Department of Defense
Fiscal Year (FY) 2018 Budget Estimates

May 2017

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, $9,544,808,000 to remain available for obligation until September 30, 2019.

The following Justification Books were prepared at a cost of $250,916: 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.

Intentionally Left Blank

FY 2018 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 2018.

2. **Relationship of the FY 2018 Budget Submitted to Congress to the FY 2017 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:

Budget Activity	OSDPE/Project	Project Title
01	0601104A/FF5	Distributed Collaborative Intelligent Systems CTA
01	0601104A/FF7	Internet of Battlefield Things CTA
03	0603001A/FF6	Individual Protection
03	0603009A/FH1	Tractor Hike
04	0603639A/XT5	30mm Anti-Personnel and Counter-Air
04	0603645A/EV7	Combat Vehicle Prototyping
04	0603807A/VS7	MEDEVAC Mission Equipment Package (MEP) - Adv Dev
04	0604017A/FD2	Soldier Robotics Systems
04	0604017A/FD3	Battery Modernization & Interface Standardization
04	0604017A/FD9	Robotics Systems

Budget Activity	OSDPE/Project	Project Title
04	0604117A/FI4	Maneuver – Short Range Air Defense (M-SHORAD)
04	0604120A/EJ3	ANTI-JAM ANTENNA
04	0604121A/FD6	Synthetic Training Environment Refine & Prototype
05	0604601A/FF2	Small Arms Fire Control
05	0604601A/FI2	Lightweight 30mm Cannon
05	0604604A/H07	Family Of Med Tac Veh
05	0604768A/688	ATACMS BLK II
05	0604768A/P01	MULTI - MODE SEEKER DEVELOPMENT AND TEST
05	0604802A/EW1	40mm LV High Explosive Air Burst, XM1166
05	0604802A/FA6	30mm Lethality
05	0604804A/FG4	Ultra-Lightweight Camouflage Net System (ULCANS)
05	0604818A/ER9	Expeditionary Army Command Post
05	0604823A/L87	Hypervelocity Projectile System
05	0604852A/FE8	Vehicle Protection Suite
05	0605013A/VR3	ASMIS-R (REPORTIT)
05	0605037A/EQ6	Evidence Collection and Detainee Processing
05	0605053A/FB2	Man Transportable Robotic System (MTRS) Inc II
05	0605053A/FB3	Robotics Architecture
05	0605053A/FB4	Common Robotic Systems
05	0605053A/FB6	Squad Multipurpose Equipment Transport (SMET)
05	0605053A/FB7	Robotics Enhanced Program (REP)
05	0605053A/FB8	Soldier Borne Sensor (SBS)

Budget Activity	**OSDPE/Project**	**Project Title**
05	0605053A/FB9	MTRS Standardization
05	1205117A/FG3	Tractor Bears
06	0606001A/FD4	Military Ground-Based CREW Technology
07	0203735A/280	RECOV VEH IMPROV PROG
07	0203735A/431	M113 IMPROVEMENTS
07	0203743A/FF9	PIM Improvement Program
07	0203802A/788	ATACMS PIP
07	0205412A/EE6	Environmental Information Tech Modernization
07	0303028A/FG2	Counterintelligence & Human Intel Modernization
07	0303140A/FF8	Unit Activity Monitoring (UAM)
07	0305172A/XT9	Combined Advanced Applications

B. Program Element/Project Restructures:

Budget Activity	Old OSDPE/Project: Title	New OSDPE/Project: Title
04	0603308A/990: Space and Missile Defense Integration	1206308A/FE5: Space and Missile Defense Integration
04	0603308A/EB7: Army Space System Enhancement/Integration	1206308A/FE6: Army Space System Enhancement/Integration
04	0305219AMQ1: MQ-1 Gray Eagle – Army UAV (MIP)	0603804A/EW8: Armored Engineer Vehicles
05	0604201A/VU3: Networking and Mission Planning	0604201A/EW7: Degraded Visual Environment
05	0603639A/EB8: OWL for Small Caliber Ammunition	0604802A/EP4: One-Way Luminescence For Small Caliber Ammo
05	0603639A/EU2: Improved Multi-Option Fuze (iMOFA/iMOFM)	0604802A/EU8: Improved Multi-Option Fuze
05	0604827A/S65: Platoon Power Generator	0604827A/EY2: Integrated Soldier Power Data System Core
05	0604827A/S65: Platoon Power Generator	0604827A/EY4: Universal Battery Charger
05	0203735A/EE2: Stryker Improvement	0604852A/XU9: Active Protection System
05	0605013A/738: AcqBiz	0605013A/FE9: ALTESS (P & R Forms)
05	0603627A/E79: Smoke/Obscurant System	0605038A/EQ7: NBC Reconnaissance Vehicle (NBCRV)
05	0605051A/ER8: Common Missile Warning System (CMWS)	0605049A/XT4: Advanced Threat Detection System (ATDS)
05	0303142A/EA3: Transportable Tactical Cmd Comms (T2C2)	0605766A/EX7: Air Vigilance System Development
06	0605898A/M03: Command HQ - MRDC	0605898A/XW7: Command HQ - ARI
06	0605301A/DX2: Army Kwajalein and Mission Support	0606002A/XW9: Reagan Test Site
07	0303142A/253: Dscs-Dcs (Phase II)	1203142A/FE1: Dscs-Dcs (Phase II)
07	0303142A/456: MILSATCOM System Engineering	1203142A/FE2: MILSATCOM System Engineering
07	0303142A/EA3: Transportable Tactical Cmd Comms (T2C2)	1203142A/FE4: Enroute Mission Command
07	0208053A/635: Joint Tact Grd Station P3I (MIP)	1208053A/FE7: Joint Tact Grd Station-P3I(MIP)
07	0305219A/RQ7: RQ-7 Shadow UAV	0607143A/EX1: Unmanned Aircraft Systems Universal Products

C. Program Terminations:

Budget Activity	OSDPE/Project	OSDPE Title/Project Title
01	0601104A/H53	University & Industry Rsch Ctrs / Army High Performance Computing Research Center
01	0601104A/H53	University & Industry Rsch Ctrs / Micro-autonomous Systems Technology (MAST) CTA
05	0604601A/S62	Infantry Support Weapons / Counter-Defilade Target Engagement - SDD

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.

Intentionally Left Blank

Department of Defense
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Appropriation	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO
Research, Development, Test & Eval, Army	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600
Total Research, Development, Test & Evaluation	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600

Department of Defense
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Appropriation	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Research, Development, Test & Eval, Army	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808
Total Research, Development, Test & Evaluation	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of Defense
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Summary Recap of Budget Activities	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO
Basic Research	450,831	428,943	428,943				
Applied Research	1,070,349	907,574	907,574				
Advanced Technology Development	1,113,746	930,065	943,365				
Advanced Component Development & Prototypes	499,287	550,635	566,835	9,375	25,395		25,395
System Development & Demonstration	2,202,652	2,265,094	2,393,383	84,043	288,443	-78,700	209,743
RDT&E Management Support	1,259,926	1,136,134	1,161,991				
Operational Systems Development	1,264,953	1,296,954	1,462,929	7,104	18,484		18,484
Undistributed		32,395	32,395	-99,022	-99,022		-99,022
Total Research, Development, Test & Evaluation	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600
Summary Recap of FYDP Programs							
General Purpose Forces	802,086	618,038	697,138		4,530		4,530
Intelligence and Communications	400,329	238,711	268,755	7,104	8,854		8,854
Research and Development	6,596,225	6,591,738	6,832,215	93,418	318,938	-78,700	240,238
Central Supply and Maintenance	58,503	62,287	62,287				
Administration and Associated Activities	65	32,395	32,395	-99,022	-99,022		-99,022
Space							
Classified Programs	4,536	4,625	4,625				
Total Research, Development, Test & Evaluation	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600

Department of Defense
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Summary Recap of Budget Activities	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Basic Research	428,943	428,943		428,943	430,022		430,022
Applied Research	907,574	907,574		907,574	889,182		889,182
Advanced Technology Development	930,065	943,365		943,365	1,070,977		1,070,977
Advanced Component Development & Prototypes	560,010	592,230		592,230	890,889	18,000	908,889
System Development & Demonstration	2,427,837	2,681,826	-78,700	2,603,126	3,012,840	57,840	3,070,680
RDT&E Management Support	1,136,134	1,161,991		1,161,991	1,253,845		1,253,845
Operational Systems Development	1,304,058	1,481,413		1,481,413	1,877,685	43,528	1,921,213
Undistributed	-66,627	-66,627		-66,627			
Total Research, Development, Test & Evaluation	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808
Summary Recap of FYDP Programs							
General Purpose Forces	618,038	701,668		701,668	710,401	15,000	725,401
Intelligence and Communications	245,815	277,609		277,609	370,519	29,728	400,247
Research and Development	6,763,856	7,151,153	-78,700	7,072,453	8,215,942	74,640	8,290,582
Central Supply and Maintenance	62,287	62,287		62,287	60,877		60,877
Administration and Associated Activities	-66,627	-66,627		-66,627			
Space					60,547		60,547
Classified Programs	4,625	4,625		4,625	7,154		7,154
Total Research, Development, Test & Evaluation	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Summary Recap of Budget Activities	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCC	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO
Basic Research	450,831	428,943	428,943				
Applied Research	1,070,349	907,574	907,574				
Advanced Technology Development	1,113,746	930,065	943,365				
Advanced Component Development & Prototypes	499,287	550,635	566,835	9,375	25,395		25,395
System Development & Demonstration	2,202,652	2,265,094	2,393,383	84,043	288,443	-78,700	209,743
RDT&E Management Support	1,259,926	1,136,134	1,161,991				
Operational Systems Development	1,264,953	1,296,954	1,462,929	7,104	18,484		18,484
Undistributed		32,395	32,395	-99,022	-99,022		-99,022
Total Research, Development, Test & Evaluation	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600
Summary Recap of FYDP Programs							
General Purpose Forces	802,086	618,038	697,138		4,530		4,530
Intelligence and Communications	400,329	238,711	268,755	7,104	8,854		8,854
Research and Development	6,596,225	6,591,738	6,832,215	93,418	318,938	-78,700	240,238
Central Supply and Maintenance	58,503	62,287	62,287				
Administration and Associated Activities	65	32,395	32,395	-99,022	-99,022		-99,022
Space							
Classified Programs	4,536	4,625	4,625				
Total Research, Development, Test & Evaluation	7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

Summary Recap of Budget Activities	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Basic Research	428,943	428,943		428,943	430,022		430,022
Applied Research	907,574	907,574		907,574	889,182		889,182
Advanced Technology Development	930,065	943,365		943,365	1,070,977		1,070,977
Advanced Component Development & Prototypes	560,010	592,230		592,230	890,889	18,000	908,889
System Development & Demonstration	2,427,837	2,681,826	-78,700	2,603,126	3,012,840	57,840	3,070,680
RDT&E Management Support	1,136,134	1,161,991		1,161,991	1,253,845		1,253,845
Operational Systems Development	1,304,058	1,481,413		1,481,413	1,877,685	43,528	1,921,213
Undistributed	-66,627	-66,627		-66,627			
Total Research, Development, Test & Evaluation	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808
Summary Recap of FYDP Programs							
General Purpose Forces	618,038	701,668		701,668	710,401	15,000	725,401
Intelligence and Communications	245,815	277,609		277,609	370,519	29,728	400,247
Research and Development	6,763,856	7,151,153	-78,700	7,072,453	8,215,942	74,640	8,290,582
Central Supply and Maintenance	62,287	62,287		62,287	60,877		60,877
Administration and Associated Activities	-66,627	-66,627		-66,627			
Space					60,547		60,547
Classified Programs	4,625	4,625		4,625	7,154		7,154
Total Research, Development, Test & Evaluation	7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
1	0601101A	In-House Laboratory Independent Research	01	12,525	12,381	12,381					U
2	0601102A	Defense Research Sciences	01	271,933	253,116	253,116					U
3	0601103A	University Research Initiatives	01	67,225	69,166	69,166					U
4	0601104A	University and Industry Research Centers	01	99,148	94,280	94,280					U
	Basic Research			450,831	428,943	428,943					
5	0602105A	Materials Technology	02	67,806	31,533	31,533					U
6	0602120A	Sensors and Electronic Survivability	02	57,202	36,109	36,109					U
7	0602122A	TRACTOR HIP	02	6,879	6,995	6,995					U
8	0602211A	Aviation Technology	02	58,497	65,914	65,914					U
9	0602270A	Electronic Warfare Technology	02	18,502	25,466	25,466					U
10	0602303A	Missile Technology	02	51,801	44,313	44,313					U
11	0602307A	Advanced Weapons Technology	02	36,906	28,803	28,803					U
12	0602308A	Advanced Concepts and Simulation	02	26,886	27,688	27,688					U
13	0602601A	Combat Vehicle and Automotive Technology	02	95,763	67,959	67,959					U
14	0602618A	Ballistics Technology	02	118,221	85,436	85,436					U
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	3,713	3,923	3,923					U
16	0602623A	Joint Service Small Arms Program	02	5,270	5,545	5,545					U
17	0602624A	Weapons and Munitions Technology	02	81,447	53,581	53,581					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
1	0601101A	In-House Laboratory Independent Research	01	12,381	12,381		12,381	12,010		12,010	U
2	0601102A	Defense Research Sciences	01	253,116	253,116		253,116	263,590		263,590	U
3	0601103A	University Research Initiatives	01	69,166	69,166		69,166	67,027		67,027	U
4	0601104A	University and Industry Research Centers	01	94,280	94,280		94,280	87,395		87,395	U
	Basic	Research		428,943	428,943		428,943	430,022		430,022	
5	0602105A	Materials Technology	02	31,533	31,533		31,533	29,640		29,640	U
6	0602120A	Sensors and Electronic Survivability	02	36,109	36,109		36,109	35,730		35,730	U
7	0602122A	TRACTOR HIP	02	6,995	6,995		6,995	8,627		8,627	U
8	0602211A	Aviation Technology	02	65,914	65,914		65,914	66,086		66,086	U
9	0602270A	Electronic Warfare Technology	02	25,466	25,466		25,466	27,144		27,144	U
10	0602303A	Missile Technology	02	44,313	44,313		44,313	43,742		43,742	U
11	0602307A	Advanced Weapons Technology	02	28,803	28,803		28,803	22,785		22,785	U
12	0602308A	Advanced Concepts and Simulation	02	27,688	27,688		27,688	28,650		28,650	U
13	0602601A	Combat Vehicle and Automotive Technology	02	67,959	67,959		67,959	67,232		67,232	U
14	0602618A	Ballistics Technology	02	85,436	85,436		85,436	85,309		85,309	U
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	3,923	3,923		3,923	4,004		4,004	U
16	0602623A	Joint Service Small Arms Program	02	5,545	5,545		5,545	5,615		5,615	U
17	0602624A	Weapons and Munitions Technology	02	53,581	53,581		53,581	41,455		41,455	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
18	0602705A	Electronics and Electronic Devices	02	62,654	56,322	56,322					U
19	0602709A	Night Vision Technology	02	37,501	36,079	36,079					U
20	0602712A	Countermine Systems	02	35,586	26,497	26,497					U
21	0602716A	Human Factors Engineering Technology	02	23,220	23,671	23,671					U
22	0602720A	Environmental Quality Technology	02	20,270	22,151	22,151					U
23	0602782A	Command, Control, Communications Technology	02	34,749	37,803	37,803					U
24	0602783A	Computer and Software Technology	02	12,266	13,811	13,811					U
25	0602784A	Military Engineering Technology	02	80,130	67,416	67,416					U
26	0602785A	Manpower/Personnel/Training Technology	02	22,474	26,045	26,045					U
27	0602786A	Warfighter Technology	02	38,420	37,403	37,403					U
28	0602787A	Medical Technology	02	74,186	77,111	77,111					U
		Applied Research		1,070,349	907,574	907,574					
29	0603001A	Warfighter Advanced Technology	03	54,606	38,831	38,831					U
30	0603002A	Medical Advanced Technology	03	103,753	68,365	68,365					U
31	0603003A	Aviation Advanced Technology	03	99,542	94,280	94,280					U
32	0603004A	Weapons and Munitions Advanced Technology	03	95,504	68,714	68,714					U
33	0603005A	Combat Vehicle and Automotive Advanced Technology	03	136,624	122,132	122,132					U
34	0603006A	Space Application Advanced Technology	03	5,384	3,904	3,904					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
18	0602705A	Electronics and Electronic Devices	02	56,322	56,322		56,322	58,352		58,352	U
19	0602709A	Night Vision Technology	02	36,079	36,079		36,079	34,723		34,723	U
20	0602712A	Countermine Systems	02	26,497	26,497		26,497	26,190		26,190	U
21	0602716A	Human Factors Engineering Technology	02	23,671	23,671		23,671	24,127		24,127	U
22	0602720A	Environmental Quality Technology	02	22,151	22,151		22,151	21,678		21,678	U
23	0602782A	Command, Control, Communications Technology	02	37,803	37,803		37,803	33,123		33,123	U
24	0602783A	Computer and Software Technology	02	13,811	13,811		13,811	14,041		14,041	U
25	0602784A	Military Engineering Technology	02	67,416	67,416		67,416	67,720		67,720	U
26	0602785A	Manpower/Personnel/Training Technology	02	26,045	26,045		26,045	20,216		20,216	U
27	0602786A	Warfighter Technology	02	37,403	37,403		37,403	39,559		39,559	U
28	0602787A	Medical Technology	02	77,111	77,111		77,111	83,434		83,434	U
		Applied Research		907,574	907,574		907,574	889,182		889,182	
29	0603001A	Warfighter Advanced Technology	03	38,831	38,831		38,831	44,863		44,863	U
30	0603002A	Medical Advanced Technology	03	68,365	68,365		68,365	67,780		67,780	U
31	0603003A	Aviation Advanced Technology	03	94,280	94,280		94,280	160,746		160,746	U
32	0603004A	Weapons and Munitions Advanced Technology	03	68,714	68,714		68,714	84,079		84,079	U
33	0603005A	Combat Vehicle and Automotive Advanced Technology	03	122,132	122,132		122,132	125,537		125,537	U
34	0603006A	Space Application Advanced Technology	03	3,904	3,904		3,904	12,231		12,231	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
35	0603007A	Manpower, Personnel and Training Advanced Technology	03	11,571	14,417	14,417					U
36	0603009A	TRACTOR HIKE	03	9,002	8,074	21,374					U
37	0603015A	Next Generation Training & Simulation Systems	03	16,735	18,969	18,969					U
38	0603020A	TRACTOR ROSE	03	11,912	11,910	11,910					U
39	0603125A	Combating Terrorism - Technology Development	03	32,430	27,686	27,686					U
40	0603130A	TRACTOR NAIL	03	2,381	2,340	2,340					U
41	0603131A	TRACTOR EGGS	03	2,431	2,470	2,470					U
42	0603270A	Electronic Warfare Technology	03	31,810	27,893	27,893					U
43	0603313A	Missile and Rocket Advanced Technology	03	102,490	52,190	52,190					U
44	0603322A	TRACTOR CAGE	03	10,999	11,107	11,107					U
45	0603461A	High Performance Computing Modernization Program	03	215,138	177,190	177,190					U
46	0603606A	Landmine Warfare and Barrier Advanced Technology	03	13,425	17,451	17,451					U
47	0603607A	Joint Service Small Arms Program	03	4,903	5,839	5,839					U
48	0603710A	Night Vision Advanced Technology	03	39,329	44,468	44,468					U
49	0603728A	Environmental Quality Technology Demonstrations	03	14,533	11,137	11,137					U
50	0603734A	Military Engineering Advanced Technology	03	26,247	20,684	20,684					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
35	0603007A	Manpower, Personnel and Training Advanced Technology	03	14,417	14,417		14,417	6,466		6,466	U
36	0603009A	TRACTOR HIKE	03	8,074	21,374		21,374	28,552		28,552	U
37	0603015A	Next Generation Training & Simulation Systems	03	18,969	18,969		18,969	16,434		16,434	U
38	0603020A	TRACTOR ROSE	03	11,910	11,910		11,910				U
39	0603125A	Combating Terrorism - Technology Development	03	27,686	27,686		27,686	26,903		26,903	U
40	0603130A	TRACTOR NAIL	03	2,340	2,340		2,340	4,880		4,880	U
41	0603131A	TRACTOR EGGS	03	2,470	2,470		2,470	4,326		4,326	U
42	0603270A	Electronic Warfare Technology	03	27,893	27,893		27,893	31,296		31,296	U
43	0603313A	Missile and Rocket Advanced Technology	03	52,190	52,190		52,190	62,850		62,850	U
44	0603322A	TRACTOR CAGE	03	11,107	11,107		11,107	12,323		12,323	U
45	0603461A	High Performance Computing Modernization Program	03	177,190	177,190		177,190	182,331		182,331	U
46	0603606A	Landmine Warfare and Barrier Advanced Technology	03	17,451	17,451		17,451	17,948		17,948	U
47	0603607A	Joint Service Small Arms Program	03	5,839	5,839		5,839	5,796		5,796	U
48	0603710A	Night Vision Advanced Technology	03	44,468	44,468		44,468	47,135		47,135	U
49	0603728A	Environmental Quality Technology Demonstrations	03	11,137	11,137		11,137	10,421		10,421	U
50	0603734A	Military Engineering Advanced Technology	03	20,684	20,684		20,684	32,448		32,448	U

