition decisions;	-	8.846	7.849

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
serve as a precursor event for S&T efforts that will later participate in Network Integration Evaluations to assure that problems are identified early enough to be corrected before further assessment. This is in compliance with the Government Accountability Office recommendation for FBRR, citing that money can be saved by doing more "early" up front work to reduce risk, which is consistent with the mission of the C4ISR OTM effort.			
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 SATCOM systems. Efforts also include adapting commercial wireless technology for use in the tactical environment. Work accomplished under PE 0602782A/project H92 and 0603794A EL5 complements this effort. This effort transferred from PE 0603008A/project TR1 in FY16. ***FY 2016 Plans:*** 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 (GPS)-denied environment. ***FY 2017 Plans:*** Will mature technologies, such as directional networking, narrowband voice and position/location information capability, for robust ground communications with efficient use of spectrum in a spectrum contested environment; develop and integrate tactical multifunction waveforms for terrestrial radios enabling coordinated C4ISR/EW functions that provide improved interoperability between RF functions, robust performance and spectrum efficiency; develop and mature software tools that simulate tactical networking conditions (i.e., latency, delay, jamming, cosite interference) to provide a high fidelity network modeling and simulation environment that enables large-scale tactical network analysis and data collection in realistic operational scenarios.	-	4.033	2.781
Title: Networking technologies for Wireless Personal Area Networks (WPAN) ***Description:*** This effort develops and matures 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	1.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Complete evaluations of WPAN system designs for performance, reliability and security; finalize specification and architecture development of WPAN hardware interfaces and software; inform 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. ***FY 2017 Plans:*** Will mature and assess low cost small form factor Intra Soldier Wireless (ISW) personal communication system design for performance, reliability and security; implement hardware interfaces, software and standards for security for ISW communication systems; begin efforts to extend the ISW technologies to develop more efficient inter Soldier wireless capabilities.			
Accomplishments/Planned Programs Subtotals	-	23.229	19.769

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 2017 Army										Date: February 2016		
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
EL5: *Secure Tactical Information Integration*	-	0.000	14.587	16.006	-	16.006	16.058	18.715	19.085	19.467	-	-

Note

Efforts in this project were transferred from Program Element (PE) 0603008A Project TR2 beginning in Fiscal Year (FY) 2016.

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 2015	FY 2016	FY 2017
Title: Tactical Defensive Cyber	-	14.587	9.006
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 0602782A/Project H92, PE 0602783A/Project Y10 and PE 0603794A/Project 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 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
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 United States 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. ***FY 2017 Plans:*** Will integrate and mature software tools tailored for the disadvantaged, intermittent and latent (DIL) tactical networking conditions that are sanctioned by NSA to increase software assurance posture while reducing time and cost of delivering secure software products to the tactical warfighter; integrate and mature robust software solutions to identify, prevent and protect role-based tactical systems from insider threats and malicious behaviors and actions; mature threat modeling to predict where and how attackers may react to a network maneuver, integrate and mature software tools and a framework to easily identify vulnerabilities during development and integration with third party software to detect potential vulnerabilities prior to the software being used on Army networks, implement and mature a software based encryption for low/no size, weight, and power (SWaP) encryption on Army use devices, implement and mature anomaly detection modules to integrate sensors into tactical servers that currently do not support Host Based System Security to complement existing signature based protection capabilities to minimizing impact of zero day attacks.			
Title: Cyber Electromagnetic Activity (CEMA) Situational Awareness (SA) ***Description:*** This effort matures and demonstrates software, architectures and frameworks in support of CEMA SA for both defensive and offensive cyber operations. This effort is coordinated with PE 0602270A/Project 906, PE 0602783A/Project Y10, PE 0603008A/Project TR1 and Project TR2 and PE 0603270A/Project K15. ***FY 2017 Plans:*** Will mature software that employs techniques for data sharing and collaboration between offensive and defensive cyber operations and across security boundaries to enable advanced warning of threats and coordinated defensive and offensive cyber response; develop and mature an integrated suite of analytic algorithms and software tools for blue/gray/red CEMA situation	-	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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 2015	FY 2016	FY 2017
awareness; mature and optimize Defensive Cyber Operations (DCO) analytic algorithms and software tools to identify and correlate threats and attacks against Army tactical systems and networks; mature architectural specifications and interfaces for interconnection of cyber sensors, data management and visualization software capabilities, and analysis to inform ongoing DCO SA doctrinal and requirement generation.			
Title: Tactical Public Key Infrastructure (PKI) and Cryptography ***Description:*** This effort matures and demonstrates PKI and cryptographic technologies tailored for the tactical environment. Work being performed under PE 0602782A/Project H92 and PE 0602783A/Project Y10 complement this effort. ***FY 2017 Plans:*** Will develop software to provide Soldiers the ability to automate, monitor, manage, validate and implement public key infrastructure in tactical networks; integrate and mature software based encryption techniques sanctioned by NSA that are tailored for the DIL tactical networking conditions.	-	-	3.000
Accomplishments/Planned Programs Subtotals	-	14.587	16.006

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A