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
51	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	36,658	44,239	44,239					U
52	0603794A	C3 Advanced Technology	03	36,339	35,775	35,775					U
		Advanced Technology Development		1,113,746	930,065	943,365					
53	0603305A	Army Missle Defense Systems Integration	04	29,270	9,433	9,433					U
54	0603308A	Army Space Systems Integration	04	29,561	23,056	23,056	9,375	9,375		9,375	U
55	0603327A	Air and Missile Defense Systems Engineering	04			14,200					U
56	0603619A	Landmine Warfare and Barrier - Adv Dev	04	40,943	72,117	72,117					U
57	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	12,894	28,244	28,244		16,020		16,020	U
58	0603639A	Tank and Medium Caliber Ammunition	04	42,272	40,096	42,096					U
59	0603645A	Armored System Modernization - Adv Dev	04								U
60	0603747A	Soldier Support and Survivability	04	5,035	10,506	10,506					U
61	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	17,562	15,730	15,730					U
62	0603774A	Night Vision Systems Advanced Development	04	7,003	10,321	10,321					U
63	0603779A	Environmental Quality Technology - Dem/Val	04	8,464	7,785	7,785					U
64	0603790A	NATO Research and Development	04	5,835	2,300	2,300					U
65	0603801A	Aviation - Adv Dev	04		10,014	10,014					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
51	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	44,239	44,239		44,239	52,206		52,206	U
52	0603794A	C3 Advanced Technology	03	35,775	35,775		35,775	33,426		33,426	U
		Advanced Technology Development		930,065	943,365		943,365	1,070,977		1,070,977	
53	0603305A	Army Missle Defense Systems Integration	04	9,433	9,433		9,433	9,634		9,634	U
54	0603308A	Army Space Systems Integration	04	32,431	32,431		32,431				U
55	0603327A	Air and Missile Defense Systems Engineering	04		14,200		14,200	33,949	15,000	48,949	U
56	0603619A	Landmine Warfare and Barrier - Adv Dev	04	72,117	72,117		72,117	72,909		72,909	U
57	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	28,244	44,264		44,264	7,135		7,135	U
58	0603639A	Tank and Medium Caliber Ammunition	04	40,096	42,096		42,096	41,452		41,452	U
59	0603645A	Armored System Modernization - Adv Dev	04					32,739		32,739	U
60	0603747A	Soldier Support and Survivability	04	10,506	10,506		10,506	10,157	3,000	13,157	U
61	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	15,730	15,730		15,730	27,733		27,733	U
62	0603774A	Night Vision Systems Advanced Development	04	10,321	10,321		10,321	12,347		12,347	U
63	0603779A	Environmental Quality Technology - Dem/Val	04	7,785	7,785		7,785	10,456		10,456	U
64	0603790A	NATO Research and Development	04	2,300	2,300		2,300	2,588		2,588	U
65	0603801A	Aviation - Adv Dev	04	10,014	10,014		10,014	14,055		14,055	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
66	0603804A	Logistics and Engineer Equipment - Adv Dev	04	20,271	20,834	20,834					U
67	0603807A	Medical Systems - Adv Dev	04	39,711	33,503	33,503					U
68	0603827A	Soldier Systems - Advanced Development	04	22,251	31,120	31,120					U
69	0604017A	Robotics Development	04								U
70	0604100A	Analysis Of Alternatives	04	7,533	6,608	6,608					U
71	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04		35,132	35,132					U
72	0604115A	Technology Maturation Initiatives	04	34,493	70,047	70,047					U
73	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04								U
74	0604118A	TRACTOR BEAM	04								U
75	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	26,967	83,279	83,279					U
76	0604121A	Synthetic Training Environment Refinement & Prototyping	04								U
77	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	149,222							U
78	0305251A	Cyberspace Operations Forces and Force Support	04		40,510	40,510					U
79	1206308A	Army Space Systems Integration	04								U
		Advanced Component Development & Prototypes		499,287	550,635	566,835	9,375	25,395		25,395	
80	0604201A	Aircraft Avionics	05	18,194	83,248	83,248					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
66	0603804A	Logistics and Engineer Equipment - Adv Dev	04	20,834	20,834		20,834	35,333		35,333	U
67	0603807A	Medical Systems - Adv Dev	04	33,503	33,503		33,503	33,491		33,491	U
68	0603827A	Soldier Systems - Advanced Development	04	31,120	31,120		31,120	20,239		20,239	U
69	0604017A	Robotics Development	04					39,608		39,608	U
70	0604100A	Analysis Of Alternatives	04	6,608	6,608		6,608	9,921		9,921	U
71	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	35,132	35,132		35,132	76,728		76,728	U
72	0604115A	Technology Maturation Initiatives	04	70,047	70,047		70,047	115,221		115,221	U
73	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04					20,000		20,000	U
74	0604118A	TRACTOR BEAM	04					10,400		10,400	U
75	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	83,279	83,279		83,279	164,967		164,967	U
76	0604121A	Synthetic Training Environment Refinement & Prototyping	04					1,600		1,600	U
77	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04					11,303		11,303	U
78	0305251A	Cyberspace Operations Forces and Force Support	04	40,510	40,510		40,510	56,492		56,492	U
79	1206308A	Army Space Systems Integration	04					20,432		20,432	U
		Advanced Component Development & Prototypes		560,010	592,230		592,230	890,889	18,000	908,889	
80	0604201A	Aircraft Avionics	05	83,248	83,248		83,248	30,153		30,153	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
81	0604270A	Electronic Warfare Development	05	20,586	34,642	37,242					U
82	0604280A	Joint Tactical Radio	05	4,415							U
83	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	8,416	12,172	12,172					U
84	0604321A	All Source Analysis System	05	4,309	3,958	3,958					U
85	0604328A	TRACTOR CAGE	05	15,138	12,525	12,525					U
86	0604601A	Infantry Support Weapons	05	86,966	66,943	66,943					U
87	0604604A	Medium Tactical Vehicles	05								U
88	0604611A	JAVELIN	05	3,789	20,011	20,011					U
89	0604622A	Family of Heavy Tactical Vehicles	05		11,429	11,429					U
90	0604633A	Air Traffic Control	05	9,714	3,421	3,421					U
91	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	13,599	39,282	39,282					U
92	0604642A	Light Tactical Wheeled Vehicles	05		494	494					U
93	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05		9,678	9,678					U
94	0604710A	Night Vision Systems - Eng Dev	05	65,482	84,519	84,519					U
95	0604713A	Combat Feeding, Clothing, and Equipment	05	1,694	2,054	2,054					U
96	0604715A	Non-System Training Devices - Eng Dev	05	26,768	30,774	35,774	33	33		33	U
97	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	33,619	53,332	61,532		143,900	-78,700	65,200	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
81	0604270A	Electronic Warfare Development	05	34,642	37,242		37,242	71,671		71,671	U
82	0604280A	Joint Tactical Radio	05								U
83	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	12,172	12,172		12,172	10,589		10,589	U
84	0604321A	All Source Analysis System	05	3,958	3,958		3,958	4,774		4,774	U
85	0604328A	TRACTOR CAGE	05	12,525	12,525		12,525	17,252		17,252	U
86	0604601A	Infantry Support Weapons	05	66,943	66,943		66,943	87,643		87,643	U
87	0604604A	Medium Tactical Vehicles	05					6,039		6,039	U
88	0604611A	JAVELIN	05	20,011	20,011		20,011	21,095		21,095	U
89	0604622A	Family of Heavy Tactical Vehicles	05	11,429	11,429		11,429	10,507		10,507	U
90	0604633A	Air Traffic Control	05	3,421	3,421		3,421	3,536		3,536	U
91	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	39,282	39,282		39,282				U
92	0604642A	Light Tactical Wheeled Vehicles	05	494	494		494	7,000		7,000	U
93	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05	9,678	9,678		9,678	36,242		36,242	U
94	0604710A	Night Vision Systems - Eng Dev	05	84,519	84,519		84,519	108,504		108,504	U
95	0604713A	Combat Feeding, Clothing, and Equipment	05	2,054	2,054		2,054	3,702		3,702	U
96	0604715A	Non-System Training Devices - Eng Dev	05	30,807	35,807		35,807	43,575		43,575	U
97	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	132,032	205,432	-78,700	126,732	28,726		28,726	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
98	0604742A	Constructive Simulation Systems Development	05	22,609	17,887	17,887					U
99	0604746A	Automatic Test Equipment Development	05	8,636	8,813	8,813					U
100	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	8,843	10,487	10,487					U
101	0604768A	Brilliant Anti-Armor Submunition (BAT)	05								U
102	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	20,808	15,068	15,068					U
103	0604798A	Brigade Analysis, Integration and Evaluation	05	96,286	89,716	146,655					U
104	0604802A	Weapons and Munitions - Eng Dev	05	18,037	80,365	99,165					U
105	0604804A	Logistics and Engineer Equipment - Eng Dev	05	43,229	75,098	75,098					U
106	0604805A	Command, Control, Communications Systems - Eng Dev	05	2,780	4,245	4,245					U
107	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	39,295	41,124	41,124					U
108	0604808A	Landmine Warfare/Barrier - Eng Dev	05	63,028	39,630	39,630					U
109	0604818A	Army Tactical Command & Control Hardware & Software	05	125,107	205,590	205,590					U
110	0604820A	Radar Development	05	11,821	15,983	15,983					U
111	0604822A	General Fund Enterprise Business System (GFEBS)	05	20,533	6,805	6,805					U
112	0604823A	Firefinder	05	2,850	9,235	9,235					U

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
98	0604742A	Constructive Simulation Systems Development	05	17,887	17,887		17,887	18,562		18,562	U
99	0604746A	Automatic Test Equipment Development	05	8,813	8,813		8,813	8,344		8,344	U
100	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	10,487	10,487		10,487	11,270		11,270	U
101	0604768A	Brilliant Anti-Armor Submunition (BAT)	05					10,000		10,000	U
102	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	15,068	15,068		15,068	18,566		18,566	U
103	0604798A	Brigade Analysis, Integration and Evaluation	05	89,716	146,655		146,655	145,360		145,360	U
104	0604802A	Weapons and Munitions - Eng Dev	05	80,365	99,165		99,165	145,232		145,232	U
105	0604804A	Logistics and Engineer Equipment - Eng Dev	05	75,098	75,098		75,098	90,965		90,965	U
106	0604805A	Command, Control, Communications Systems - Eng Dev	05	4,245	4,245		4,245	9,910		9,910	U
107	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	41,124	41,124		41,124	39,238		39,238	U
108	0604808A	Landmine Warfare/Barrier - Eng Dev	05	39,630	39,630		39,630	34,684		34,684	U
109	0604818A	Army Tactical Command & Control Hardware & Software	05	205,590	205,590		205,590	164,409		164,409	U
110	0604820A	Radar Development	05	15,983	15,983		15,983	32,968		32,968	U
111	0604822A	General Fund Enterprise Business System (GFEBS)	05	6,805	6,805		6,805	49,554		49,554	U
112	0604823A	Firefinder	05	9,235	9,235		9,235	45,605		45,605	U

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
113	0604827A	Soldier Systems - Warrior Dem/Val	05	15,694	12,393	12,393					U
114	0604852A	Suite of Survivability Enhancement Systems - EMD	05								U
115	0604854A	Artillery Systems - EMD	05	2,251	1,756	4,506					U
116	0605013A	Information Technology Development	05	48,028	74,236	74,236					U
117	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	116,215	155,584	155,584					U
118	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	213,034	184,221	184,221					U
119	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05		4,980	4,980					U
120	0605030A	Joint Tactical Network Center (JTNC)	05	12,834	15,041	15,041					U
121	0605031A	Joint Tactical Network (JTN)	05	20,790	16,014	16,014					U
122	0605032A	TRACTOR TIRE	05	10,677	27,254	27,254		10,000		10,000	U
123	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05		5,032	5,032					U
124	0605034A	Tactical Security System (TSS)	05		2,904	2,904					U
125	0605035A	Common Infrared Countermeasures (CIRCM)	05	98,496	96,977	96,977	10,900	10,900		10,900	U
126	0605036A	Combating Weapons of Mass Destruction (CWMD)	05		2,089	2,089					U
127	0605037A	Evidence Collection and Detainee Processing	05								U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
113	0604827A	Soldier Systems - Warrior Dem/Val	05	12,393	12,393		12,393	16,127		16,127	U
114	0604852A	Suite of Survivability Enhancement Systems - EMD	05					98,600		98,600	U
115	0604854A	Artillery Systems - EMD	05	1,756	4,506		4,506	1,972		1,972	U
116	0605013A	Information Technology Development	05	74,236	74,236		74,236	81,776		81,776	U
117	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	155,584	155,584		155,584	172,361		172,361	U
118	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	184,221	184,221		184,221	199,778		199,778	U
119	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05	4,980	4,980		4,980	4,418		4,418	U
120	0605030A	Joint Tactical Network Center (JTNC)	05	15,041	15,041		15,041	15,877		15,877	U
121	0605031A	Joint Tactical Network (JTN)	05	16,014	16,014		16,014	44,150		44,150	U
122	0605032A	TRACTOR TIRE	05	27,254	37,254		37,254	34,670	5,000	39,670	U
123	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05	5,032	5,032		5,032	5,207		5,207	U
124	0605034A	Tactical Security System (TSS)	05	2,904	2,904		2,904	4,727		4,727	U
125	0605035A	Common Infrared Countermeasures (CIRCM)	05	107,877	107,877		107,877	105,778	21,540	127,318	U
126	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	2,089	2,089		2,089	6,927		6,927	U
127	0605037A	Evidence Collection and Detainee Processing	05					214		214	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
128	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05								U
129	0605041A	Defensive CYBER Tool Development	05		33,836	33,836		50,500		50,500	U
130	0605042A	Tactical Network Radio Systems (Low-Tier)	05		18,824	18,824					U
131	0605047A	Contract Writing System	05		20,663	20,663					U
132	0605049A	Missile Warning System Modernization (MWSM)	05								U
133	0605051A	Aircraft Survivability Development	05	77,395	41,133	51,133	73,110	73,110		73,110	U
134	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05		83,995	83,995					U
135	0605053A	Ground Robotics	05								U
136	0605350A	WIN-T Increment 3 - Full Networking	05	32,187							U
137	0605380A	AMF Joint Tactical Radio System (JTRS)	05	10,143	5,028	5,028					U
138	0605450A	Joint Air-to-Ground Missile (JAGM)	05	79,897	42,972	42,972					U
139	0605456A	PAC-3/MSE Missile	05	2,201							U
140	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	222,074	252,811	272,811					U
141	0605625A	Manned Ground Vehicle	05	37,692							U
142	0605626A	Aerial Common Sensor	05	2							U
143	0605766A	National Capabilities Integration (MIP)	05	10,599	4,955	4,955					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
128	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05					16,125		16,125	U
129	0605041A	Defensive CYBER Tool Development	05	33,836	84,336		84,336	55,165		55,165	U
130	0605042A	Tactical Network Radio Systems (Low-Tier)	05	18,824	18,824		18,824	20,076		20,076	U
131	0605047A	Contract Writing System	05	20,663	20,663		20,663	20,322		20,322	U
132	0605049A	Missile Warning System Modernization (MWSM)	05					55,810		55,810	U
133	0605051A	Aircraft Survivability Development	05	114,243	124,243		124,243	30,879	30,100	60,979	U
134	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	83,995	83,995		83,995	175,069		175,069	U
135	0605053A	Ground Robotics	05					70,760		70,760	U
136	0605350A	WIN-T Increment 3 - Full Networking	05								U
137	0605380A	AMF Joint Tactical Radio System (JTRS)	05	5,028	5,028		5,028	8,965		8,965	U
138	0605450A	Joint Air-to-Ground Missile (JAGM)	05	42,972	42,972		42,972	34,626		34,626	U
139	0605456A	PAC-3/MSE Missile	05								U
140	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	252,811	272,811		272,811	336,420		336,420	U
141	0605625A	Manned Ground Vehicle	05								U
142	0605626A	Aerial Common Sensor	05								U
143	0605766A	National Capabilities Integration (MIP)	05	4,955	4,955		4,955	6,882		6,882	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
144	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	31,197	11,530	11,530					U
145	0605830A	Aviation Ground Support Equipment	05	13,528	2,142	2,142					U
146	0210609A	Paladin Integrated Management (PIM)	05	136,353	41,498	41,498					U
147	0303032A	TROJAN - RH12	05	5,022	4,273	4,273					U
148	0303267A	Auctioned Spectrum Relocation Fund	05	71,823							U
149	0303367A	Spectrum Access Research and Development	05	125,283							U
150	0304270A	Electronic Warfare Development	05	12,686	14,425	18,425					U
151	1205117A	Tractor Bears	05								U
		System Development & Demonstration		2,202,652	2,265,094	2,393,383	84,043	288,443	-78,700	209,743	
152	0604256A	Threat Simulator Development	06	27,157	25,675	25,675					U
153	0604258A	Target Systems Development	06	16,163	19,122	19,122					U
154	0604759A	Major T&E Investment	06	65,059	84,777	84,777					U
155	0605103A	Rand Arroyo Center	06	20,014	20,658	20,658					U
156	0605301A	Army Kwajalein Atoll	06	200,393	236,648	236,648					U
157	0605326A	Concepts Experimentation Program	06	18,705	25,596	25,596					U
158	0605502A	Small Business Innovative Research	06	220,833							U
159	0605601A	Army Test Ranges and Facilities	06	273,275	293,748	307,882					U
160	0605602A	Army Technical Test Instrumentation and Targets	06	52,254	52,404	64,127					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
144	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	11,530	11,530		11,530	23,467		23,467	U
145	0605830A	Aviation Ground Support Equipment	05	2,142	2,142		2,142	6,930		6,930	U
146	0210609A	Paladin Integrated Management (PIM)	05	41,498	41,498		41,498	6,112		6,112	U
147	0303032A	TROJAN - RH12	05	4,273	4,273		4,273	4,431	1,200	5,631	U
148	0303267A	Auctioned Spectrum Relocation Fund	05								U
149	0303367A	Spectrum Access Research and Development	05								U
150	0304270A	Electronic Warfare Development	05	14,425	18,425		18,425	14,616		14,616	U
151	1205117A	Tractor Bears	05					17,928		17,928	U
		System Development & Demonstration		2,427,837	2,681,826	-78,700	2,603,126	3,012,840	57,840	3,070,680	
152	0604256A	Threat Simulator Development	06	25,675	25,675		25,675	22,862		22,862	U
153	0604258A	Target Systems Development	06	19,122	19,122		19,122	13,902		13,902	U
154	0604759A	Major T&E Investment	06	84,777	84,777		84,777	102,901		102,901	U
155	0605103A	Rand Arroyo Center	06	20,658	20,658		20,658	20,140		20,140	U
156	0605301A	Army Kwajalein Atoll	06	236,648	236,648		236,648	246,663		246,663	U
157	0605326A	Concepts Experimentation Program	06	25,596	25,596		25,596	29,820		29,820	U
158	0605502A	Small Business Innovative Research	06								U
159	0605601A	Army Test Ranges and Facilities	06	293,748	307,882		307,882	307,588		307,588	U
160	0605602A	Army Technical Test Instrumentation and Targets	06	52,404	64,127		64,127	49,242		49,242	U

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
161	0605604A	Survivability/Lethality Analysis	06	33,069	38,571	38,571					U
162	0605606A	Aircraft Certification	06	4,571	4,665	4,665					U
163	0605702A	Meteorological Support to RDT&E Activities	06	8,104	6,925	6,925					U
164	0605706A	Materiel Systems Analysis	06	20,203	21,677	21,677					U
165	0605709A	Exploitation of Foreign Items	06	10,396	12,415	12,415					U
166	0605712A	Support of Operational Testing	06	49,128	49,684	49,684					U
167	0605716A	Army Evaluation Center	06	52,265	55,905	55,905					U
168	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	901	7,959	7,959					U
169	0605801A	Programwide Activities	06	61,060	51,822	51,822					U
170	0605803A	Technical Information Activities	06	25,991	33,323	33,323					U
171	0605805A	Munitions Standardization, Effectiveness and Safety	06	48,335	40,545	40,545					U
172	0605857A	Environmental Quality Technology Mgmt Support	06	3,673	2,130	2,130					U
173	0605898A	Army Direct Report Headquarters - R&D - MHA	06	48,312	49,885	49,885					U
174	0606001A	Military Ground-Based CREW Technology	06								U
175	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06								U
176	0303260A	Defense Military Deception Initiative	06		2,000	2,000					U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
161	0605604A	Survivability/Lethality Analysis	06	38,571	38,571		38,571	41,843		41,843	U
162	0605606A	Aircraft Certification	06	4,665	4,665		4,665	4,804		4,804	U
163	0605702A	Meteorological Support to RDT&E Activities	06	6,925	6,925		6,925	7,238		7,238	U
164	0605706A	Materiel Systems Analysis	06	21,677	21,677		21,677	21,890		21,890	U
165	0605709A	Exploitation of Foreign Items	06	12,415	12,415		12,415	12,684		12,684	U
166	0605712A	Support of Operational Testing	06	49,684	49,684		49,684	51,040		51,040	U
167	0605716A	Army Evaluation Center	06	55,905	55,905		55,905	56,246		56,246	U
168	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	7,959	7,959		7,959	1,829		1,829	U
169	0605801A	Programwide Activities	06	51,822	51,822		51,822	55,060		55,060	U
170	0605803A	Technical Information Activities	06	33,323	33,323		33,323	33,934		33,934	U
171	0605805A	Munitions Standardization, Effectiveness and Safety	06	40,545	40,545		40,545	43,444		43,444	U
172	0605857A	Environmental Quality Technology Mgmt Support	06	2,130	2,130		2,130	5,087		5,087	U
173	0605898A	Army Direct Report Headquarters - R&D - MHA	06	49,885	49,885		49,885	54,679		54,679	U
174	0606001A	Military Ground-Based CREW Technology	06					7,916		7,916	U
175	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06					61,254		61,254	U
176	0303260A	Defense Military Deception Initiative	06	2,000	2,000		2,000	1,779		1,779	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
177	0909999A	Financing for Cancelled Account Adjustments	06	65							U
	RDT&E	Management Support		1,259,926	1,136,134	1,161,991					
178	0603778A	MLRS Product Improvement Program	07	21,202	9,663	34,763					U
179	0603813A	TRACTOR PULL	07	9,461	3,960	3,960					U
180	0605024A	Anti-Tamper Technology Support	07		3,638	3,638					U
181	0607131A	Weapons and Munitions Product Improvement Programs	07	5,678	14,517	14,517		5,100		5,100	U
182	0607133A	TRACTOR SMOKE	07	7,569	4,479	4,479					U
183	0607134A	Long Range Precision Fires (LRPF)	07		39,275	67,006					U
184	0607135A	Apache Product Improvement Program	07	62,964	66,441	66,441					U
185	0607136A	Blackhawk Product Improvement Program	07	64,011	46,765	46,765					U
186	0607137A	Chinook Product Improvement Program	07	31,122	91,848	91,848					U
187	0607138A	Fixed Wing Product Improvement Program	07	1,105	796	796					U
188	0607139A	Improved Turbine Engine Program	07	49,137	126,105	126,105					U
189	0607140A	Emerging Technologies from NIE	07	2,383	2,369	2,369					U
190	0607141A	Logistics Automation	07	1,318	4,563	4,563					U
191	0607142A	Aviation Rocket System Product Improvement and Development	07			8,000					U
192	0607143A	Unmanned Aircraft System Universal Products	07								U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
177	0909999A	Financing for Cancelled Account Adjustments	06								U
	RDT&E	Management Support		1,136,134	1,161,991		1,161,991	1,253,845		1,253,845	
178	0603778A	MLRS Product Improvement Program	07	9,663	34,763		34,763	8,929		8,929	U
179	0603813A	TRACTOR PULL	07	3,960	3,960		3,960	4,014		4,014	U
180	0605024A	Anti-Tamper Technology Support	07	3,638	3,638		3,638	4,094		4,094	U
181	0607131A	Weapons and Munitions Product Improvement Programs	07	14,517	19,617		19,617	15,738		15,738	U
182	0607133A	TRACTOR SMOKE	07	4,479	4,479		4,479	4,513		4,513	U
183	0607134A	Long Range Precision Fires (LRPF)	07	39,275	67,006		67,006	102,014		102,014	U
184	0607135A	Apache Product Improvement Program	07	66,441	66,441		66,441	59,977		59,977	U
185	0607136A	Blackhawk Product Improvement Program	07	46,765	46,765		46,765	34,416		34,416	U
186	0607137A	Chinook Product Improvement Program	07	91,848	91,848		91,848	194,567		194,567	U
187	0607138A	Fixed Wing Product Improvement Program	07	796	796		796	9,981		9,981	U
188	0607139A	Improved Turbine Engine Program	07	126,105	126,105		126,105	204,304		204,304	U
189	0607140A	Emerging Technologies from NIE	07	2,369	2,369		2,369	1,023		1,023	U
190	0607141A	Logistics Automation	07	4,563	4,563		4,563	1,504		1,504	U
191	0607142A	Aviation Rocket System Product Improvement and Development	07		8,000		8,000	10,064		10,064	U
192	0607143A	Unmanned Aircraft System Universal Products	07					38,463		38,463	U

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
193	0607665A	Family of Biometrics	07	7,179	12,098	12,098					U
194	0607865A	Patriot Product Improvement	07	87,537	49,482	49,482					U
195	0202429A	Aerostat Joint Project - COCOM Exercise	07	10,171	45,482	45,482					U
196	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	30,669	30,455	30,455					U
197	0203735A	Combat Vehicle Improvement Programs	07	382,176	316,857	327,357					U
198	0203740A	Maneuver Control System	07	14,864	4,031	4,031					U
199	0203743A	155mm Self-Propelled Howitzer Improvements	07								U
200	0203744A	Aircraft Modifications/Product Improvement Programs	07		35,793	35,793					U
201	0203752A	Aircraft Engine Component Improvement Program	07	349	259	259					U
202	0203758A	Digitization	07	4,188	6,483	6,483					U
203	0203801A	Missile/Air Defense Product Improvement Program	07	3,029	5,122	53,722					U
204	0203802A	Other Missile Product Improvement Programs	07	49,191	7,491	7,491		1,080		1,080	U
205	0203808A	TRACTOR CARD	07	34,686	20,333	20,333					U
206	0205402A	Integrated Base Defense - Operational System Dev	07	10,324				3,450		3,450	U
207	0205410A	Materials Handling Equipment	07	386	124	124					U
208	0205412A	Environmental Quality Technology - Operational System Dev	07								U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
193	0607665A	Family of Biometrics	07	12,098	12,098		12,098	6,159		6,159	U
194	0607865A	Patriot Product Improvement	07	49,482	49,482		49,482	90,217		90,217	U
195	0202429A	Aerostat Joint Project - COCOM Exercise	07	45,482	45,482		45,482	6,749		6,749	U
196	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	30,455	30,455		30,455	33,520		33,520	U
197	0203735A	Combat Vehicle Improvement Programs	07	316,857	327,357		327,357	343,175		343,175	U
198	0203740A	Maneuver Control System	07	4,031	4,031		4,031	6,639		6,639	U
199	0203743A	155mm Self-Propelled Howitzer Improvements	07					40,784		40,784	U
200	0203744A	Aircraft Modifications/Product Improvement Programs	07	35,793	35,793		35,793	39,358		39,358	U
201	0203752A	Aircraft Engine Component Improvement Program	07	259	259		259	145		145	U
202	0203758A	Digitization	07	6,483	6,483		6,483	4,803		4,803	U
203	0203801A	Missile/Air Defense Product Improvement Program	07	5,122	53,722		53,722	2,723	15,000	17,723	U
204	0203802A	Other Missile Product Improvement Programs	07	7,491	8,571		8,571	5,000		5,000	U
205	0203808A	TRACTOR CARD	07	20,333	20,333		20,333	37,883		37,883	U
206	0205402A	Integrated Base Defense - Operational System Dev	07		3,450		3,450				U
207	0205410A	Materials Handling Equipment	07	124	124		124	1,582		1,582	U
208	0205412A	Environmental Quality Technology - Operational System Dev	07					195		195	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
209	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	61,653	69,417	73,417					U
210	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	36,032	22,044	38,044					U
211	0208053A	Joint Tactical Ground System	07	28,015	12,649	12,649					U
213	0303028A	Security and Intelligence Activities	07	13,156	11,619	11,619					U
214	0303140A	Information Systems Security Program	07	31,032	38,280	38,280					U
215	0303141A	Global Combat Support System	07	25,304	27,223	28,667					U
216	0303142A	SATCOM Ground Environment (SPACE)	07	9,045	18,815	18,815					U
217	0303150A	WWMCCS/Global Command and Control System	07	6,810	4,718	4,718					U
219	0305127A	Foreign Counterintelligence Activities	07			4,100					U
220	0305172A	Combined Advanced Applications	07								U
221	0305179A	Integrated Broadcast Service (IBS)	07	750							U
222	0305204A	Tactical Unmanned Aerial Vehicles	07	15,370	8,218	8,218					U
223	0305206A	Airborne Reconnaissance Systems	07	20,725	11,799	11,799					U
224	0305208A	Distributed Common Ground/Surface Systems	07	25,592	32,284	32,284					U
225	0305219A	MQ-1C Gray Eagle UAS	07	22,285	13,470	30,970					U
226	0305232A	RQ-11 UAV	07		1,613	1,613					U
227	0305233A	RQ-7 UAV	07	11,797	4,597	7,597					U
228	0307665A	Biometrics Enabled Intelligence	07				7,104	8,854		8,854	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
209	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	69,417	73,417		73,417	78,926		78,926	U
210	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	22,044	38,044		38,044	102,807		102,807	U
211	0208053A	Joint Tactical Ground System	07	12,649	12,649		12,649				U
213	0303028A	Security and Intelligence Activities	07	11,619	11,619		11,619	13,807		13,807	U
214	0303140A	Information Systems Security Program	07	38,280	38,280		38,280	132,438		132,438	U
215	0303141A	Global Combat Support System	07	27,223	28,667		28,667	64,370		64,370	U
216	0303142A	SATCOM Ground Environment (SPACE)	07	18,815	18,815		18,815				U
217	0303150A	WWMCCS/Global Command and Control System	07	4,718	4,718		4,718	10,475		10,475	U
219	0305127A	Foreign Counterintelligence Activities	07		4,100		4,100				U
220	0305172A	Combined Advanced Applications	07					1,100		1,100	U
221	0305179A	Integrated Broadcast Service (IBS)	07								U
222	0305204A	Tactical Unmanned Aerial Vehicles	07	8,218	8,218		8,218	9,433	7,492	16,925	U
223	0305206A	Airborne Reconnaissance Systems	07	11,799	11,799		11,799	5,080	15,000	20,080	U
224	0305208A	Distributed Common Ground/Surface Systems	07	32,284	32,284		32,284	24,700		24,700	U
225	0305219A	MQ-1C Gray Eagle UAS	07	13,470	30,970		30,970	9,574		9,574	U
226	0305232A	RQ-11 UAV	07	1,613	1,613		1,613	2,191		2,191	U
227	0305233A	RQ-7 UAV	07	4,597	7,597		7,597	12,773		12,773	U
228	0307665A	Biometrics Enabled Intelligence	07	7,104	8,854		8,854	2,537	6,036	8,573	U

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2016 Base + OCO	FY 2017 PB Request with CR Adj Base	FY 2017 Total PB Requests* with CR Adj Base	FY 2017 PB Request with CR Adj OCO	FY 2017 Total PB Requests* with CR Adj OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj OCO	Sec
229	0310349A	Win-T Increment 2 - Initial Networking	07	3,649	4,867	4,867					U
230	0708045A	End Item Industrial Preparedness Activities	07	58,503	62,287	62,287					U
231	1203142A	SATCOM Ground Environment (SPACE)	07								U
232	1208053A	Joint Tactical Ground System	07								U
9999	9999999999	Classified Programs		4,536	4,625	4,625					U
		Operational Systems Development		1,264,953	1,296,954	1,462,929	7,104	18,484		18,484	
233	0901560A	Continuing Resolution Programs	20		32,395	32,395	-99,022	-99,022		-99,022	U
		Undistributed			32,395	32,395	-99,022	-99,022		-99,022	
Total Research, Development, Test & Eval, Army				7,861,744	7,547,794	7,897,415	1,500	233,300	-78,700	154,600	

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Department of the Army
FY 2018 President's Budget Request
Exhibit R-1 FY 2018 President's Budget Request
Total Obligational Authority
(Dollars in Thousands)

26 Apr 2017

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

Line No	Program Element Number	Item	Act	FY 2017 Total PB Requests** with CR Adj Base+OCO+SAA	FY 2017 Total PB Requests* with CR Adj Base + OCO	FY 2017 Less Enacted Div B P.L.114-254** OCO	FY 2017 Remaining Req with CR Adj Base + OCO	FY 2018 Base	FY 2018 OCO	FY 2018 Total	Sec
229	0310349A	Win-T Increment 2 - Initial Networking	07	4,867	4,867		4,867	4,723		4,723	U
230	0708045A	End Item Industrial Preparedness Activities	07	62,287	62,287		62,287	60,877		60,877	U
231	1203142A	SATCOM Ground Environment (SPACE)	07					11,959		11,959	U
232	1208053A	Joint Tactical Ground System	07					10,228		10,228	U
9999	9999999999	Classified Programs		4,625	4,625		4,625	7,154		7,154	U
		Operational Systems Development		1,304,058	1,481,413		1,481,413	1,877,685	43,528	1,921,213	
233	0901560A	Continuing Resolution Programs	20	-66,627	-66,627		-66,627				U
		Undistributed		-66,627	-66,627		-66,627				
Total Research, Development, Test & Eval, Army				7,627,994	8,130,715	-78,700	8,052,015	9,425,440	119,368	9,544,808	

R-1C1F: FY 2018 President's Budget Request (Published Version), as of April 26, 2017 at 08:46:19

Table of Contents

Program Element Table of Contents (by Budget Activity then Line Item Number)

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

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

Program Element Table of Contents (Alphabetically by Program Element Title)

Intentionally Left Blank

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	54.606	38.831	44.863	-	44.863	34.213	35.738	37.377	38.932	-	-
242: *Airdrop Equipment*	-	2.617	3.618	5.681	-	5.681	0.000	0.000	0.000	0.000	-	-
543: *Ammunition Logistics*	-	2.630	2.284	2.326	-	2.326	0.000	0.000	0.000	0.000	-	-
C07: *Joint Service Combat Feeding Tech Demo*	-	2.153	2.134	2.177	-	2.177	0.000	0.000	0.000	0.000	-	-
FF6: *Individual Protection*	-	0.000	0.000	6.352	-	6.352	11.364	10.986	10.277	10.347	-	-
J50: *Future Warrior Technology Integration*	-	31.711	26.550	24.894	-	24.894	16.813	16.148	18.867	19.731	-	-
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	9.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	6.495	4.245	3.433	-	3.433	2.056	2.276	1.796	1.869	-	-
XW6: *Small Unit Expeditionary Maneuver*	-	0.000	0.000	0.000	-	0.000	3.980	6.328	6.437	6.985	-	-

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/Project FF6), 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.

Beginning in Fiscal Year (FY) 18, Project FF6 will be included under PE 0603001A.

Efforts in this PE support 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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
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*

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).

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	55.973	38.831	40.937	-	40.937
Current President's Budget	54.606	38.831	44.863	-	44.863
Total Adjustments	-1.367	0.000	3.926	-	3.926
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.367	-			
• Adjustments to Budget Years	0.000	0.000	3.926	-	3.926

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Program Increase*	9.000	-
Congressional Add Subtotals for Project: J52	9.000	-
Congressional Add Totals for all Projects	9.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
242: *Airdrop Equipment*	-	2.617	3.618	5.681	-	5.681	0.000	0.000	0.000	0.000	-	-

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 2016	FY 2017	FY 2018
Title: Airdrop/Aerial Delivery	2.617	3.618	5.681
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 operation. 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 2016 Accomplishments: Demonstrated precision airdrop functionality and reliability while intentionally interjecting faults into the system in order to gather statistical data in an operationally relevant environment; focused on accuracy and survivability improvements: guidance,			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
navigation, and control improvements in heavy/variable winds cost reductions, and minimization of retrograde weight/volume; demonstrated and transitioned the high altitude low opening parachute capability for 100-500 lb. payloads utilizing main parachutes currently in the Army inventory; demonstrated auto hook up and improvement in payload stability for helicopter sling loads. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will optimize autonomously guided system technologies to reduce system cost and to support accurate and survivable landings in urban and jungle environments. Technologies will include soft-landing systems for Joint Precision Airdrop System (JPADS) and high fidelity instrumentation for characterization of payload impact; mature advanced parachute control vent positioning to expand flight envelope of airdrop systems; demonstrate improvements to the static line reserve parachute automatic activation device prototype on T-11R parachute with mannequins to determine its ability to detect and identify various malfunctions and towed jumper scenarios.			
Accomplishments/Planned Programs Subtotals	2.617	3.618	5.681

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
543: *Ammunition Logistics*	-	2.630	2.284	2.326	-	2.326	0.000	0.000	0.000	0.000	-	-

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 2016	FY 2017	FY 2018
Title: Automated Material Handling Technology ***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 2016 Accomplishments:*** Completed development of the robotic add-on kit for rough terrain 5,000 lb forklift and conducted the final demonstration.	1.982	-	-
Title: Explosive Safety for Automated Base Camp Planning ***Description:*** This effort integrates explosives safety site planning software with the automated base camp planning tool to reduce the time to plan base camps and improve Soldier safety. ***FY 2016 Accomplishments:*** Completed validation testing of ammunition planning/management software module with ammunition management system; conducted integrated demonstration with the Virtual Forward Operating Base (VFOB) planning tool.	0.384	-	-
Title: Total Ammunition Logistics Knowledge (TALK)	0.264	-	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 Accomplishments:*** Conducted preliminary design of environmental monitoring and data delivery mechanisms for artillery ammunition.			
Title: Automated Supply Point-Scalable ***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:*** Develop software architecture for the command, control, and integration of Automated Supply Point – Scalable operational functions. ***FY 2018 Plans:*** Will complete development of Automated Supply Point-Scalable software prototype technology demonstrator to support basic automation of ammunition supply point (ASP) warehouse management operations at the pallet and sub-pallet levels, with a focus on demonstrating the basic concept of automated control of operations, manned and unmanned teaming, situational monitoring, interfacing and control of robotic movement resource devices, and supply configuration tracking; demonstrate ammunition resupply technologies.	-	2.284	2.326
Accomplishments/Planned Programs Subtotals	2.630	2.284	2.326

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
C07: *Joint Service Combat Feeding Tech Demo*	-	2.153	2.134	2.177	-	2.177	0.000	0.000	0.000	0.000	-	-

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 Force Sustainment Systems (PM FSS), Product Manager Combat Support Equipment (PM CSE), Naval Sea Systems Command (NAVSEA)/Naval Supply Systems Command (NAVSUP), and/or United States Air Force Basic Expeditionary Airfield Resources (BEAR) Program Office. Demonstrated ration technologies are transitioned to the Combat Feeding Directorate for Advanced Component Development & Prototypes under Program Element (PE) 0603747A (Soldier Support and Survivability).

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

Work in this Project complements and is fully coordinated with 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 2016	FY 2017	FY 2018
Title: Joint Service Combat Feeding Technical Demonstration	2.153	2.134	2.177
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. This effort will demonstrate technologies in support of the Defense Health Agency Veterinary Services (DHA VS) 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 Accomplishments:*** Exploited and demonstrated 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; demonstrated novel food pathogen extraction methods and commercial-off-the-shelf (COTS) diagnostic technologies; developed and demonstrated technologies to stabilize amino acids to improve protein quality and functionality; demonstrated novel ration processing techniques for significant cost reductions while expanding nutrient retention within shelf stable components; demonstrated technology for next generation of ration components with increased nutrient density to decrease sustainment burden, improve performance and reduce Soldier load; demonstrated novel ration packaging material technologies (e.g., bio-based hybrid materials) to reduce ration packaging waste. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will mature technologies that enable the use of carbon dioxide as a refrigerant in cold storage units to reduce cost, improve efficiency, and eliminate reliance on hydrofluorocarbons; demonstrate high efficiency foodservice systems that reduce generation of greywater and water demand; demonstrate technology to condition battlefield fuels for use in commercial gas-fired appliances to simplify acquisition and improve supportability; validate food safety tools to mitigate exposure to foodborne pathogens and food contaminants; demonstrate ration components with increased phytochemical content to optimize warfighter performance; mature novel food processing technologies to increase consumption of fruits and vegetables in tactical environments; demonstrate calorically dense ration components with reduced weight and cube; validate retention of required barrier properties in novel packaging prototypes.			
Accomplishments/Planned Programs Subtotals	2.153	2.134	2.177

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) FF6 / *Individual Protection*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
FF6: *Individual Protection*	-	0.000	0.000	6.352	-	6.352	11.364	10.986	10.277	10.347	-	-

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates Soldier protective clothing and individual equipment focused on enhancing Soldier survivability from combat threats (flame and thermal, blast and ballistic, multispectral sensors, and laser threats), environmental threats (e.g., cold, heat, wet, vector, antimicrobial, etc.), and power management solutions. This effort includes the demonstration and validation of technologies, novel subsystems/systems, and test methods related to personnel armor, helmets, hearing protection, eyewear, uniforms, handwear, footwear, and other clothing and individual equipment items.

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

Work in this project complements and is fully coordinated with Program Elements (PEs) 0602786A (Warfighter Technology), PE 0602716A (Human Factors Engineering Technology), and PE 0602705A (Electronics and Electronic Devices).

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 2016	FY 2017	FY 2018
Title: Soldier/Small Unit Multi-Threat Protection	-	-	6.352
Description: This effort focuses on maturing and demonstrating multifunctional protective component materials, sub-systems, protection technologies, and test methodologies that have the potential to significantly increase protection afforded by Soldier clothing and individual protective equipment. This effort also focuses on the maturation and demonstration of ballistic, blast, and integrated protection technologies that support tradeoff optimization in component design. Work includes small arms and fragmentation protection, flame and thermal, environmental, and multispectral concealment capabilities as well as novel hydration and water purification technologies for the individual Soldier. This work is fully coordinated with PE 0602786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/Project H94. Demonstrated technologies transition to various Program Executive Office (PEO) Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2018 Plans:*** Will mature and demonstrate an optimized material solution and uniform architecture to address jungle environmental extremes; mature new material systems specifically designed for cold/extreme cold environments and integrate these systems into a newly optimized cold/extreme cold ensemble; demonstrate anthropometrically correct flame resistant hand and head test equipment			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** FF6 / *Individual Protection*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
and methodology; mature and demonstrate repellent capabilities to enhance insect vector protection; optimize models that support virtual camouflage testing based on realistic terrain backgrounds; demonstrate new helmet test methodology with improved behind helmet blunt trauma measurement; demonstrate the ballistic performance from the latest developments in high performance ballistic materials integrated into a suite of common helmet designs; optimize comprehensive hearing protection test methodology by collecting operational sound profiles for integration with test equipment and methods; optimize predictive tools that allow for the advancement of material system baselines for regionally specific uniform configurations with an emphasis on cold weather protection.			
Accomplishments/Planned Programs Subtotals	-	-	6.352

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
J50: *Future Warrior Technology Integration*	-	31.711	26.550	24.894	-	24.894	16.813	16.148	18.867	19.731	-	-

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 Soldier protective clothing and individual equipment focused on enhancing Soldier survivability from combat threats (flame and thermal, blast and ballistic, multispectral sensors, and laser threats) and environmental threats (e.g., cold, heat, wet, vector, antimicrobial, etc.) for all weather conditions, and power management solutions. This effort includes the demonstration and validation of technologies, novel subsystems/systems, and test methods related to personnel armor, helmets, hearing protection, eyewear, uniforms, handwear, footwear, and other clothing and individual equipment items. 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. This Project also matures and demonstrates mission command and power and energy technologies for the dismounted Soldier and small unit operating in a networked operating environment.

In Fiscal Year (FY) 18, efforts entitled Soldier/Small Unit Ballistic and Blast Protection and Soldier/Small Unit Multi-Threat Protection will be moved from Project J50 to Project FF6.

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 (Command, Control, Communications Adv 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.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Title: Soldier/Small Unit Ballistic and Blast Protection	6.554	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 the potential to significantly increase protection for individual Soldiers and/or reduce physical load at equal or better capability. This work is fully coordinated with PE 0602786A/Project H98, PE 0602716A/Project H70, and PE 0602705A/ Project H94. Demonstrated technologies will transition to various Program Executive Office (PEO) Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. This effort will end in FY18. Future work will be included in Soldier/Small Unit Multi-Threat Protection under Project FF6.			
FY 2016 Accomplishments: Optimized non-destructive inspection technologies for evaluation of effects of environmental aging and mechanical damage on helmet and armor system performance; integrated ballistic and blast protection capabilities into extremity protection equipment; exploited 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; verified and validated improved casualty reduction model with the ability to fully pose digitally scanned Soldier and equipment models in operationally relevant scenarios; demonstrated prototype of self-powering single lens protective eyewear system with sun, ballistic, and laser protective capabilities; demonstrated integration of active auditory protection with ballistic protection eyewear.			
FY 2017 Plans: 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	8.208	4.836	-
Description: This effort focuses on maturing and demonstrating multifunctional protective component materials, sub-systems, protection technologies, and test methodologies that have the potential to significantly increase protection of individual Soldiers. This includes the maturation and demonstration of improved flame, thermal, environmental, and multispectral concealment capabilities as well as novel desalinization and purification technologies for individual Soldier hydration. 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. This effort will be moved from Project J50 to Project FF6 in FY18.			
FY 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Exploited 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; demonstrated prototype uniforms with thermal signature management technologies in a wide range of environmental conditions; completed trade analysis of relative effects of pattern size and color on visual signature management; demonstrated improved flame resistant fabric with enhanced durability and reduced cost. ***FY 2017 Plans:*** 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 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 2016 Accomplishments:*** Continued 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; matured the framework to create design criteria to experiment, demonstrate, verify, and validate technical maturity and military utility of future technologies; integrated logical structure and shared repository for the Soldier community; demonstrated 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:*** 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	12.105	11.795	14.285

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will conduct analyses of the use cases developed in FY 2017 to demonstrate the benefits of SSEA against specified objectives. Analyses will include: the efficacy and benefits of systems engineering processes, the utility of SSEA tools and processes for development of the Soldier as a System, and the benefits of utilizing SSEA during early capability development; improve SSEA tools and processes by simplifying user functions and automating operations; demonstrate the application of human performance assessment methods for powered and unpowered physical human augmentation technologies; identify and validate individual Soldier cognitive metrics sensitive to equipment load and fatigue in a simulated environment.			
Title: Soldier and Small Unit Mission Command/Situational Awareness (SA) and Power and Energy Integration	2.231	2.359	5.936
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 Accomplishments:*** Began 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; assessed cognitive load associated with all mission information systems; improved the capability of Soldier integration lab live simulation by integrating cognitive measures into operational scenarios (e.g., cordon and search); integrated and demonstrated mission performance impacts using handheld information portrayal technologies for applications such as aerial resupply and factors related to Soldier readiness; matured and demonstrated 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:*** 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
technologies for situational awareness such as augmented reality and information portrayal on head-borne devices; mature and 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. ***FY 2018 Plans:*** Will mature distributed power management concepts and technologies for efficiently transferring power on the Soldier; mature advanced kinetic energy electrical components for improved efficiency of the backpack energy harvester; mature and demonstrate Soldier data management tools and assess the transfer of wired and wireless data between Soldier borne electronic devices; mature and demonstrate advanced Global Positioning System (GPS) denied navigation and environmental sensing algorithms for Soldier borne sensor platforms; integrate and assess Soldier carried unmanned ground and aerial vehicles and physiological status monitor sensors within the Nett Warrior system architecture to understand the human systems integration challenges of interfacing Soldiers with sensors and robotics.			
Title: Soldier and Small Unit Human Systems Performance ***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 effort develops low-cognitive workload tactical information cuing guidelines and technologies and matures a testbed for assessing cognitive load and mission performance of Soldiers using situational awareness technologies. 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 Training and Doctrine Command (TRADOC) and be integrated into the SSEA and Systems Integration Laboratory environment. ***FY 2016 Accomplishments:*** Optimized biomechanics tools and metrics to quantify performance effects of Soldier and small unit load and protective clothing on Soldier effectiveness; correlated operational field relevance with laboratory research to mimic impacts of physical fatigue, load redistribution, personal augmentation, agility, and weight sensitivity on performance and injury; demonstrated 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; established the impact of load carriage over variable grades to inform future requirements for load carriage; identified markers of fatigue that may predict declines in cognitive performance; optimized understanding of the effects of exoskeleton designs on gait and energy. ***FY 2017 Plans:*** 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	2.613	3.358	4.673

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
against operational tasks and missions to correlate lab to field data to strengthen prediction of Soldier and squad 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. ***FY 2018 Plans:*** Will mature a virtual testbed that can be used to evaluate novel situational awareness technologies for their impact on cognitive workload as it relates to mission performance; develop basic and individualized tactile, audio, and visual cueing information portrayal software standards to enable streamlining of systems from Nett Warrior to novel future situational awareness technologies; exploit human systems integration tools to baseline physical characteristics and performance requirements of enhanced Soldier equipment.			
Accomplishments/Planned Programs Subtotals	31.711	26.550	24.894

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: FY 2018 Army												Date: May 2017
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	9.000	0.000	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 2016	FY 2017
Congressional Add: Program Increase	9.000	-
FY 2016 Accomplishments: Program increase for warfighter advanced technology		
Congressional Adds Subtotals	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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	6.495	4.245	3.433	-	3.433	2.056	2.276	1.796	1.869	-	-

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 Program Element (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 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 2016	FY 2017	FY 2018
Title: Expeditionary Base Camp (EBC) Technology Demonstrations	6.495	4.245	3.433
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: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
T40, PE 0603734A/Project T08, PE 0603004A/Project L97, PE 0603005A/Project 497, PE 0603125A/Project DF5, and PE 0603772A/Project 101. ***FY 2016 Accomplishments:*** Validated base camp technology component performance data using a model-based systems engineering approach with approved sustainability and logistics baseline; optimized technology integration to improve small contingency base camp operations and conduct integrated demonstrations; matured and demonstrated water demand reduction technologies to reduce logistical tail to base operations; demonstrated integrated components of the black waste treatment technologies; optimized a highly mobile shelter design to enable a leaner force and a highly expeditionary force; demonstrated cooling technologies for small basing applications that will decrease logistic demands and improve Soldier readiness. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will optimize and assess base camp life support technologies that potentially impact Warfighter cognitive and physical performance; exploit composite material repairing methodologies for tactical shelters to reduce system replacement costs; exploit self-powered waste to energy technologies to include black waste treatment for small base camps for self-sustaining base camp concept; provide and mature the design of next generation shelter to improve shelter energy efficiency and durability; demonstrate flexible photovoltaic material technology as an alternative operational energy source for forward operating bases; mature self-cooling technologies for human remains transfer without increasing the weight of the current system.			
Accomplishments/Planned Programs Subtotals	6.495	4.245	3.433

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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-2A, RDT&E Project Justification: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*				Project (Number/Name) XW6 / *Small Unit Expeditionary Maneuver*			
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
XW6: *Small Unit Expeditionary Maneuver*	-	0.000	0.000	0.000	-	0.000	3.980	6.328	6.437	6.985	-	-

A. Mission Description and Budget Item Justification

The Small Unit Expeditionary Maneuver project will focus on innovative technologies which provide maneuver capabilities such as aerial delivery and advances human performance sustainment capabilities which enable units to operate for hours, days and/or weeks while still sustaining a high maneuver tempo for sustained periods.

B. Accomplishments/Planned Programs ($ in Millions)

N/A

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: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	103.753	68.365	67.780	-	67.780	63.996	61.237	66.452	71.102	-	-
810: *Ind Base Id Vacc&Drug*	-	17.950	16.762	17.888	-	17.888	17.061	18.030	21.352	21.721	-	-
814: *NEUROFIBROMATOSIS*	-	15.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
840: *Combat Injury Mgmt*	-	26.904	19.131	19.716	-	19.716	20.263	21.220	21.613	23.364	-	-
945: *BREAST CANCER STAMP PROCEEDS*	-	0.569	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	0.000	11.656	9.958	-	9.958	9.151	4.893	5.057	6.766	-	-
FH4: *Force Health Protection - Adv Tech Dev*	-	1.232	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
MM3: *Warfighter Medical Protection & Performance*	-	18.098	20.816	20.218	-	20.218	17.521	17.094	18.430	19.251	-	-

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) matures 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 United States (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 (DoD) 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 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 and practice guidelines 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, vascular and bone tissues in wounded Service Members. 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 which is a restructure of efforts funded elsewhere in this Program Element, 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 tissues in wounded Service Members.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
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 matures, 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 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 (USAMRIID) and the Armed Forces Institute of Regenerative Medicine (AFIRM), 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	108.584	68.365	70.847	-	70.847
Current President's Budget	103.753	68.365	67.780	-	67.780
Total Adjustments	-4.831	0.000	-3.067	-	-3.067
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.831	-			
• Adjustments to Budget Years	0.000	0.000	-3.179	-	-3.179
• Civ Pay Adjustments	0.000	0.000	0.112	-	0.112

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 814: *NEUROFIBROMATOSIS*		
Congressional Add: *Neurofibromatosis Research Program*	15.000	-
Congressional Add Subtotals for Project: 814	15.000	-
Project: 97T: *NEUROTOXIN EXPOSURE TREATMENT*		
Congressional Add: *Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program*	16.000	-
Congressional Add Subtotals for Project: 97T	16.000	-
Project: MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Military Burn Trauma Research Program*	8.000	-
Congressional Add Subtotals for Project: MM2	8.000	-
Congressional Add Totals for all Projects	39.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
810: *Ind Base Id Vacc&Drug*	-	17.950	16.762	17.888	-	17.888	17.061	18.030	21.352	21.721	-	-

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 United States (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 Project 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 the United States Army Medical Research and Materiel Command (USAMRMC) in coordination 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: FY 2018 Army		Date: May 2017
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 (WRAIR), Silver Spring, MD, and its overseas laboratories; the U.S. Army Medical Research Institute of Infectious Disease (USAMRIID), Fort Detrick, MD; and the NMRC, Silver Spring, MD, and its overseas laboratories.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Drugs to Prevent/Treat Parasitic Diseases	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 2016 Accomplishments: The down-selected compounds from Triazine group showing positive results in small animal testing in FY15 were used in clinical testing for safety and effectiveness in human volunteers. Conducted 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). Transitioned best therapeutic (treatment or drug promoting disease healing) and preventive drug candidates to advanced development.			
Title: Vaccines for Prevention of Malaria	4.734	-	-
Description: This effort selects candidate vaccines for various types of malaria, including the severe form of malaria (Plasmodium falciparum) and the less severe but relapsing form (Plasmodium vivax), prepares technical data packages required for FDA approval of testing in humans and conducts testing of promising malaria vaccine candidates in humans. A malaria vaccine would minimize the progression and impact of drug resistance and poor Warfighter compliance with taking preventive anti-malarial drugs. 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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Continued 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-selected 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 this 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. ***FY 2018 Plans:*** Will submit initial human testing data for FDA review and down-select lead Triazine compound for further human testing. Will assess improved strategy for safe and more effective use of primiquine-like drugs for radical cure in humans. Will continue to conduct trials in human volunteers using multiple technologies to evaluate efficacy of selected vaccine candidates in a controlled human malaria infection model.	-	6.591	6.916
Title: Bacterial Disease Threats ***Description:*** This effort selects promising candidate vaccines against each of the three main bacterial causes of diarrheas (E. coli, Campylobacter, and Shigella; that pose 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.	4.518	3.880	4.291

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Prepared data packages to present to the FDA for approval for human testing of vaccine candidates for bacterial diarrheal agents. Conducted extended safety and effectiveness studies by using different escalating doses of down selected vaccine candidates against each of the three diarrheal agents (Shigella, Enterotoxigenic E. coli (ETEC) and Campylobacter) in human volunteers. Transitioned 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. ***FY 2018 Plans:*** Will conduct expanded (FDA) safety/initial efficacy study in humans for Shigella and ETEC vaccine candidates. Will perform analyses of samples obtained from human safety studies and make decisions regarding advancement of vaccine candidates for further testing at field sites. Will conduct initial (FDA) safety study in humans for a Campylobacter vaccine candidate. Will perform analyses of samples obtained from safety study of the Campylobacter vaccine candidate and make a decision regarding advancement of this candidate in efficacy testing studies.			
Title: Viral Disease Threats	5.116	5.035	5.000
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), as well as conducts FDA-required nonclinical safety and protection testing (laboratory- based) in animals, prepares FDA investigational new drug technical data packages, and conducts clinical testing of candidate vaccines in humans.			
FY 2016 Accomplishments: Conducted assessments of vaccine effectiveness and safety among human populations immunized with experimental dengue vaccines. Continued development and testing of the experimental dengue human challenge model initiated in FY15. Continued clinical trials with candidate deoxyribonucleic acid (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). Coordinated with the FDA to establish specific guidelines for the licensure of a hantavirus DNA vaccine.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will assess safety and immunogenicity (ability to provoke an immune response) of vaccine candidates measured from sera (body fluids) and immune cells obtained from human volunteers enrolled in new dengue vaccine trial conducted with commercial partner. Will continue to evaluate safety of controlled human dengue infection model with newly developed Dengue viruses. Will validate effectiveness of candidate dengue vaccines using challenge model (mimics dengue in a controlled setting by infecting human volunteers with a weakened live dengue virus and measuring outcome. Will conduct human trials to evaluate the biological activity of the DNA-based vaccine to prevent Hemorrhagic Fever with Renal Syndrome (HFRS).			
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 2016 Accomplishments:*** Supported projects to research and develop rapid human diagnostic devices (RHDDs) for priority diseases and pathogens (infectious agents) that are usable at or near the point of need. Developed military relevant assays (i.e. panels differentiating diseases that have similar symptoms) to be transitioned for the next-generation diagnostic system (NGDS) platform. Continued 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 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	1.624	1.256	1.681

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will advance the evaluation of new generation spatial repellant(s) in the field for efficacy against insect and other arthropod vectors. Will continue to perform laboratory and field evaluations with commercial partners and OCONUS laboratories to evaluate rapid diagnostic assays for infectious agents applicable to military interests.			
Accomplishments/Planned Programs Subtotals	17.950	16.762	17.888

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
814: *NEUROFIBROMATOSIS*	-	15.000	0.000	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 2016	FY 2017
Congressional Add: Neurofibromatosis Research Program	15.000	-
FY 2016 Accomplishments: Neurofibromatosis Research Program		
Congressional Adds Subtotals	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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
840: *Combat Injury Mgmt*	-	26.904	19.131	19.716	-	19.716	20.263	21.220	21.613	23.364	-	-

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 new clinical practices for control of severe bleeding, treatment for traumatic brain injury (TBI), resuscitation 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 five 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)

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 (U.S.) 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), at Multiple Institutions across the U.S.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Damage Control Resuscitation	7.200	6.183	6.035

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** Continued research from FY15 to evaluate hemostatic drugs, biologics, devices and techniques in relevant traumatic bleeding shock models. Extended FY15 work, evaluated promising hemostatic devices designed to stop bleeding in body locations where tourniquets cannot be used; evaluations were done in manikins and normal human volunteers. Evaluated 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. ***FY 2018 Plans:*** Will perform preclinical studies to evaluate stem cell therapies in an animal model of severe traumatic bleeding. Will evaluate currently available and new products for control of compressible bleeding under prolonged field care scenarios, i.e., when medical evacuation is delayed and/or prolonged. Will perform animal studies to determine impact of prolonged hypotensive (low blood pressure) resuscitation, due to delayed evacuation, on subsequent survival once patient receives definitive surgical care and full resuscitation. Will evaluate different types of mechanical interventions (e.g., compression, wound packing, use of tourniquets) to determine optimal practices for control of bleeding from junctional wounds. Will continue to evaluate small volume resuscitative therapies with blood products and hemostatic drugs (drugs that stop or slow down the flow of blood) to identify combinations that optimally mitigate the effects of inflammation and prolonged ischemia (inadequate or absent blood supply) in critical tissues. Will evaluate methods to refrigerate whole blood that do not impair platelet function.			
Title: Combat Trauma Therapies	3.508	5.467	6.343
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 2016 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
As follow on to research from FY15, evaluated therapies to reduce fibrosis (development of excessive connective tissue after injury) during recovery from large volume muscle loss injury and improve muscle functionality. Performed small clinical studies to characterize effects of traumatic and burn injuries on vital organ preservation, scarring, and need for pain-relieving drugs. Fielded 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. ***FY 2018 Plans:*** Follow on work to evaluate therapies that reduce excessive scar tissue formation following traumatic muscle injury will move under Clinical and Rehabilitative Medicine. Will perform studies to determine impact of prolonged tourniquet use on antibiotic concentrations at wound site. Will perform retrospective analyses to identify clinical determinants of long-term disability in casualties with musculoskeletal injuries. Will perform animal studies to determine optimal concentration of dilute hypochlorite for initial wash-out of dismounted complex battlefield injuries. Will perform preclinical studies to 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.			
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 2016 Accomplishments:*** Examined promising therapies to protect brain cells following TBI using relevant animal models of penetrating and concussive TBI. Performed studies to establish drug protocols targeting the sub-acute (within the first few days following TBI) and chronic TBI recovery phases. Continued 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	4.062	4.192	4.085

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
neuroprotection therapies (therapies to protect brain tissue from further damage following a TBI event) using validated small animal model of polytrauma (multiple traumatic injuries). ***FY 2018 Plans:*** Will complete studies to mitigate post-TBI hyperthermia (TBI-induced fever) and transition knowledge to clinical practice guidelines. Will continue to further evaluate two neuroprotective drugs (therapies to protect brain tissue from further damage following a TBI event) with demonstrated synergistic effects in animal models of TBI. Will use a small animal model of severe TBI to evaluate the potential beneficial effects of resuscitative endovascular balloon occlusion of the aorta (a surgical technology used to control non-compressible hemorrhage in the abdomen) on TBI outcomes.			
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 2016 Accomplishments:*** Evaluated 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. Concluded work on ventilation strategies and transition to advanced development. Started 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. Performed 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. ***FY 2018 Plans:*** Will evaluate inhalation delivery of stem cells to treat lung injury in animal model. Will continue to clinically evaluate means to prevent pressure ulcer development during evacuation. Will transition knowledge from enroute nursing care and sepsis (the condition or syndrome caused by the presence of microorganisms or their toxins in the tissue or the bloodstream) management to	3.692	3.289	3.253

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
clinical practice guidelines. Will perform animal studies to determine effects of endovascular balloon occlusion of the aorta (used for control of intra-abdominal bleeding) on organ function to ensure use is optimized to prevent organ failure and death.			
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. ***FY 2016 Accomplishments:*** Executed preclinical studies of drug delivery, diagnostic, tissue repair, and/or treatment strategies for traumatic eye injury and assessed the preclinical safety and efficacy of promising strategies to facilitate clinical translation. Further advanced novel drug delivery, diagnostic, reconstructive, and regenerative strategies including novel biological materials and cell-based therapies (i.e. stem cells) toward clinical translation; utilized and refined the combination of cell-based therapies and tissue scaffolds to restore soft and bone tissue form and function; enhanced 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. Evaluated improved monitoring technologies for tissue rejection during hand and face transplant procedures for advancement into clinical trials.	7.886	-	-
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 2016 Accomplishments:*** Continued funding for scientific expertise, legal, contracting, research protections, regulatory affairs, and resource support personnel to manage active projects.	0.556	-	-
Accomplishments/Planned Programs Subtotals	26.904	19.131	19.716

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
945: *BREAST CANCER STAMP PROCEEDS*	-	0.569	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 2016	FY 2017	FY 2018
Title: Breast Cancer Stamp Proceeds	0.569	-	-
Description: This is a Congressional Interest Item.			
FY 2016 Accomplishments: blank			
Accomplishments/Planned Programs Subtotals	0.569	-	-

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
97T: *NEUROTOXIN EXPOSURE TREATMENT*	-	16.000	0.000	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 2016	FY 2017
Congressional Add: Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program	16.000	-
FY 2016 Accomplishments: Neurotoxin Exposure Treatment Parkinsons Research Program		
Congressional Adds Subtotals	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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	0.000	11.656	9.958	-	9.958	9.151	4.893	5.057	6.766	-	-

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 2016	FY 2017	FY 2018
Title: Clinical and Rehabilitative Medicine	-	11.656	9.958
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: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will advance early human clinical trials to ensure the safety and efficacy of an ocular bandage designed to rescue vision post-injury. Will conduct pre-clinical investigation of engineered skin substitutes for regeneration of functional skin without scarring. Will conduct pre-clinical trials of devices for repairing traumatic injury to craniofacial and extremity tissues. Will evaluate candidate biological therapies and drugs for reduced need of immunosuppressive (inhibition of the immune response) therapies following hand and face transplants. Will advance translation of candidate technologies and biologics that create a wound environment more conducive to bone healing.			
Accomplishments/Planned Programs Subtotals	-	11.656	9.958

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: FY 2018 Army					Date: May 2017							
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
FH4: *Force Health Protection - Adv Tech Dev*	-	1.232	0.000	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. This Project 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 2016	FY 2017	FY 2018
Title: Health Research	1.232	-	-
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: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** 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	1.232	-	-

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Advanced Technology Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Military Burn Trauma Research Program	8.000	-
FY 2016 Accomplishments: Military Burn Trauma Research Program		
Congressional Adds Subtotals	8.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
MM3: *Warfighter Medical Protection & Performance*	-	18.098	20.816	20.218	-	20.218	17.521	17.094	18.430	19.251	-	-

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 2016	FY 2017	FY 2018
Title: Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring)	2.736	5.753	7.214
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 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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will evaluate the impact of nutritionally optimized ration items on body composition and physiological status in Warfighters. Will demonstrate the effectiveness of nutrient and dietary strategies (e.g., omega-3 polyunsaturated fatty acids, zinc, and hydration) for reducing the vulnerability to and/or accelerating the recovery from mild TBI. Will validate and transition a novel mathematical method for estimating thermal-work strain from non-invasive measures such as heart rate, skin temperature, and heat flux. Will deliver a testable Cold Weather Ensemble Decision Aid (CWEDA), to compare different clothing ensembles for predicting cold weather endurance. Will perform initial field trials and demonstrations of Real Time Physiological Status Monitoring (RT-PSM) for the Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) and United States Marine Corps (USMC) communities. The RT-PSM system will enable real-time health surveillance and immediate recognition, characterization, and response to changes in force health status. Will mature an anatomically-correct Finite Element Thermoregulatory Model (FETM), which is used to simulate regional thermal differences in human physiology (e.g., sweat rate, heat production) and clothing (e.g., thermal and vapor resistance), as well as human-clothing thermal interactions, enabling individualized predictions of human responses to environmental, mission, and load carriage stresses.			
Title: Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments.	1.759	4.024	2.953
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 2016 Accomplishments:*** 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
to physiological status monitoring system(s) for end-user field validation studies. Refine localized heating strategies to improve hand dexterity and develop a militarily-relevant dexterity assessment method for cold weather operations and provide policy guidance for validated intervention strategies. ***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). ***FY 2018 Plans:*** Will provide validated evidence-based practice recommendations for biomarkers of physiological adaptation and mathematical models for optimizing health and performance against combinations of environmental threats. Will develop a portable, field-detection device capable of diagnosing target organ injury following exposure to extreme environments and assessing risk of adverse health effects and informing command return-to-duty decisions. Will develop a mobile application for identifying megacity chemical threats and adverse health effects and informing Command decisions, Will integrate patented skin temperature feedback technology into current microclimate cooling system. Will improve cooling efficiency by increasing the microclimate cooling surface area in direct contact with skin.			
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 2016 Accomplishments:*** 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:***	4.101	4.842	5.299

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 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. ***FY 2018 Plans:*** Will collect human middle ear reflex data to validate objective auditory injury risk models. Will evaluate metrics that predict the type and severity of blast-induced eye and visual pathway injuries. Will provide improved auditory protection standards and guidelines for speech discrimination, attenuation, and localization properties of active and passive hearing protection systems. Will validate objective assessment criteria for the prediction of protective capabilities of current Authorized Protective Eyewear List (APEL) spectacles and goggles resulting from blast-wave forces using multiple low and high energy pounds per square inch (PSI) forces. Will provide improved aeromedical standards for human performance during degraded visual environments. Will evaluate pilot metrics under selected visual and physiological stress conditions. Will evaluate how components of soldier tasks contribute to musculoskeletal injury and incorporate these data into predictive musculoskeletal injury risk models for improved injury prevention guidance. Will finalize and publish the Return to Duty (RTD) Toolkit and distribute it to clinical providers to enable RTD decisions. Will publish provisional biomedical-based spinal injury criteria and assessment methodologies for two types of vertebral body fractures that seated occupants of military vehicles experience during vertical exposure.			
Title: Psychological Health and Resilience	9.502	5.082	3.667
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 2016 Accomplishments:*** 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 deoxyribonucleic acid (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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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:*** 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. ***FY 2018 Plans:*** Will expand the Systems Biology Enterprise PTSD biomarker research effort to focus on identifying the impact of treatment on PTSD disease biomarkers and to relate changes in biomarkers to specific interventions toward the development of a prescriptive intervention regimen. Will validate at least one novel neurocognitive target of aggression and a corresponding intervention tool. Will develop and test a gaming-based neurocognitive optimization application. Will validate a mobile app platform by directly comparing response rates and behavioral health benchmarks across standard paper-and-pencil and app-based behavioral health assessments (both individual and unit-based).			
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	-	1.115	1.085

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will quantify dose-response relationships to operationally-relevant exposures of permethrin (a synthetic chemical found in insect repellants) and polycyclic aromatic compounds (created from the incomplete combustion of animal or plant matter, or carbon fuels, such as coal) in the military personnel population. Will provide pertinent model parameters for the assessment of real-time personal dose levels to operationally relevant exposures among the high-risk military job population subgroups. Will evaluate longer-term neurological and/or physical health trajectories associated with operationally relevant exposures during military service.			
Accomplishments/Planned Programs Subtotals	18.098	20.816	20.218

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	99.542	94.280	160.746	-	160.746	127.723	109.378	110.247	112.356	-	-
313: *Adv Rotarywing Veh Tech*	-	70.142	80.948	147.882	-	147.882	115.712	97.125	97.750	99.603	-	-
436: *Rotarywing MEP Integ*	-	8.109	8.385	6.767	-	6.767	5.857	5.976	6.095	6.220	-	-
447: *ACFT Demo Engines*	-	7.891	4.947	6.097	-	6.097	6.154	6.277	6.402	6.533	-	-
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	13.400	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 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: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	103.136	94.280	100.731	-	100.731
Current President's Budget	99.542	94.280	160.746	-	160.746
Total Adjustments	-3.594	0.000	60.015	-	60.015
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.594	-			
• Adjustments to Budget Years	0.000	0.000	60.000	-	60.000
• Civ Pay Adjustment	0.000	0.000	0.015	-	0.015

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Helicopter Seat Improvements*	3.400	-
Congressional Add: *Future Vertical Lift Research*	10.000	-
Congressional Add Subtotals for Project: BA7	13.400	-
Congressional Add Totals for all Projects	13.400	-

Change Summary Explanation

Fiscal Year (FY) 2018 increased funding for JMR Technology Demonstrator (TD) will be used to mature and demonstrate additional component technologies to better inform and reduce risk for the Future Vertical Lift program.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
313: *Adv Rotarywing Veh Tech*	-	70.142	80.948	147.882	-	147.882	115.712	97.125	97.750	99.603	-	-

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 (TD) 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 2016	FY 2017	FY 2018
Title: Aircraft & Occupant Survivability Systems	6.117	9.073	9.196

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 2016 Accomplishments:
Completed full scale demonstration of Combat Tempered Platform Technology. Conducted 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

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will continue maturation of individual technologies that comprise the Aircraft and Aircrew Protection solution. Will establish a virtual prototype of the integrated Aircraft and Aircrew Protection solution and initiate incremental verification testing. Will refine aircraft integration and system level demonstration strategies. Will continue the demonstration of efficient, low drag rotor and hub designs and technologies to allow for high speed flight. Will mature rotorcraft threat protection capabilities including self-protection and engagement technologies.			
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 2016 Accomplishments:*** Demonstrated 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. Conducted 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 efficient, low drag rotor and hub designs and technologies that mitigate the interactional aerodynamics issue affecting high speed operation. ***FY 2018 Plans:*** Will complete detailed design of a new Research Flight Control Computer Assembly for the modernized RASCAL and conduct a thorough government evaluation through a comprehensive technical review.	1.444	4.098	3.172
Title: Platform Design & Structures Systems	55.488	55.476	120.355

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018

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 2016 Accomplishments:
Continued execution of the following for the JMR TD Program: Air Vehicle demonstration efforts, Joint Common Architecture (JCA) standard validation and implementation demonstrations, and Mission System Architecture Demo (MSAD) efforts. Specific tasks for the Air Vehicle effort included (for both flight vehicles): completed fabrication of major air vehicle components; continue flight vehicle assembly; completed scaled wind tunnel tests and continue data reduction activities; development and submittal of subsystem test plans, air vehicle ground test plan, and critical analytical results in support of the on-going airworthiness evaluation; completed fabrication of full scale subsystem test fixtures; initiated 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 included: issuance of Requests for Information (RFI) to refine the scope of the implementation demonstrations; continued development of the JCA standard including the functional decomposition of subsystem modules using both government and industry experts and government laboratory facilities; support the development of the model-based software tool with the System Architecture Virtual Integration effort; and conducted 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 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.

FY 2018 Plans:
JMR TD air vehicle demonstration: Will continue flight demonstrations of two technology demonstrator aircraft to collect data and assess the capabilities of advanced rotary-wing configurations (an advanced tilt rotor and lift-offset, co-axial helicopter with a pusher prop) and enabling component technologies. Will begin design and build of a test stand and test articles (hardware and software) for a Single Rotor Tiedown (SRT) test of the two-speed gearbox, Independent Blade Control (IBC) and rotors critical to realizing the performance capabilities of an Optimum Speed Tilt Rotor (OSTR). Will complete analysis and modeling of interactional aerodynamics and piloted simulations of a Compound Co-Axial Helicopter (CCH) configuration. Mission Systems Architecture Demonstration: Continued development JCA v2.0. Release of JCA v2.0, including a functional model,

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
data model, supporting documentation and tools. Will continue development of model-based engineering processes and tools for the development and analysis of mission systems architectures as part of Development, Architecture Centric Virtual Integration Process (ACVIP). Will release of a Broad Area Announcement (BAA) for the Mission System Architecture Capstone Demonstration, seeking the development of a mission systems architecture from a representative architecture specification using JCA, model-based engineering tools, virtual integration methods and open systems architecture. Completion of source selection activities for the Capstone Demonstration and agreement awards to multiple vendors. Will begin Mission System Architecture Capstone Demonstration.			
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 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. ***FY 2018 Plans:*** Will complete design of advanced multi-speed drive train for advanced aircraft configurations under the Next Generation Rotorcraft Transmission program and initiate fabrication of demonstrator hardware.	-	1.013	2.262
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 2016 Accomplishments:*** Matured 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; matured technologies to enable lighter weight designs through loads monitoring of critical components; mature and demonstrate technologies for component self-assessment, usage tracking and embedded history; and mature embedded multifunctional sensors with built-in processing and	3.242	3.785	3.897

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
communications. Conducted 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. ***FY 2018 Plans:*** Will initiate effort to develop an embedded and networked rotorcraft sustainment capability. Will mature integrated health management technologies in a SIL environment to demonstrate: an aircraft level sustainment network; embedded health assessment, adaptive aircraft control inputs, and component self-assessment; usage tracking; and embedded history data interfaces with mission planning and enterprise logistics systems. Will identify and select hardware and software for integration into a sustainment rig and/or SIL test.			
Title: Survivability for Degraded Visual Environment (DVE) Operations	3.851	7.503	9.000
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 United States (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 Accomplishments:*** Conducted 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 was executed with a UH-60 aircraft that hosted program developed modernized			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
control laws (MCLAWS version 3), multi-modality sensor suites (two) and advanced cueing elements. All modes of flight were tested (take-off, en-route, landing) and numerous obstacle fields were presented to the flight crew in order to assess overall DVE system performance, system capability and pilot workload. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will continue to refine Integrated Cueing Environment (ICE) design and to integrate new technology, including spatial aural cues and experiment in the flight environment. Will conduct limited flight test of real time enroute path guidance from sensor data using Obstacle Field Navigation (OFN) algorithms.			
Accomplishments/Planned Programs Subtotals	70.142	80.948	147.882

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
436: *Rotarywing MEP Integ*	-	8.109	8.385	6.767	-	6.767	5.857	5.976	6.095	6.220	-	-

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 2016	FY 2017	FY 2018
Title: Unmanned and Optionally Manned Systems	8.109	8.385	6.767
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 2016 Accomplishments: Demonstrated advanced autonomous behaviors in a virtual battle space to be integrated into a simulation facility to evaluate Manned/Unmanned Teaming (MUM-T). Integrated close proximity flight in a simulated environment and mature technology in preparation for a simulation demonstration. Matured and demonstrated data fusion technologies of both on and off board sensors			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
in a simulation environment. Demonstrated advanced decision aiding technologies to aid an airborne mission commander to control both his or her own ship and a team of unmanned systems. Implemented 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. ***FY 2018 Plans:*** Will integrate and demonstrate third party vendor pilot aiding software and advanced human machine interface technologies in simulations to inform cockpit development programs for both legacy fleet aircraft upgrades and future aircraft procurements. Will demonstrate software integration within an open systems, modular architecture based system.			
Accomplishments/Planned Programs Subtotals	8.109	8.385	6.767

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
447: *ACFT Demo Engines*	-	7.891	4.947	6.097	-	6.097	6.154	6.277	6.402	6.533	-	-

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 2016	FY 2017	FY 2018
Title: Future Affordable Turbine Engine (FATE)	7.891	-	-
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 2016 Accomplishments:*** Completed fabrication of redesigned engine components and complete assembly, instrumentation, and testing of the final performance demonstration engine. This full engine system level test validated the horsepower to weight ratio and specific fuel consumption goals of the advanced FATE architecture.			
Title: Alternative Concept Engine (ACE)	-	4.947	6.097
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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will complete detailed design and initiate fabrication of innovative/adaptive engine component technologies such as variable speed power turbine. Will perform component design integration efforts in preparation for full system demonstration.			
Accomplishments/Planned Programs Subtotals	7.891	4.947	6.097

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	13.400	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Aviation advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Helicopter Seat Improvements ***FY 2016 Accomplishments:*** This Congressional Add supported research for helicopter seat improvements.	3.400	-
Congressional Add: Future Vertical Lift Research ***FY 2016 Accomplishments:*** This Congressional Add supported research for Future Vertical Lift technologies and concepts in support of the Joint Multi-Role Tech Demo Program.	10.000	-
Congressional Adds Subtotals	13.400	-

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	95.504	68.714	84.079	-	84.079	85.808	79.455	84.389	74.319	-	-
232: *Advanced Lethality & Survivability Demo*	-	39.202	46.051	54.977	-	54.977	53.532	42.663	46.128	35.550	-	-
43A: *ADV WEAPONRY TECH DEMO*	-	40.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
L96: *High Energy Laser Technology Demo*	-	12.134	17.728	24.096	-	24.096	26.253	30.169	30.035	30.736	-	-
L97: *Smoke And Obscurants Advanced Technology*	-	4.168	4.935	5.006	-	5.006	6.023	6.623	8.226	8.033	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures weapons and munitions components/subsystems and demonstrates lethal and non-lethal weapons 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	82.663	68.714	76.822	-	76.822
Current President's Budget	95.504	68.714	84.079	-	84.079
Total Adjustments	12.841	0.000	7.257	-	7.257
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	15.000	-			
• SBIR/STTR Transfer	-2.159	-			
• Adjustments to Budget Years	0.000	0.000	7.236	-	7.236
• Civ Pay Adjustments	0.000	0.000	0.021	-	0.021

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 43A: *ADV WEAPONRY TECH DEMO*		
Congressional Add: *Program Increase*	25.000	-
Congressional Add: *Hybrid Projectile Technology Research*	15.000	-
Congressional Add Subtotals for Project: 43A	40.000	-
Congressional Add Totals for all Projects	40.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
232: *Advanced Lethality & Survivability Demo*	-	39.202	46.051	54.977	-	54.977	53.532	42.663	46.128	35.550	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for affordable precision munitions. Technologies include advanced energetic materials, insensitive munitions, novel fuze designs, penetrators, and scalable effects.

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 2016	FY 2017	FY 2018
Title: Ground Based Networked Munitions Technologies	0.965	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 2016 Accomplishments: Developed area denial munition technologies including networked munition level architecture and advanced methods for precision delivery/location of remote effects.			
FY 2017 Plans: Mature the networked munition modular architecture for use in future Programs of Record; demonstrate technologies for non-kinetic energy vehicle stopping.			
Title: Cluster Munitions Replacement Acceleration	2.882	8.500	8.000
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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Matured a novel cluster munition policy compliant warhead for 155mm artillery; conducted 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; conducted static and ballistic testing on an integrated projectile, culminating in a Technical Readiness Level (TRL) 6 demonstration. ***FY 2017 Plans:*** 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 continues 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 Dual Purpose Improved Conventional Munition (DPICM) bomblet and incorporates high reliability fuzing while maintaining the traditional lethal mechanisms of DPICM. In Fiscal Year (FY) 2017 the efforts 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 mature system level designs of unitary solutions and improve initial system level performance. Efforts 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. ***FY 2018 Plans:*** Will mature and demonstrate various materiel cluster munition components at the system and component level; evaluate effectiveness of materiel solutions; and optimize solutions to address desired target sets. Submunition concepts will undergo extensive laboratory testing to ensure arming in proper environments and ensure fuzing reliability growth.			
Title: Medium Caliber Weapon Systems	9.608	16.000	18.700
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 2016 Accomplishments:*** Validated weapon system integration with ammo handling system (AHS) and conducted fixed hardstand integration to support initial weapon system demonstration to optimize and improve weapon/ammo performance prior to test bed turret integration; matured test bed turret designs to support weapon system integration; exploited data from initial weapon demonstration to improve fire control software performance that will provide increased system accuracy. Improved effectiveness and performance			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
of programmable air burst munition (PABM) and armor piercing (AP) munition against personnel and materiel targets. Continued to mature combat load AHS to support integration into test bed turret for TRL 6 integrated system demonstration. ***FY 2017 Plans:*** 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 AHS prototypes; exploit advances in advanced Fire Control hardware to improve system performance; mature Fire Control software. ***FY 2018 Plans:*** Will validate weapon system integration with AHS and will conduct fixed hardstand integration to support initial weapon system demonstration to optimize and improve weapon/ammo performance prior to test bed turret integration; mature test bed turret designs to support weapon system integration; exploit data from initial weapon demonstration to improve fire control software performance that will provide increased system accuracy; improve effectiveness and performance of PABM and AP munition against personnel and materiel targets; and continue to mature combat load AHS to support integration into test bed turret for TRL 6 integrated system demonstration.			
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 2016 Accomplishments:*** Began the transition of insensitive energetic materials of interest to the Army; and down-selected and evaluated energetic materials to be scaled up to production levels to verify they meet the Army needs and can be produced in large quantity. ***FY 2018 Plans:*** Will qualify energetic materials to provide complete material characterization to reduce technical risk when transitioning to end-item; continue to mature the advancement of nano-energetic formulations to validate nano-materials characteristics to provide substantially less shock sensitivity than current formulations while maintaining optimal performance.	1.888	-	1.400
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.	5.764	6.250	7.250

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Developed hard-kill countermeasure system requirements to ensure proper interface with the Modular APS (MAPS); continued 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:*** 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; determine subsystem integration requirements and optimize interface specifications to support a Modular APS Framework (MAF) compliant Hard Kill component; mature modularity of subsystem components. ***FY 2018 Plans:*** Will modify Hard Kill Counter Measure (HKCM) subsystems to be compliant to MAPS standards; integrate, simulate and demonstrate Modular APS performance capability given mission scenario sets. Performance measures will include: threat detection, tracking, signal processing (Fire Control/Modular APS Controller (MAC)) and threat defeat of rocket propelled grenades (RPGs) and recoilless rifles. Will optimize interface specifications to support layered demonstrator of MAPS compliant hard kill component.			
Title: Precision Non-Line-of-Sight (NLOS) Munition for Light Forces ***Description:*** This effort provides a precision technology capability for an 81mm mortar cartridge for light forces for base defense. ***FY 2016 Accomplishments:*** Fabricated and demonstrated 81mm precision mortar design through a series of inert system flight tests which culminated in a capability demonstration at the end of FY16.	0.965	-	-
Title: Enhanced Sniper Technologies ***Description:*** This effort investigates advanced projectile designs such as long rod penetrator technologies that will provide snipers with the capability for increased range effectiveness (up to 1500m, possibly greater), hit probability, and armor penetration, for use in man-portable sniper weapons. ***FY 2016 Accomplishments:*** Optimized and demonstrated advanced sniper ammunition concepts through modeling and simulation and design verification; and demonstrated selected fully integrated ammunition-weapon designs in relevant operational environments.	2.893	-	-
Title: Long Range Gun Technology	7.003	1.686	1.700

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** Matured designs of component technologies associated with longer range artillery capabilities including cannon tube, breech and mount; conducted initial component verification; and conducted prototype technology demonstrator testing of weapon sub-systems. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will demonstrate and optimize integrated long range artillery subsystems including the armament and lightweight trunnion support bracket and mature component designs of secondary weapon subsystems such as scavenge systems, elevation, equilibration, automated breech operation, and thermal warning; mature and demonstrate armament with emerging charge and projectile technologies.			
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 2016 Accomplishments:*** Demonstrated image navigation guidance technology with algorithms and associated optics integrated in a projectile through a series of captive flight tests; demonstrated guidance and control system in a dynamic test to verify the ability to maneuver in flight. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will demonstrate the integrated image based terminal guidance system on an indirect fire platform. The system demonstration will show the end to end functionality of the Guidance, Navigation, and Control (GNC) system's ability to maintain <10m precision	2.402	2.000	3.000

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
capability in a GPS denied environment. After this demonstration series, a Technical Readiness Assessment (TRA) will be conducted to verify system at TRL-6.			
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 Accomplishments:*** Matured and integrated technologies for UAS tracking and defeat; evaluated and selected weapon systems and munitions for defeat of UAS and integrated into current system of systems for mobile and area defense; integrated precision fire control mechanisms and demonstrated the system of systems defeat of UASs; evaluated results of demonstrated UAS defeat mechanisms. ***FY 2017 Plans:*** Continue the maturation and optimization of technologies for UAS tracking and defeating to include the integration of precision fire control mechanisms and weapons systems; validate the technologies at the subsystem level and evaluate results of the UAS defeat mechanisms. ***FY 2018 Plans:*** Will integrate matured C-UAS technologies, to include precision fire control radar and small caliber munitions, onto a common weapons platform to form a system of systems for UAS detection, tracking, and defeat; perform system integration evaluations and validate the fire control radar and software for the UAS kill chain; update modeling and simulation tools based on collected data.	1.633	2.700	1.700
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 Accomplishments:*** Matured and integrated 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 could survive launch conditions in an extended range cannon environment. ***FY 2017 Plans:***	3.199	2.800	3.134

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will continue to exploit, mature, and demonstrate enhanced lethality from rocket assisted projectiles using technology enablers to optimize extended range vs. lethality; demonstrate integration of lifting surfaces, advanced navigation, flight control, and guidance technologies to enable precision at greatly extended ranges.			
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:*** 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). ***FY 2018 Plans:*** Will optimize and demonstrate reduced range error for increased accuracy in multi-mode medium caliber rounds; demonstrate advanced large caliber fuze setting technologies; and demonstrate advanced multi-point initiation systems and optimize advanced power systems for both fuze and munition systems. These technologies will continue to support the Joint Munitions Program TCG-5 and TCG-10 and the Joint Fuze Technology Program (JFTP).	-	1.800	2.860
Title: Advanced Small Arms Ballistic System ***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:***	-	1.915	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 Program Management (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:*** 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. ***FY 2018 Plans:*** Will develop and qualify the power source, which powers the electronic fuze system, at extreme temperature; design and qualify dual printed detonators; integrate power source and dual printed detonators into the system, conduct final TRL 5 demonstration.	-	1.100	1.000
Title: Extended Range Armament and Fire Control Integration ***Description:*** This effort matures and demonstrates extended range Armament technologies including light weight Cannon and Mount structures, high efficiency recoil cylinders, common lower power fire control hardware, improved fire control software, and improved sensor to shooter communications which will increase range and accuracy. ***FY 2018 Plans:*** Will begin to exploit, mature, and demonstrate enhanced light weight structures for cannon and mount components; mature and demonstrate common fire control hardware with improved software to improve accuracy at extended and current ranges.	-	-	3.096
Title: Aviation Armament System Technologies ***Description:*** This effort matures and demonstrates armament solutions adaptable to current aviation and future vertical lift applications in small caliber, medium caliber, counter measure and non-lethal technologies with a focus on light lethal aerodynamic systems. ***FY 2018 Plans:*** Will mature and integrate technology for a multi-role armaments solution on Future Vertical Lift aircraft system; improve fire control algorithms for holistic offensive and defensive fires for aviation; optimize weapon system for stowed and deployed operability and munitions with hard kill lethality at range for conventional and more challenging threats.	-	-	1.237
Title: Leader-Soldier Effects Tool Suite	-	-	0.700

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Description: This effort matures and demonstrates fires and effects planning, coordination and execution tool suite for sensor to shooter and tactical application. Provides enhanced collaborative engagement capability of fielded and emerging battle command systems supporting PM Soldier Warrior and PM Mission Command Program of Record (POR) architectures. ***FY 2018 Plans:*** Will demonstrate advance fires planning capabilities, specifically develop commander guidance matrix, battery defense application, and echelonment of fires capability that provides digitized tools for the commanders at various echelons; enhance current fires and effects planning tools such as howitzer platforms and dismounted units range cards as well as sector sketches, optimal weapon emplacement tools, and three-dimensional (3D) de-conflictions.			
Title: Advanced Small Arms Fire Control ***Description:*** This effort will mature and demonstrate advanced small arms ballistic calculations from advanced sensor input and optimized architecture for the precision-optical wind system. ***FY 2018 Plans:*** Will mature and demonstrate optimized architecture for the precision-optical wind system. Will mature technologies to improve and increase probability of hit, exploiting advanced sensor data including down-range wind sensing, to provide ballistic corrections supporting PM Individual-Weapons platforms.	-	-	1.200
Accomplishments/Planned Programs Subtotals	39.202	46.051	54.977

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
43A: *ADV WEAPONRY TECH DEMO*	-	40.000	0.000	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 2016	FY 2017
Congressional Add: Program Increase ***FY 2016 Accomplishments:*** Advanced weaponry technology demonstrations	25.000	-
Congressional Add: Hybrid Projectile Technology Research ***FY 2016 Accomplishments:*** Integrated and demonstrated technologies that extend range, increase lethality, improve accuracy and munition survivability for large and medium caliber munitions, both direct and indirect fired. Examples of such technologies include: integration of lifting surfaces, reducing projectile cross sections for increased survivability, and providing multiple lethality effects from the same munition.	15.000	-
Congressional Adds Subtotals	40.000	-

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
L96: *High Energy Laser Technology Demo*	-	12.134	17.728	24.096	-	24.096	26.253	30.169	30.035	30.736	-	-

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 2016	FY 2017	FY 2018
Title: Laser System Ruggedization	4.867	4.216	12.961
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 2016 Accomplishments: Continued ruggedization of the thermal management subsystem and power management subsystem; ruggedized available power storage hardware received from the United States (U.S.) Army Tank-Automotive Research Development and Engineering Center (TARDEC) in preparation for integration; continued ruggedization of 50 kW class solid state laser subsystem components; and began ruggedization of the BMC3 subsystem.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 Fiscal Year (FY) 2018 and optimize the command and control subsystem to manage the new laser, power, and thermal management subsystems. ***FY 2018 Plans:*** Complete ruggedization and modification of the High Energy Laser Mobile Test Truck (HELMTT) Beam Control System (BCS) and ruggedization of the Robust Electric Laser Initiative (RELI) 60 kW laser to enable integration. Complete the Demonstrator Initial Design Review (IDR) of the next generation pre-prototype HEL weapon system. This IDR matures the design of the HEL system as part of the HEL Tactical Vehicle Demonstrator effort.			
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 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 2016 Accomplishments:*** Continued coordination activities for 50kW class laser demonstration and data collection events with range, the Laser Clearing House, and the Federal Aviation Authority (FAA) organizations; began modifications of interfaces and integration of thermal management and power management subsystems; began performance validation of integrated thermal management and power management subsystems for the 50 kW class demonstration; and began 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 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. ***FY 2018 Plans:*** Complete planning for the 50 kW-class HELMTT system demonstration in FY 2018. Conduct risk reduction demonstration of the 50 kW-class integrated laser system on the HELMTT to validate system design and interfaces. Collect data to be used to verify lethality models on atmospheric propagation data. This effort is part of the HEL Tactical Vehicle Demonstrator effort.	7.267	13.512	11.135
Accomplishments/Planned Programs Subtotals	12.134	17.728	24.096

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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*

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
L97: *Smoke And Obscurants Advanced Technology*	-	4.168	4.935	5.006	-	5.006	6.023	6.623	8.226	8.033	-	-

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 2016	FY 2017	FY 2018
Title: Obscurant Enabling Technologies	0.802	0.851	0.866
Description: This effort demonstrates the dissemination of new and advanced obscurants. ***FY 2016 Accomplishments:*** Continued 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. ***FY 2018 Plans:*** Will redesign and improve vehicle protection grenade cloud characteristics. Will initiate particulate materials dissemination studies for the Screening Obscuration Module generator system. Will explore obscurants' ability to defeat anti-tank guided missiles.			
Title: Forensic Analysis of Explosives	1.515	2.096	2.134

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Description: This effort demonstrates improved point and stand-off detection of explosives and homemade explosive (HME) precursors. ***FY 2016 Accomplishments:*** Optimized and matured the Chemical Fingerprint Imaging System (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. ***FY 2018 Plans:*** Will refine prototype CFIS standalone instrument and compare with commercial off the shelf alternative on their ability meet the fingerprinting and chemical identification requirements for the Common Analytical Lab System (CALS). Will evaluate spatially offset Raman prototype for the forensic analysis of explosive materials in opaque containers.			
Title: Detection Mechanisms for Contaminants ***Description:*** This effort demonstrates improved point and standoff detection of a wide range of hazardous materials. ***FY 2016 Accomplishments:*** Expanded 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; integrated software and algorithms supporting the detection of explosive materials in the CED; optimized and matured 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 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. ***FY 2018 Plans:***	1.851	1.988	2.006

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Will improve standoff detection capabilities for homemade and military explosives by developing advanced Raman detection algorithm emphasizing detection of trace explosives on surfaces. Will conduct analysis of alternative solutions for solid state laser sources and spectrometer designs to enhance detection sensitivity. Will integrate hardware and software improvements into existing commercial system for subsequent testing.			
Accomplishments/Planned Programs Subtotals	4.168	4.935	5.006

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	136.624	122.132	125.537	-	125.537	121.013	116.716	117.184	112.935	-	-
221: *Combat Veh Survivablty*	-	53.300	63.269	66.436	-	66.436	65.084	57.001	56.439	59.065	-	-
441: *Combat Vehicle Mobilty*	-	41.673	39.067	33.447	-	33.447	29.398	30.943	32.550	34.160	-	-
497: *Combat Vehicle Electro*	-	6.396	7.118	7.162	-	7.162	7.215	7.359	7.506	7.662	-	-
515: *Robotic Ground Systems*	-	12.755	12.678	18.492	-	18.492	19.316	21.413	20.689	12.048	-	-
533: *Ground Vehicle Demonstrations*	-	22.500	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.

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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
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*

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	135.571	122.132	126.724	-	126.724
Current President's Budget	136.624	122.132	125.537	-	125.537
Total Adjustments	1.053	0.000	-1.187	-	-1.187
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	5.500	-			
• SBIR/STTR Transfer	-4.447	-			
• Adjustments to Budget Years	0.000	0.000	-0.609	-	-0.609
• Civ Pay Adjustments	0.000	0.000	0.165	-	0.165
• Other Adjustments 2	0.000	0.000	-0.743	-	-0.743

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 533: *Ground Vehicle Demonstrations*		
Congressional Add: *Program Increase*	22.500	-
Congressional Add Subtotals for Project: 533	22.500	-
Congressional Add Totals for all Projects	22.500	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
221: *Combat Veh Survivablty*	-	53.300	63.269	66.436	-	66.436	65.084	57.001	56.439	59.065	-	-

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 2016	FY 2017	FY 2018
Title: Vision Protection:	2.842	5.000	5.052
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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Matured optical power-limiting materials to improve protection of camera sensors from laser energy. Evaluated the power-limiting materials protection capability against low-powered continuous wave and short-pulsed laser threats. Integrated the power-limiting material onto a current fire-control sensor and determined 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. ***FY 2018 Plans:*** Will complete vulnerability evaluation of current systems against ultra-short pulse laser threats; will integrate fabricated components of the ultra-short pulse laser protection concepts onto current systems for performance demonstrations in a relevant environment; will improve future protection concepts by reducing optical cross-section, minimizing jamming and dazzling, and increasing damage thresholds.			
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 Accomplishments:*** Began armor integration approaches to help achieve an overall ground vehicle armor subsystem weight reduction of 10-15%. Demonstrated advanced passive and explosive reactive armor technologies and designed approaches for defeat of kinetic energy threats, chemical energy threats, and improvised explosive devices. Demonstrations included environmental testing followed by ballistic testing of advanced armor components. Matured advanced passive armor system design for integration of the armor technology components and attachment schemes. Matured advanced explosive reactive armor system design for integration of the armor component technologies. Matured weight optimization methods for holistic vehicle lightweighting that supports and complements the vehicle armor systems. ***FY 2017 Plans:***	8.332	6.679	13.120

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will mature subsystem integration study for passive (B-kit) and reactive armor (C-kit); will improve integrated subsystem performance while decreasing weight and maintaining cost; will demonstrate capabilities of various adaptive armor solutions in relevant environment; will down-select between various adaptive armor solution options.			
Title: Occupant Centric Protection (OCP) Technologies:	9.873	5.934	4.263
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 2016 Accomplishments:*** Matured passive and active levels of occupant-centric protection technologies for combat vehicle survivability. Optimized combat vehicle survivability demonstrator designs using modeling and simulation to include the integration of a lightweight structure design, and occupant protection component technologies. Conducted optimization to balance weight, mobility and performance goals. Verified occupant-centric design guidelines and procedures/processes. Evaluated the performance of the initial Warrior Injury Assessment Manikin Project (WIAMan) test device in a simulated test environment. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will refine integration of advanced flooring, advanced seating, lightweight hulls and structures, and active blast technologies using results from laboratory and blast tests to improve system performance and minimize weight; will begin fabrication of hardware required for subsystem integration of Survive Demonstrator; will complete next generation WIAMan device testing based on the			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
previously developed test certification procedures; will update WIAMan test capability requirements documentation and materiel solution design specifications based on WIAMan device testing.			
Title: Blast Mitigation: ***Description:*** This effort fabricates and matures advanced survivability and protection components, tools and subsystems for enhanced protection against vehicle mines, improvised explosive devices (IEDs) and other underbody blast threats, and vehicle collision and rollover events that result from blast events. This effort also integrates and improves occupant protection technologies such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious performance evaluation through 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 2016 Accomplishments:*** Matured and integrated the next generation of seats, restraints, and flooring technologies to mitigate underbody blast effects to the occupant in Combat Vehicle Prototyping (CVP) program concepts. Demonstrated the CVP concepts' performance using modeling and simulation along with sub-system level blast tests. Validated integration methods for blast mitigation technologies onto a combat vehicle platform. Exploited 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 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. ***FY 2018 Plans:*** Will mature integration of subsystem technologies into subsystem demonstrator based on blast test results; will integrate armor and Modular Active Protection System (MAPS) surrogate subsystems into subsystem demonstrator to maximize performance; will verify refined subsystem design through modeling and simulation prior to subsystem fabrication improvements.	4.143	9.633	10.090
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.	2.234	2.903	1.915

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Improved designs and technologies to minimize vehicle and crew vulnerabilities to fires. Evaluated next generation materials, components and system level technologies to address emerging military ground vehicle thermal threats. Validated automatic fire-extinguishing system (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. ***FY 2018 Plans:*** Will improve fire protection technologies performance based on results from modeling and simulation and laboratory testing; will evaluate no/low global warming potential (GWP) agents through full scale testing. Will evaluate vehicle concepts that support the next generation of combat vehicles for fire protection technology integration feasibility and effectiveness.			
Title: Hit Avoidance Technologies: ***Description:*** This effort matures, integrates and demonstrates hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) 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 2016 Accomplishments:*** Continued maturation of the modular APS common architecture, and maturation of the modular APS common controller. Continued software and hardware maturation for the APS common controller, enabling integration of active protection components that accommodate varying performance and vehicle needs. Enhanced 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. Continued 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. Conducted 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	25.876	29.924	29.331

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 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. ***FY 2018 Plans:*** Will complete the design and build of the soft-kill and hard-kill modular APS controller (MAC); will validate MAC capability to ensure that it is configurable for the Army Vehicle Fleet and compliant with Army Safety Standards; demonstrate and validate soft-kill APS configuration on a demonstrator platform against anti-tank guided missiles in various environmental conditions; mature soft-kill and hard-kill system/platform demonstrator integration design and begin fabrication of hardware required for integration; will mature MAPS subsystem integration onto SURVIVE demonstrator in preparation for eventual capability testing.			
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 Department of Defense (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. ***FY 2018 Plans:*** Will mature and demonstrate lightweighting capabilities through the continued use of virtual modeling and simulation and other lightweighting tools; will optimize demonstrator upper hull and lower hull for reduced weight, improved transportability, increased	-	3.196	2.665

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
fuel economy, and increased reliability; will validate lightweighting capability with demonstrator performance against relevant environment threats.			
Accomplishments/Planned Programs Subtotals	53.300	63.269	66.436

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
441: *Combat Vehicle Mobilty*	-	41.673	39.067	33.447	-	33.447	29.398	30.943	32.550	34.160	-	-

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 2016	FY 2017	FY 2018
Title: Onboard Vehicle Electric Power Component Development:	4.227	4.701	4.162
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 2016 Accomplishments: Matured and demonstrated 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. Demonstrated power			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will exploit SIL system optimization, performance, and reliability resulting in a matured, high-voltage integrated OBVP system. Will begin integration of advanced OBVP system on combat vehicle advanced propulsion system. Will validate strategy for intelligent engine start/stop for the minimization of idle fuel usage.			
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 2016 Accomplishments:*** Improved elastomer materials and road wheels to demonstrate improved combat vehicle track system durability. Continued fabrication, integration and optimization of external suspension unit system for 60-70 ton combat vehicle application. Matured suspension control architectures for system control of vehicle dynamics, ride height and handling. Characterized combat vehicle external suspension unit functionality, durability and system performance relative to performance metrics. Executed 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	4.806	4.576	3.622

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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 ***FY 2018 Plans:*** Will continue integration of advanced track and 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. Will fabricate integrated system for future testing.			
Title: Combat Vehicle Subsystem Demonstrations ***Description:*** This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, 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 2016 Accomplishments:*** Matured 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. Optimized engine fuel efficiency and increase commonality of engine components to reduce engine logistical and life cycle costs. Developed novel future combat vehicle concepts for the Combat Vehicle Prototyping (CVP) program leveraging leap-ahead technologies and technology concepts. Conducted 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 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. ***FY 2018 Plans:***	14.439	5.200	12.500

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Will complete design of advanced propulsion components such as advanced engine, advanced transmission, and advanced thermal management system. Will mature and optimize next generation combat vehicle with advanced technologies and technology concepts to allow for flexible, scalable and modular technologies. Will continue to conduct capability 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 2016 Accomplishments:*** Matured standardized low voltage battery systems to improve fuel efficiency and support vehicle lightweighting. Matured control electronics and battery management system for advanced, standardized, military specific batteries to improve durability and reliability. Optimized 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. ***FY 2018 Plans:*** Will optimize advanced form factor (6T) Lithium-ion battery pack system level performance and durability testing to decrease recharge time, weight and volume while integrating a battery management system Will begin demonstrating safe logistical transportation of Lithium-ion battery packs with the Navy.	2.811	3.050	3.114
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,	3.672	4.632	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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. ***FY 2016 Accomplishments:*** Integrated energy storage and high-voltage power electronic components into a power system to support electromagnetic armor development weight reduction goals of 10% to 15%. Demonstrated and validated pulse power system and electromagnetic armor module in relevant environments. Began integrated demonstration of pulse power and electromagnetic armor systems, including durability and environmental testing, Validated 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 Jet Propellant 8 (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 2016 Accomplishments:*** Matured 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. Integrated and optimized rotary engine-based auxiliary power unit system for increased fuel efficiency and improved packaging of rotary engine, electrical generator and other components to decrease acoustic signature.	2.974	-	-
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,	4.804	12.808	5.000

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** Matured combat vehicle mechanical automatic transmission design and increased transmission efficiency by targeting the optimal efficiency through all vehicle operating ranges. Optimized powertrain system mobility and steering performance by delivering increased engine power to the vehicle track system while reducing heat rejection. Validated model of advanced powertrain system. Matured 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 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. ***FY 2018 Plans:*** Will complete design and software development of high power density, low heat rejection, fuel efficient opposed piston engine concept and validate subsystem performance and calibration. Will optimize the control strategy for the combat vehicle transmission. Will mature and optimize gear set design for integration into combat vehicle transmission. Will mature combat vehicle transmission for integration into advanced combat propulsion system.			
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 2016 Accomplishments:***	3.940	4.100	5.049

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Performed modeling and analysis of waste water treatment and recycling technologies to assess the scalability of technologies and optimize system designs. Evaluated and qualified synthetic fuels made from non-petroleum sources against performance requirements for use in military ground systems. Matured and demonstrated fuel sensor technologies and a portable fuel analyzer for contaminate detection. Validated 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. ***FY 2018 Plans:*** Will continue to demonstrate energy efficient waste water treatment and recycling technologies to support sustainability logistics basing. Will continue to optimize performance of synthetic fuel blends made from non-petroleum sources to determine suitability for military ground systems that will allow for an increase in energy security. Will validate that fuel efficient gear oils maintain and improve vehicle axle durability and provide extended performance time over current gear oil, as well as limited slip performance.			
Accomplishments/Planned Programs Subtotals	41.673	39.067	33.447

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
497: *Combat Vehicle Electro*	-	6.396	7.118	7.162	-	7.162	7.215	7.359	7.506	7.662	-	-

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 Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance / Electronic Warfare (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 2016	FY 2017	FY 2018
Title: Vehicle Electronics Integration Technologies:	4.308	3.532	2.907
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 2016 Accomplishments: Matured and demonstrated vehicle electronics architecture to facilitate rapid integration of card-based communication equipment into combat and tactical systems. Continued all maturation and integration activities of the next generation power and data architecture and corresponding system design in a System Integration Laboratory (SiL). Verified and validated the next generation			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
power and data architecture through testing traced to power, network and SIL designs and requirements. Enhanced 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. Exploited 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 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. ***FY 2018 Plans:*** Will transition matured technology demonstration designs and technologies (such as optimized performance specifications for open power, data, and network interface requirements, standards, and architectural design patterns) from the VEA Research SIL into a current combat vehicle platform for future test and evaluation activities.			
Title: Vehicle Electronics Architecture and Standards:	2.088	2.174	2.843
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 (MAPS) Architecture. This effort is coordinated with PEs 0602601A and 0603005A. ***FY 2016 Accomplishments:*** Continued to mature and validate the VICTORY specification through demonstration in the VICTORY SIL. Completed the VICTORY SIL update to standard version 1.7, which adds capabilities for Logistics and Training systems and demonstrated component compliance to standard version 1.7. Began the VICTORY SIL update to VICTORY standard version 1.8, providing the			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 MAPS using standard interfaces to improve MAPS interoperability with the other vehicle electronic subsystems. ***FY 2018 Plans:*** Will optimize the open data and power architecture capabilities as the VEA Mobile Demonstrator (VMD) component technologies are being integrated. Will continue to mature and demonstrate integration of MAPS standard interface definitions which guide other vehicle electronic subsystems development.			
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. ***FY 2018 Plans:*** Will develop a common system architecture for autonomous vehicles through the exploitation of multiple different pre-existing autonomous vehicle systems architectures. Will develop algorithm software modules, vehicle architecture, a common interface, and hardware & software integration within the end-to-end autonomous vehicle architecture.	-	1.412	1.412
Accomplishments/Planned Programs Subtotals	6.396	7.118	7.162

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
515: *Robotic Ground Systems*	-	12.755	12.678	18.492	-	18.492	19.316	21.413	20.689	12.048	-	-

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, Army Engineer Research and Development Center (ERDC), Vicksburg, MS, Army Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA, and Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Unmanned Ground Systems Technology:	12.755	12.678	12.054
Description: This program 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, and reduced physical and cognitive burden. Challenges can be met by utilizing relevant technologies such as behavior algorithms, autonomy kits, sensor integration, advanced navigation and planning, 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 2016 Accomplishments: Matured, integrated and demonstrated advanced scalable autonomous technologies onto tactical vehicles to automate driving tasks and reduce logistics support requirements. Matured and integrated software and behavior algorithms to enable autonomous			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
convoy and autonomous vehicle loading/unloading operations to improve the effectiveness of unit resupply and sustainment operations. Matured and demonstrated 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. ***FY 2018 Plans:*** Will continue to mature and develop the modeling and simulation tools to support the design, development, testing and evaluation of autonomous vehicles. Will continue to mature and demonstrate hardware-in-the-loop / software-in-the loop integrations of the physics-based simulations with prototype hardware and software autonomous vehicle technologies. Will begin to mature technologies for manned-unmanned teaming to further extend Autonomous Ground Resupply in a tactical environment and perform sustainment mission operational experiments to get Warfighter feedback on system performance. Will conduct operational experiments with unmanned Reconnaissance Surveillance and Target Acquisition (RSTA) missions leveraging autonomous ground platforms teamed with tethered unmanned aerial vehicles (UAVs).			
Title: Autonomous Ground Vehicle Architecture Integration and Demonstration	-	-	6.438
Description: This project matures, integrates, and demonstrates advanced robotic and autonomous foundational architecture and the technologies to enable tactically relevant unmanned ground systems. Technologies focused on creating an open Autonomous Ground Vehicle Reference Architecture for all future unmanned platforms, improved tactical and maneuver intelligence and behavior algorithms based off the architecture, sensor integration and advanced perception for off road, manned and unmanned teaming for the tactical environment, and enabling the integration of weapons and vehicle self-protection capabilities. This effort is coordinated with efforts in PEs 0602120A, 0602601A, 0602784A, 0603001A, and 0603734A. ***FY 2018 Plans:*** Will publish and demonstrate modularity of an open Autonomous Ground Vehicle Reference Architecture (AGVRA) which will be the foundational architecture for all future autonomous ground vehicle development. Will mature and demonstrate advanced			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
vehicle behaviors for defensive maneuvers and tactical convoy formations built upon the open architecture. Will mature and integrate off-road path planning software to enable robotic vehicles to perceive, classify and navigate complex, difficult terrains. Will improve advanced vehicle behaviors for sustainment convoy operations to improve leader follower functionality, improved obstacle detection and avoidance, and increased platform speed.			
Accomplishments/Planned Programs Subtotals	12.755	12.678	18.492

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
533: *Ground Vehicle Demonstrations*	-	22.500	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 2016	FY 2017
Congressional Add: Program Increase	22.500	-
FY 2016 Accomplishments: Program increase.		
Congressional Adds Subtotals	22.500	-

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	5.384	3.904	12.231	-	12.231	13.000	13.986	16.675	17.158	-	-
592: *Space Application Tech*	-	5.384	3.904	12.231	-	12.231	13.000	13.986	16.675	17.158	-	-

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 (S&T) 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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	5.554	3.904	14.026	-	14.026
Current President's Budget	5.384	3.904	12.231	-	12.231
Total Adjustments	-0.170	0.000	-1.795	-	-1.795
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.170	-			
• Adjustments to Budget Years	0.000	0.000	-1.795	-	-1.795

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603006A *I Space Application Advanced Technology*

Change Summary Explanation

Fiscal Year (FY) 2018 decrease reflects realignment of funds to higher priority Army S&T efforts.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
592: *Space Application Tech*	-	5.384	3.904	12.231	-	12.231	13.000	13.986	16.675	17.158	-	-

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 2016	FY 2017	FY 2018
Title: Payload Technology Development	5.384	3.904	12.231
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 2016 Accomplishments: Demonstrated proof-of-concept small satellite control using standard Army networks; integrated small satellite communications and imagery payload software onto standard Army network platforms and assessed ability to control on-orbit small satellites and onboard payloads; and matured Software Defined Radio (SDR) and imagery payloads based on lessons learned from earlier on-orbit demonstrations.			
FY 2017 Plans: 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.			
FY 2018 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Will develop a plan to demonstrate small satellite technologies to support multi-band beyond-line-of-sight (BLOS) and on-the-move comms for disadvantaged users; mature and demonstrate incremental advances in capability for experimental small satellite communication infrastructure; assess and improve architecture and software, and plan for demonstration of tag, track, and locate payloads, to include planning for tasking, processing, exploitation, and dissemination.			
Accomplishments/Planned Programs Subtotals	5.384	3.904	12.231

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.571	14.417	6.466	-	6.466	8.088	12.676	12.969	15.275	-	-
792: *Personnel Performance & Training*	-	11.571	14.417	6.466	-	6.466	8.088	12.676	12.969	15.275	-	-

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.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
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*		
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	12.636	14.417	14.695	-	14.695
Current President's Budget	11.571	14.417	6.466	-	6.466
Total Adjustments	-1.065	0.000	-8.229	-	-8.229
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.700	-			
• SBIR/STTR Transfer	-0.365	-			
• Adjustments to Budget Years	0.000	0.000	-8.229	-	-8.229

Change Summary Explanation

Fiscal Year (FY) 2018 funding reduction reflects realignment of Army Research Institute manpower to a Management Headquarters PE; Realignment does not alter Research, Development, Test, and Evaluation (RDTE) Management Decision Packets (MDEPs).

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
792: *Personnel Performance & Training*	-	11.571	14.417	6.466	-	6.466	8.088	12.676	12.969	15.275	-	-

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 Project 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 2016	FY 2017	FY 2018
Title: Personnel Assessment	5.348	6.000	4.395
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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Validated and refined non-cognitive predictors of success (e.g., attrition, performance, attitudes) for enlisted Soldiers and non-commissioned officers at accession and selection for special assignments; conducted 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 ongoing validation of non-cognitive assessments for valued Army outcomes (e.g., attrition, performance) across a Soldier's first term of enlistment. ***FY 2018 Plans:*** Mature research that tests competency assessments (i.e., a collection of competencies that together define successful performance in a particular work setting) of critical military occupations (e.g., cyber operations for more flexible personnel management of enlisted Soldiers).			
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 2016 Accomplishments:*** Developed measures of conduct and performance as indicators of unit climate of dignity, respect, and inclusion; designed and developed measures of collective performance; developed methods and measures to identify and develop high quality Army instructors; developed training methods that allow Soldiers to better use and control highly automated training systems. ***FY 2017 Plans:*** 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); 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). ***FY 2018 Plans:*** Demonstrate the effectiveness of strategies to optimize individual training performance.	6.223	8.417	2.071
Accomplishments/Planned Programs Subtotals	11.571	14.417	6.466

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	-	9.002	21.374	28.552	-	28.552	20.631	21.041	21.459	21.898	-	-
B18: *DB18*	-	9.002	21.374	16.642	-	16.642	8.704	8.879	9.055	9.240	-	-
FH1: *TRACTOR HIKE*	-	0.000	0.000	11.910	-	11.910	11.927	12.162	12.404	12.658	-	-

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	7.502	8.074	8.650	-	8.650
Current President's Budget	9.002	21.374	28.552	-	28.552
Total Adjustments	1.500	13.300	19.902	-	19.902
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.500	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	0.000	13.300	19.902	-	19.902

Change Summary Explanation

Fiscal Year (FY) 2016 - Classified Program funds increase.
FY17 - Classified Program funds increase.
FY18 - Classified Program funds increase.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) B18 / *DB18*			
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
B18: *DB18*	-	9.002	21.374	16.642	-	16.642	8.704	8.879	9.055	9.240	-	-

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: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) FH1 / *TRACTOR HIKE*			
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
FH1: *TRACTOR HIKE*	-	0.000	0.000	11.910	-	11.910	11.927	12.162	12.404	12.658	-	-

A. Mission Description and Budget Item Justification

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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	16.735	18.969	16.434	-	16.434	20.672	21.087	21.512	21.982	-	-
S28: *Immersive Learning Environments*	-	2.997	3.254	0.483	-	0.483	0.000	0.000	0.000	0.000	-	-
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.848	6.172	6.273	-	6.273	9.953	10.195	10.443	10.687	-	-
S31: *Modeling And Simulation Infrastructure Technology*	-	4.890	9.543	9.678	-	9.678	10.719	10.892	11.069	11.295	-	-

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: FY 2018 Army					Date: May 2017
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*		
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	17.425	18.969	19.053	-	19.053
Current President's Budget	16.735	18.969	16.434	-	16.434
Total Adjustments	-0.690	0.000	-2.619	-	-2.619
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.690	-			
• Adjustments to Budget Years	0.000	0.000	-2.619	-	-2.619

Change Summary Explanation

Fiscal Year (FY) 2018 funding decreased to support higher priority efforts.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
S28: *Immersive Learning Environments*	-	2.997	3.254	0.483	-	0.483	0.000	0.000	0.000	0.000	-	-

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 (Army Training and Doctrine Command (TRADOC) and 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 2016	FY 2017	FY 2018
Title: Immersive Techniques for Training Applications	2.997	3.254	0.483
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 2016 Accomplishments: Matured collaborative virtual environments through the incorporation of live objects to enhance user's immersion experience and improve user's performance; and optimized 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:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will research new interaction techniques and develop technologies that will enable more effective face-to-face communication and collaboration in multi-user virtual reality, augmented reality, and mixed reality environments; expand the integrated pipelines and virtual asset creation tools for virtual humans to support multiple platforms, including web, mobile and desktop, in a semi-automated fashion; conduct evaluations and assessments of dL courseware developed and transition the developed dL courseware to government agencies such as Program Executive Office Simulation, Training, and Instrumentation (PEO STRI); collaborate with government agencies to promote the use of the improved dL methods, techniques and technologies on the Army Learning Management System (ALMS); Improve capabilities for incorporating previously unavailable/unused open-source and government-provided environmental data sources (i.e., geospatial source data such as satellite imagery) for use in the next generation game/simulation platforms.			
Accomplishments/Planned Programs Subtotals	2.997	3.254	0.483

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.848	6.172	6.273	-	6.273	9.953	10.195	10.443	10.687	-	-

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 2016	FY 2017	FY 2018
Title: Embedded Techniques	7.696	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 Soldier computer systems. This effort has been refocused and renamed Mixed and Augmented Reality.			
FY 2016 Accomplishments: Completed Fiscal Year (FY) 2015 component designs for embedded training on current and future command and control systems; developed prototype systems of advanced sensor technology for locomotion, gesturing and tactile feedback technologies			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
for computer generated forces to simulate dismounted squads; and matured, demonstrated and assessed 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 2016 Accomplishments:*** Provided 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); began 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. ***FY 2018 Plans:*** Will mature and demonstrate performance measurement technologies that facilitate optimization of training efficiency and effectiveness. Will improve predictive models for training outcomes in live and simulated training environments for both individual and team tasks. Will demonstrate methods for effectively blending training across classroom, computer-based, simulation-based, and live environments.	1.152	1.300	1.300
Title: Mixed and Augmented Reality ***Description:*** This effort matures and demonstrates mixed and augmented reality technologies that seamlessly blend synthetic and real environments to provide a more realistic training environment for Soldiers. Efforts matured by this effort transition to PEO-STRI.	-	-	4.973

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
FY 2018 Plans: Will mature mixed and augmented reality components such as advanced optics and occlusion, and increase computation of the man-wearable computer for future integration into prototype soldier squad or team trainer to increase Soldier readiness.			
Accomplishments/Planned Programs Subtotals	8.848	6.172	6.273

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
S31: *Modeling And Simulation Infrastructure Technology*	-	4.890	9.543	9.678	-	9.678	10.719	10.892	11.069	11.295	-	-

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, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Simulation Tools and Models	4.890	7.543	7.678
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 2016 Accomplishments: Exploited 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 identified associated technology gaps; refined and demonstrated distributed Soldier simulation for use in training and analysis applications; matured and demonstrated M&S as a cloud-based service that supports experimentation and testing across geographically distributed areas; and demonstrated the 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:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will mature simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities (Training, Experimentation and Acquisition targeted); will optimize authoring tools that support a variety of user types ranging from simulation expert to exercise developer in support of advancing simulation execution; will refine composable modeling methods that are required to represent a synthetic force at various levels in real time; and will mature repeatable measurement methodologies for human behavior modeling to enhance training intervention or simulation technologies.			
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. ***FY 2018 Plans:*** Will develop tools and methods for early HSI based on gaps determined in Fiscal Year (FY) 17. Will mature concepts and metrics to establish return on investment (ROI) for early HSI in acquisition. Analytic approaches that bridge disciplines and analysis communities will be linked.	-	2.000	2.000
Accomplishments/Planned Programs Subtotals	4.890	9.543	9.678

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603020A *I TRACTOR ROSE*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.912	11.910	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
DB1: *DDB1*	-	11.912	11.910	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)(l).

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	11.912	11.910	11.911	-	11.911
Current President's Budget	11.912	11.910	0.000	-	0.000
Total Adjustments	0.000	0.000	-11.911	-	-11.911
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	0.000	0.000	-11.911	-	-11.911

Change Summary Explanation

Fiscal Year 2018 funding decrease for Classified Program.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	-	32.430	27.686	26.903	-	26.903	21.268	20.593	21.004	21.433	-	-
DF5: *Agile Integration & Demonstration*	-	26.430	27.686	26.903	-	26.903	21.268	20.593	21.004	21.433	-	-
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	6.000	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) 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 United States (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.

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: FY 2018 Army	Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	33.520	27.686	24.906	-	24.906
Current President's Budget	32.430	27.686	26.903	-	26.903
Total Adjustments	-1.090	0.000	1.997	-	1.997
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.090	-			
• Adjustments to Budget Years	0.000	0.000	1.997	-	1.997

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
DF5: *Agile Integration & Demonstration*	-	26.430	27.686	26.903	-	26.903	21.268	20.593	21.004	21.433	-	-

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 United States (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.

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 2016	FY 2017	FY 2018
Title: Rapidly Deployable Technologies	4.860	-	-
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 2016 Accomplishments: Incorporated Army G-2 and Army Training and Doctrine 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. Integrated Pacific Command (PACOM), Africa Command			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
(AFRICOM), Southern Command (SOUTHCOM) and/or the Central Command (CENTCOM)-based scenarios into experiments and targeted specific environments of interest (e.g., wooded, marine, urban, contested and congested radio frequency (RF)). Replicated relevant threat/overmatch capabilities (e.g., commercially available computer network, RF, and electromagnetic (EM) attack methodologies) and integrated, trained, and operated technology systems in increasingly complex blue/red team scenarios. Expanded and refined quantitative measures of success for the Warfighter Technology Tradespace Methodology, and assessed systems' performance across technical, user, supportability, and adaptability factors. Uncovered technology system vulnerabilities, including risks to user acceptance, and recommended 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 to 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 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). ***FY 2016 Accomplishments:*** Incorporated 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. Designed and conducted a series of in-depth, phased assessments that incorporate near-peer threats and field experiments with experienced Warfighters; stressed 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. Recommended means to mitigate or reduce systems' vulnerabilities, with the goal of informing current or future acquisition programs early in the development lifecycle.	11.811	-	-
Title: Ground Platform Subsystem Demonstrations	4.801	5.000	4.000

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** Analyzed the next generation power and data architecture and the corresponding system design's interface with vehicle subsystems, specifically powertrain subsystems. Demonstrated electronic control communication between powertrain system components. Matured the engine controls architecture to optimize engine power density, fuel efficiency and heat rejection. Finalized 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. ***FY 2018 Plans:*** Will mature the VEA Mobile Demonstrator (VMD) technology by optimizing subsystem performance during hardware integration onto vehicle platform, and beginning demonstrations of VMD capabilities to validate system performance against future power and data requirements. Will mature and validate powertrain controls architecture and algorithm to improve powertrain efficiencies and minimize parasitic losses through component modeling and simulation. Will mature and validate integrated starter generator, advanced thermal management system, and advanced modular lithium ion battery technologies to improve subsystem fuel efficiency and increase electrical power generation.			
Title: Ground Vehicle Power and Energy	4.958	5.249	5.343
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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
lubricants; hybrid propulsion systems; batteries and energy storage; and analytical tools (e.g., modeling and simulation). This effort is coordinated with PE 0602601A. ***FY 2016 Accomplishments:*** Continued to support the Advanced Vehicle Power Technology Alliance (AVPTA) with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Completed demonstration of lightweight structures and materials using advanced manufacturing techniques. Developed advanced lubricants to help mitigate frictional losses in powertrain to increase vehicle efficiency. Developed the capability to model advanced chemistry batteries and batteries in extreme temperature conditions. Investigated 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. ***FY 2018 Plans:*** Will continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Will continue to provide the capability to model and simulate advanced chemistry batteries and batteries in extreme temperature conditions to improve characterizing battery life cycle estimations. Will improve tire modeling and simulation capabilities based on dynamic property data from advanced tire testing. Will improve correction prevention capabilities through results from investigation of corrosion mechanisms and effects on dissimilar material joints which identified materials and processes to inhibit corrosion.			
Title: Red Teaming Field Demonstration	-	8.718	7.282
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 Army Science and Technology			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Enterprise as well as those by other Services, Agencies, Academia, and Industry. Some technologies undergoing System Intensive Analysis may be selected to undergo Field Demonstration 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. ***FY 2018 Plans:*** Will conduct a series of multi-day live field demonstrations where warfighters utilize technologies and systems in operationally relevant scenarios to address a set of priority, threat-informed challenges and areas of overmatch concern. Potential technical areas of interest include force protection, interoperability, internet of things, autonomous systems, and electronic warfare. Demonstrations are structured to stress the technologies/systems and uncover vulnerabilities through (a) their employment in increasingly complex mission scenarios with friendly and adaptive opposing forces, (b) emulated threat probes for electronic warfare vulnerabilities, and (c) hierarchical task analysis; implement methodologies to factor technology evolution into assessment frameworks; and provide feedback to developers through structured Red (threat), Blue (US Forces), and White Cell (technical observer) assessments to facilitate reduction or mitigation of vulnerabilities.			
Title: Red Teaming Systems Intensive Analysis ***Description:*** This effort conducts detailed analysis (from concepts to employment to interoperability) for selected technologies with planned 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. Analysis of some technologies may leverage Red Teaming Field Demonstration activities to further understand vulnerabilities. This effort builds upon the work previously completed in Rapidly Deployable Technologies and Technology Systems Adaptive Red Teaming. ***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	-	5.107	4.369

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
performance in contested environments; potential technical areas of interest include human performance, advanced weapons, autonomous systems, and electronic warfare. ***FY 2018 Plans:*** Will conduct the first phase of intensive analysis for key emerging systems and concepts identified from intelligence, requirements, acquisition, and science and technology community stakeholder strategy events; and continue to the next phase of ongoing intensive analysis for select key emerging systems and/or concepts 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 will include operations in subterranean and urban interior environments, indicators of military activity through social media, unmanned medivac and resupply, and electronic warfare.			
Title: Red Teaming Vulnerability Exercises ***Description:*** This effort conducts tabletop exercises for 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 future “what if” assessments. Outputs of these exercises influence technologies and scenarios chosen for Systems Intensive Analysis and Field Demonstrations. This effort builds upon the work previously completed in Rapidly Deployable Technologies and Technology Systems Adaptive Red Teaming. ***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. ***FY 2018 Plans:*** Will design and conduct a series of virtual scenario-based exercises, rooted in stakeholder input on emerging threats and areas of overmatch concern, with participants from government, academia, and industry who represent red (threat), blue (US forces), and green (influence base, neutrals) perspectives in order to expose assumptions, characterize needed capabilities, and identify current and future critical vulnerabilities. Exercises will cover broader time and space conditions than are possible in live field experiments. Will implement team challenge experiments to identify potential vulnerabilities and risks for developing concepts or systems; and, based on previous year evaluations, modify analysis methodologies, structured assessments, and frameworks to improve data captured for analysis and feedback, with the goal of providing insight and data to enable risk mitigation, informing	-	3.612	2.912

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
current or future acquisition programs early in the development lifecycle. Potential technical areas of interest will include force protection, interoperability, internet of things, autonomous systems, and electronic warfare.			
Title: Unmanned Teaming Technology Assessment ***Description:*** Unmanned Teaming Technology Assessment ***FY 2018 Plans:*** Will identify components, technologies and enablers required to establish a manned unmanned teaming capability to provide enhanced combat power in complex and contested environments. Will determine component priority by assessing unmanned capabilities in support of realistic mission scenarios. Primary components of the assessment include: Soldiers, unmanned ground vehicles, unmanned air vehicles, command and control, communications and lethality.	-	-	2.997
Accomplishments/Planned Programs Subtotals	26.430	27.686	26.903

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: FY 2018 Army				Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	6.000	0.000	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 2016	FY 2017
Congressional Add: Force Protection Radar Development	6.000	-
FY 2016 Accomplishments: 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	-	2.381	2.340	4.880	-	4.880	4.896	4.943	4.992	5.044	-	-
DS8: *Tractor Nail*	-	2.381	2.340	4.880	-	4.880	4.896	4.943	4.992	5.044	-	-

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	2.381	2.340	2.381	-	2.381
Current President's Budget	2.381	2.340	4.880	-	4.880
Total Adjustments	0.000	0.000	2.499	-	2.499
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	0.000	0.000	2.499	-	2.499

Change Summary Explanation

Fiscal Year 2018 Classified Program funds increase.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603131A *I TRACTOR EGGS*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	2.431	2.470	4.326	-	4.326	6.041	8.591	10.144	10.206	-	-
DS9: *Tractor Eggs*	-	2.431	2.470	4.326	-	4.326	6.041	8.591	10.144	10.206	-	-

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	2.431	2.470	2.515	-	2.515
Current President's Budget	2.431	2.470	4.326	-	4.326
Total Adjustments	0.000	0.000	1.811	-	1.811
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	0.000	0.000	1.811	-	1.811

Change Summary Explanation

Fiscal Year 2018 Classified Program funds increase.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	31.810	27.893	31.296	-	31.296	34.241	36.859	37.484	38.541	-	-
K12: *EW Demonstrations (CA)*	-	6.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
K15: *Advanced Comm Ecm Demo*	-	7.141	8.103	9.288	-	9.288	10.922	11.623	11.824	12.078	-	-
K16: *Non-Commo Ecm Tech Dem*	-	18.669	19.790	22.008	-	22.008	23.319	25.236	25.660	26.463	-	-

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 (U.S.) 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 complements PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602270A (Electronic Warfare Technology), PE 0603772A (Advanced Tactical Computer Science) and PE 0603794A (Command, Control and Communications Advanced Technology), and is 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 Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	32.874	27.893	25.767	-	25.767
Current President's Budget	31.810	27.893	31.296	-	31.296
Total Adjustments	-1.064	0.000	5.529	-	5.529
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.064	-			
• Adjustments to Budget Years	0.000	0.000	5.500	-	5.500
• Civ Pay Adjustments	0.000	0.000	0.029	-	0.029

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
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	-

Change Summary Explanation

In Fiscal Year 2018 funding increased to support needed aircraft survivability and Multifunction Electronic Warfare efforts.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
K12: *EW Demonstrations (CA)*	-	6.000	0.000	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 2016	FY 2017
Congressional Add: Program Increase	6.000	-
FY 2016 Accomplishments: 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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
K15: *Advanced Comm Ecm Demo*	-	7.141	8.103	9.288	-	9.288	10.922	11.623	11.824	12.078	-	-

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.

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 Communications - Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Offensive Operations	4.801	5.575	6.177
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), electronic warfare (EW) and cyber 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 and non-combatant communications. Work being accomplished under Program Element (PE) 0603270A/project K16 and PE 0602270/project 906 complement this effort.			
FY 2016 Accomplishments: Used representative blue force systems to conduct exploitation of emerging signals of interest (SOI) to determine potential cyber/ EW/collection applications for each signal; matured and integrated advanced techniques to enable new mission capabilities to exploit emerging target SOI; and utilized 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will finalize interface definitions for advanced techniques to perform various Cyber and EW functions (locate, degrade, disrupt,deny) against identified SOIs; mature and demonstrate techniques to perform command & control (C2) cyber functions from EW and SIGINT platforms across/within security domains; mature data models (structure and method for ingest and relational analysis of data) necessary for the delivery of data products to the intelligence enterprise that provide the tactical commander with a better cyber electromagnetic activities (CEMA) situational awareness (SA) and understanding (SU); mature and conduct modeling and simulation within the laboratory to replicate next generation CEMA architecture and mature analytic tools to inform/develop the commander's SU; and replicate the current offensive cyber operation (OCO) operational state within a simulated laboratory environment to facilitate an EW/Cyber tactical rehearsal and training capability.			
Title: Stand-off Non-Cooperative Multi-Intelligence (Multi-INT) Technologies ***Description:*** This effort matures and demonstrates hardware and software to conduct standoff EW intelligence, surveillance reconnaissance, planning and effects in a three dimensional urban battlespace. ***FY 2016 Accomplishments:*** Matured, assessed and demonstrated multi-intelligence and EW techniques and effects on emerging threats, such as unmanned aerial systems (UAS), to identify potential vulnerabilities; and integrated, assessed and demonstrated 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 laboratory environment; assess requirement to coordinate data exchange between national and tactical assets to achieve desired, coordinated effects on designated threat systems. ***FY 2018 Plans:*** Will mature and develop techniques focused on executing ES (sense/detect/identify/geolocate) and EA (deny/degrade/disrupt) capabilities against peer/near peer threat systems and networks operating within congested and contested environments; begin identification of measurable characteristics for EW system effects (i.e. battle damage assessment) commensurate with and to be integrated with kinetic effect characteristics in support of mission planning and employment capabilities; and extend and demonstrate EW Planning and Management Tool (EWPMT) Program of Record (POR) interfaces supporting data fusion and	2.340	2.528	3.111

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
analysis for the Distributed Common Ground Station – Army (DCGS-A) POR and remote C2/coordination of EW assets and effects for the Multi-Function EW (MFEW) POR and defensive electronic attack (DEA) capabilities.			
Accomplishments/Planned Programs Subtotals	7.141	8.103	9.288

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
K16: *Non-Commo Ecm Tech Dem*	-	18.669	19.790	22.008	-	22.008	23.319	25.236	25.660	26.463	-	-

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.

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 Communications-Electronic Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Multispectral Threat Detection and Countermeasures Technologies (formerly titled Distributed Aperture Infrared Countermeasures Technologies (DAIRCM))	3.150	3.326	6.447
Description: This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against EO, IR and RF guided threats. ***FY 2016 Accomplishments:*** Continued to mature wideband RF warning sensor and integrate RF warning sensor into representative hardware suite; and conducted 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. ***FY 2018 Plans:*** Will mature and demonstrate cognitive and adaptive threat agnostic (functional against unknown threats to the area) detection and countermeasure algorithms using statistics-based machine learning techniques as part of an integrated survivability suite; use modeling and simulation to ensure the modular architecture framework supports rapid updates for algorithm maturation and			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
assessment; design, code and integrate a new class of warning algorithms to operate against unknown/unexploited low signature and emerging threats; mature and fabricate digital readout integrated circuit specifically for threat warning applications; and mature and validate an integrated software framework that utilizes cognitive controls to select the best countermeasure given the information the integrated survivability suite provides.			
Title: Advanced Tactical EW Countermeasure Technologies (formerly titled Advanced Tactical Radio Frequency Countermeasures Technologies (ATRFCM)) ***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 2016 Accomplishments:*** Integrated and demonstrated 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; and demonstrated 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. ***FY 2018 Plans:*** Will mature processing and learning algorithms that go beyond traditional detection and countermeasure for ground based threats by exploiting unused embedded features within sensor data sets to increase the probability of neutralizing the threat through improved identification, classification, direction finding and countermeasure effectiveness; use modeling and simulation to assess the ability of learning algorithms to improve platform survivability; and demonstrate capability in a relevant environment.	4.716	4.964	5.056
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 0603772/Project 243 and 0602270A/Project 906 complements this effort. ***FY 2016 Accomplishments:***	3.361	3.500	3.502

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Analyzed previously conducted testing of counter EW techniques to determine effectiveness against identified threats; developed and documented standard EW technique assessment protocols to enable independent validation to be conducted of all results; and continued 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. ***FY 2018 Plans:*** Will mature and integrate electronic protection (EP) software and algorithms in an open standards and open architecture design; conduct hardware in the loop analysis of prioritized emerging threat interference techniques; assess potential interactions on emerging blue force systems, (i.e. communication, radar) and apply EP algorithms to mitigate the electromagnetic interference caused by these effects; mature EP algorithms for detection, localization and neutralization of electronic interference, and demonstrate their performance; and enhance hardware in the loop testing capabilities to support a future threat analysis to achieve full closed loop capability.			
Title: Active Protection System (APS) Soft Kill (SK)/Hard Kill (HK) Sensors (formerly titled Active Protection System (APS) Soft Kill) ***Description:*** This effort matures and demonstrates hardware, software and techniques to provide an EW soft kill, and cueing/ tracking 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 2016 Accomplishments:*** Investigated and matured sensor framework to facilitate integration of cueing sensors and EW soft kill into the Modular Active Protection System (MAPS) architecture; matured algorithm to utilize a cueing sensor to enable threat detection and determine threat angle of arrival; matured tracking sensor to improve capability to provide accurate threat tracking and false alarm reduction, characterize threats, provided warning and fire control functions and confirm effective countermeasure performance; and matured	6.722	7.250	3.251

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
and conducted 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. ***FY 2018 Plans:*** Will complete SK demonstration and system analysis of sensors, SK countermeasure (SKCM) and brassboard controller on MAPS platform demonstrator; verify sensor interface designs with modular active protection framework by demonstrating real time cueing and handoff of the threat message to the SKCM; continue integration of cueing sensor into the HK demonstration, as well as integrating new SK techniques into the SKCM demonstration hardware to address a wider list of current and emerging threats; continue tracking sensor development, demonstrate the integration and threat message pass through of multiple subsystems (cueing and tracking sensors, controller and SKCM); and integrate tracking sensor into the controller to prepare for the HK/SK demonstration.			
Title: Modeling Simulation and Technique Maturation for Integrated RF Operations (formerly titled 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 technique development and integration of new EW capabilities, target signals of interest and environmental simulations. Work being accomplished under PE 0602270A/Project 906 and PE 0603794A/Project EL4 complements this effort. ***FY 2016 Accomplishments:*** Developed improvements to RF M&S capabilities that increase M&S fidelity of blue force system performance and interactions with various signals of interest (SOI) to enable the evaluation of advanced, emerging EW techniques; and assessed 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	0.720	0.750	1.751

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will continue to evolve the M&S environment capable of assessing the expected performance and tradeoffs of employing EW effects in a coordinated operation; mature analysis tools to assess and validate employment scenarios in conjunction with the Cyber Center of Excellence using one or more remotely managed EW assets against one or more threat categories (i.e., communications, radar, electronic countermeasure) systems; and develop M&S software tools and mature EW techniques and waveforms against specific SOIs (i.e., point-to-point, network devices, emerging modern communications) to allow manipulation of both EW asset and threat network characteristics and parameters (i.e., density, placement, terrain, transmit power levels, and receive power thresholds) for the development of concept of operations (CONOPs) and EW techniques supporting the emerging Army Integrated Electronic Warfare System concept.			
Title: Intelligence Processing and Architecture Modernization ***Description:*** This effort will leverage Intelligence Community investments in software frameworks and exploits against threat SOIs to develop a library of open, modular, and scalable software solutions to address identified capability gaps and to provide the commander with electronic situational awareness while at the same time protecting his assets from enemy deception and jamming. Work accomplished under PE 0602270A/Project 906 and PE 0603772A/Project 243 complements this effort. In Fiscal Year (FY) 18 this effort continues work previously reported under PE 0603772A/Project243 Intelligence Processing and Architecture Modernization. ***FY 2018 Plans:*** Will demonstrate a reference design of a multi-channel electronic support receiver designed according to the Modular Open Radio Frequency Architecture to conduct access and effects operations against regional threats to blue force Programs of Record; and develop and demonstrate an open architecture transmit capability that supports multiple mission spaces.	-	-	2.001
Accomplishments/Planned Programs Subtotals	18.669	19.790	22.008

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	102.490	52.190	62.850	-	62.850	64.396	59.304	58.254	54.877	-	-
206: *Missile Simulation*	-	1.662	2.435	2.476	-	2.476	2.490	2.576	2.626	2.681	-	-
263: *Future Msl Tech Integr(FMTI)*	-	26.480	23.282	34.725	-	34.725	39.224	30.177	31.334	38.668	-	-
704: *Advanced Missile Demo*	-	19.348	26.473	25.649	-	25.649	22.682	26.551	24.294	13.528	-	-
NA6: *Missile and Rocket Initiatives (CA)*	-	55.000	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, fabricates, and demonstrates advanced rocket, missile, interceptor, and guided munition technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability. Project 206 develops high fidelity simulations for advanced tactical missiles and interceptors. Project 263 demonstrates missile and interceptor systems with capabilities to provide protection against rockets, artillery, and mortars; provide precision weapons for small units in close combat; provide precision long-range fires; and provide minimum smoke propulsion for aviation missiles. Project 704 demonstrates the capability to detect and track rocket, artillery, mortar, and unmanned air vehicles threats. Project 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	104.449	52.190	58.142	-	58.142
Current President's Budget	102.490	52.190	62.850	-	62.850
Total Adjustments	-1.959	0.000	4.708	-	4.708
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.959	-			
• Adjustments to Budget Years	0.000	0.000	4.700	-	4.700
• Civ Pay Adjustments	0.000	0.000	0.008	-	0.008

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: NA6: *Missile and Rocket Initiatives (CA)*		
Congressional Add: *Program Increase*	55.000	-
Congressional Add Subtotals for Project: NA6	55.000	-
Congressional Add Totals for all Projects	55.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
206: *Missile Simulation*	-	1.662	2.435	2.476	-	2.476	2.490	2.576	2.626	2.681	-	-

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 2016	FY 2017	FY 2018
Title: Missile Simulation	1.662	2.435	2.476

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 2016 Accomplishments:
Matured radio frequency (RF) scene generation algorithms and continued hardware/software integration into hardware-in-the-loop to support testing of advanced millimeter wave radar sensors. Matured a modeling and simulation environment to significantly reduce seeker algorithm design and development timelines. Refined and validated missile life-cycle cost analysis model against existing life-cycle cost information, optimized for use during the science and technology (S&T) phase of technology development to design in cost saving features. Designed and began 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 RF scene generation algorithms and continue hardware/software

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Mature the distributed architecture test bed for air defense weapon behavior exploration; provide a fast running model for use in fragmentation warhead design, insensitive munitions design, and lethality analysis; mature novel methods to address deficiencies in EO/IR real-time high-bandwidth sensor stimulation for Hardware in the loop; improve modeling and simulation capability to give more accurate lethality credit from blast effects and lower the cost of smaller missile systems; improve algorithms for forecasting air and missile tactical threat maneuvers, improve the missile threat maneuver forecaster, and mature algorithms for engagement tailoring and predicted intercept point (pip) management; mature cost-estimating tools for propulsion systems, software, modular systems, and for converting commercial off-the-shelf cost to military off-the-shelf cost .			
Accomplishments/Planned Programs Subtotals	1.662	2.435	2.476

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
263: *Future Msl Tech Integr(FMTI)*	-	26.480	23.282	34.725	-	34.725	39.224	30.177	31.334	38.668	-	-

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 2016	FY 2017	FY 2018
Title: Low Cost Tactical Extended Range Missile	9.255	10.962	8.538
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 2016 Accomplishments: Completed simulation trade studies determining subsystem requirements for delivery of enhanced lethal effects to long range targets; matured multi-functional payload technologies to service the broad threat set of targets with one warhead; matured and performed preliminary testing of advanced propulsion technologies that provide low cost energy management to enhance kinematic performance for long range precision fires; matured navigation technologies for GPS challenged environments in order			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
to enhance the precision of long range precision fires in denied environments; designed and fabricated control actuation system hardware, developed navigation algorithms and performed structural analysis for tail controlled long range rockets. ***FY 2017 Plans:*** Continue to refine and update the long range fires missile system simulation to reflect the emerging navigation, propulsion, and payload technologies. This system simulation is 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. ***FY 2018 Plans:*** Will continue to mature and validate the long range fires missile systems 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 mature navigation system concept designs that provide alternate precision navigation solutions to GPS that leverage emerging navigation technologies; conduct preliminary design review of candidate technologies; perform lab and bench evaluations; assess system integration and performance evaluations through advanced simulation; continue to develop technologies to increase range to include motor technologies for long range precision fires and light-weight, thermally-protected airframe structures; conduct static motor testing to assess extended range performance; and perform modeling and simulation analysis of advanced materials for thermal management techniques.			
Title: Active Protection System Interceptor Demonstration	5.765	6.250	6.250
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 the United States (U.S.) Army Aviation and Missile Research, Development and Engineering Center (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 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 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Advanced APS modeling and simulation to configure and evaluate subsystem integration on physical and virtual demonstrator platforms; evaluated 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:*** Continue analysis of APS-countermeasure 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. ***FY 2018 Plans:*** Will improve modeling and simulation of APS countermeasure and fire control sensor alternatives; continue maturation and adaptation of a hard-kill countermeasure and fire control sensor to improve performance of survivability equipment.			
Title: Affordable Extended Range Precision Missile Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, hardware-in-the-loop (HWIL) test, and flight demonstration of technology for an affordable discriminate extended range precision missile to include critical component technologies such as advanced propulsion, seekers, fire control, datalink, guidance and controls, and maneuverable airframes. Critical subsystem technology development transitions to 0603313A/263 Low Cost Extended Range Missile and 0603313A/704 Low Cost Extended Range Air Defense and to future fire support efforts for further maturation. ***FY 2016 Accomplishments:*** Completed trade studies determining system and subsystems requirements for an affordable discriminate extended range precision missile; advanced development of system-level modeling and simulation to mature and evaluate concepts for system performance predictions; matured key critical subsystem technologies in support of identified system requirements such as propulsion and navigation; matured maneuverable airframe guidance and controls algorithms. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will provide high fidelity simulations to improve lethal effects for maritime targets, seeker technology for terminal homing, a datalink for in-flight target updates using system-level trade studies; perform system level integration activities as the subcomponent technologies mature, and will begin integration of an Anti-Radiation Homing (ARH) capability into Guided Multiple Launch Rocket System (GMLRS) airframe. Critical system level attributes will include: target detection, target acquisition,	7.493	4.024	13.149

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
target classification, target tracking, target aim point selection, trajectory management, thermal characterization and lethality assessment.			
Title: Close Combat Weapons Technology	3.967	2.046	6.788
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 Accomplishments:*** Finalized fabrication, integration, and testing of reduced weight, advanced composite housing including foam components for Javelin Light Weight Command Launch Unit (LW CLU); fabricated, integrated, and tested 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; fabricated, integrated, and tested a target acquisition sensor for the Javelin LW CLU increasing target acquisition range and reducing SWaP; performed system-level trade studies to identify critical technology needs such as seekers, propulsion and guidance for a next generation close combat missile system; matured key technologies for a next generation close combat missile system. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will mature detailed system designs of critical propulsion and warhead components within severe constraints of size, weight, and power, and improve modeling and simulation of man-portable squad/vehicle crew weapons with fire from enclosure capability, overwhelming precision, and firefight-ending lethality; improve components and flight demonstrate a precision maneuverable missile in a relevant environment; provide an application-based fire control unit for reduced operator load; provide an affordable advanced imaging sensor and advanced autotracker features for increased precision; and provide a datalink for increase range and security, and provide a power system that increases endurance and decreases maintenance.			
Accomplishments/Planned Programs Subtotals	26.480	23.282	34.725

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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)*

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
704: *Advanced Missile Demo*	-	19.348	26.473	25.649	-	25.649	22.682	26.551	24.294	13.528	-	-

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 2016	FY 2017	FY 2018
Title: Counter Rockets, Artillery, Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missile Tracking and Fire Control	6.968	8.038	7.497
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 2016 Accomplishments: Tested and refined 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; refined and verified aerodynamic performance predictions; and updated the HTK system simulation used for system performance prediction and analysis.			
FY 2017 Plans: 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; continue to coordinate integration of a mobile multi-purpose			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
detect, decide, and defeat expeditionary technology; and continue to mature software algorithms and perform platform integration of cueing and tracking sensor capability. ***FY 2018 Plans:*** Will provide a surrogate demonstration launcher with integrated digital data link and inertial and network alignment technology and ground station components, and demonstrate its missile launch functionality through flight testing in a relevant environment; improve the integration of multi-mission radar input and detect data into a common tactical air picture and focused energy weapon cueing and fire control.			
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 2016 Accomplishments:*** Completed design and began static testing of solid rocket motor; completed target generator for hardware-in-the-loop calibration and testing of active radar seeker, guidance electronics, and control system; completed wind tunnel testing and aerodynamic analysis of interceptor. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will mature the low-cost air defense interceptor system with integrated solid rocket motor, digital data link, mission computer, power system, and flight termination system and demonstrate in ballistic flight testing; provide system analysis via hardware-in-the-loop flight simulation of the digital data link, mission computer, power system, navigation system, and control actuation system.	6.535	9.184	8.882
Title: Seeker and Guidance Technology for Air Defense	5.845	7.601	7.267

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Description: This effort focuses on the maturation, integration, and fabrication 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 Accomplishments:*** Matured 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; matured 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; continued maturation of guidance algorithms and navigation technology to support low-cost extended range air defense interceptor; matured 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. ***FY 2018 Plans:*** Demonstrate active RF seeker in hardware-in-the-loop flight simulation with GEU and in field testing in a relevant environment; continue maturation of guidance algorithms for accurate mid-course and terminal homing guidance at extended ranges; provide flight control scripts for testing the speed, accuracy, and stability of the flight control system for use in future flight testing.			
Title: Multi-Role Missile Demonstration	-	1.650	2.003
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:***			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Demonstrate in a ground-launched flight test the guidance and control performance of the guided forward firing configuration and continue maturation of the component technology of the drop/glide configuration from PE 602303A (Multi-Role Missile Technology) which includes seeker, payload, guidance electronics unit, control actuation subsystem, propulsion subsystem, and subsystem interface bus.			
Accomplishments/Planned Programs Subtotals	19.348	26.473	25.649

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
NA6: *Missile and Rocket Initiatives (CA)*	-	55.000	0.000	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 2016	FY 2017
Congressional Add: Program Increase	55.000	-
FY 2016 Accomplishments: Program increase for missile and rocket advanced technology development		
Congressional Adds Subtotals	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: FY 2018 Army	Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603322A *I TRACTOR CAGE*

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	-	10.999	11.107	12.323	-	12.323	12.400	13.128	13.362	14.104	-	-
B92: *DB92*	-	10.999	11.107	12.323	-	12.323	12.400	13.128	13.362	14.104	-	-

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	10.999	11.107	11.311	-	11.311
Current President's Budget	10.999	11.107	12.323	-	12.323
Total Adjustments	0.000	0.000	1.012	-	1.012
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	0.000	0.000	1.000	-	1.000
• Civ Pay Adjustments	0.000	0.000	0.012	-	0.012

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	215.138	177.190	182.331	-	182.331	183.322	186.329	190.046	193.929	-	-
DS7: *High Performance Computing Modernization Program*	-	170.138	177.190	182.331	-	182.331	183.322	186.329	190.046	193.929	-	-
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	45.000	0.000	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 (RDTE) 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 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 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 RDTE 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	222.159	177.190	182.338	-	182.338
Current President's Budget	215.138	177.190	182.331	-	182.331
Total Adjustments	-7.021	0.000	-0.007	-	-0.007
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-7.021	-			
• Adjustments to Budget Years	0.000	0.000	-0.023	-	-0.023
• Civ Pay Adjustments	0.000	0.000	0.016	-	0.016

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*		
Congressional Add: *Congressional Increase*	45.000	-
Congressional Add Subtotals for Project: DW5	45.000	-
Congressional Add Totals for all Projects	45.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
DS7: *High Performance Computing Modernization Program*	-	170.138	177.190	182.331	-	182.331	183.322	186.329	190.046	193.929	-	-

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 2016	FY 2017	FY 2018
Title: Department of Defense Supercomputing Resource Centers	89.142	94.555	97.298
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: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018

DoD RDTE community to effectively and efficiently investigate, demonstrate, and mature a broad range of technologies through advanced computational methods.

FY 2016 Accomplishments:

Refined and exploited 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, networking, and systems, (10) environmental quality, and (11) integrated modeling and test environments; demonstrated 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; matured 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; matured 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 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

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will refine and exploit the advanced capabilities of previously demonstrated supercomputers (utilizing the existing capability complete 31,000 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. 2018) processor, memory, disk I/O, interconnect, and OS capabilities (adding an additional capability of 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; will mature shared above secret capabilities to address critical DoD mission requirements.			
Title: Defense Research and Engineering Network ***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 and its contract entities as they employ HPCMP advanced capabilities; employs complementary specialized expertise to mature and exploit this environment. ***FY 2016 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 Systems Agency (DISA)-accredited Level 3 computer network defense capability to effectively protect the intellectual property of the DoD and its contract entities, when employing HPCMP advanced capabilities; matured the advanced network technologies and complex information assurance mechanisms required to implement logically-separated (as opposed to physically-separated)	30.852	30.402	31.284

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
networking communities-of-interest (COIs); demonstrated 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; demonstrated (in coordination with White House Office of Science and Technology Policy (OSTP), the National Science Foundation (NSF), and Army Research Laboratory (ARL)) the ability to employ software-defined networks (SDNs) to allow traditional Internet protocol (IP) and experimental protocol networks to coexist within a common DoD networking infrastructure; matured (in collaboration with the DoD Chief Information Officer's Office, United States (U.S.) Cyber Command, the NSA, DISA, and ARL) a 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. ***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 RDTE 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 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 SDNs to allow traditional IP and experimental protocol networks to coexist within a common DoD networking infrastructure; will mature an 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. ***FY 2018 Plans:*** Will continue to 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 Test & Evaluation (T&E) and Acquisition Engineering communities; will continue strategic technical planning and acquisition strategy development for DREN IV, a follow-on to DREN III, with next-generation technical capabilities and significantly increased bandwidths to support the HPCMP and DoD RDTE communities; will continue to refine and exploit the HPCMP's DISA-accredited Tier 2 cybersecurity service provider capability to effectively protect the intellectual property of the DoD and its contract entities as they utilize HPCMP advanced capabilities; will continue to mature the advanced network technologies and complex cybersecurity mechanisms required to implement logically-separated networked COIs at multiple			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 Tier 2 cybersecurity service provider capabilities and (2) active experimentation for novel, adaptive cybersecurity detection and intervention methods; will continue to demonstrate the ability to employ SDNs to allow traditional IP and experimental protocol networks to coexist within a common DoD networking infrastructure; will continue to mature an ISCM and cyber situational awareness capability to ingest robust, diverse, host-based and network-based near-real-time information by harnessing HPC resources for advanced mission essential task elements; improve cybersecurity methods to aid in the detection of insider threats.			
Title: Software Applications	50.144	52.233	53.749
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) 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 2016 Accomplishments:*** Matured jet engine propulsion portion of fixed-wing aircraft model to account for engine dynamics under transient flight conditions (i.e., complex maneuvers); matured rotorcraft model to address the intricate maneuvers required to analyze the Joint Multi-Role (JMR) Helicopter (an anticipated replacement for over 4,000 medium-lift helicopters); matured coupled-physics model for conducting analysis of alternatives (AoA) for fixed-wing aircraft concept designs to investigate (a) next generation cargo aircraft (i.e., potential future replacements for the C-130 and C-17) and (b) advanced precision-guided Army parachutes for deployment of equipment and supplies to ground troops; matured RF electromagnetic (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); matured multi-physics ship model to allow refined ship/shock analysis for underwater/surface explosions, capturing the effects of moderate and severe structural damage; matured multi-physics ship model to allow detailed propeller analysis,			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
capturing the effects of cavitation [i.e., the creation of voids/bubbles]; matured model for conducting AoAs for concept ship designs by incorporating cost as a design variable; matured 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) 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. Matured model for examining personnel/platform blast protection (e.g. determining blast effects on (a) wheeled 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 RDTE 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 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 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. ***FY 2018 Plans:*** Will mature multi-disciplinary software technology in support of current and future defense programs. For aeronautical systems of all types (i.e., fixed and rotary-wing aircraft, munitions, missiles, rockets, etc.), this endeavor will mature model-centric conceptual design software technology to support pre Milestone-A Defense acquisition processes, enabling application of physics-based analysis of alternatives, technology trade-space exploration, and cost implications. For fixed-wing aircraft, this will include, but will not be limited to, high-fidelity physics-based 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.), mission planning for fielded and new systems and associated upgrades, and acquisition decisions associated with exploration and design analysis of future manned and unmanned aerial vehicle concepts. Additionally, it will include implementation of foundational software improvements necessary to begin development of physics-based design analysis tools for future hypersonic weapon systems (High Speed Strike, Tactical Boost-Glide, and Manned/Unmanned Conventional Prompt Global Strike). For rotorcraft, exemplars will include aeromechanics analysis associated with maneuvers, airframe-propulsion system integration, and weapons carriage and release, as well as infrared suppression analysis, chaff trajectory prediction, debris ingestion analysis, and loads prediction capability necessary for structural airworthiness assessments. These capabilities will be deployed in support of the FVL Program, as well as for sustainment of existing rotorcraft-based programs and associated upgrades, such as the ITEP. For RF antenna design analysis, 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 and will optimize computational methods for electronic warfare assessments and evaluation of multiple antenna systems on a single platform. For Naval Ships (surface and submarine), will further mature conceptual and early modeling capabilities in sync with detailed design and analyses, to realize full-lifecycle management of systems and platforms, and for conducting AoAs.			
Accomplishments/Planned Programs Subtotals	170.138	177.190	182.331

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	45.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This is a Fiscal Year 2016 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 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 Plan.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Congressional Increase	45.000	-
FY 2016 Accomplishments: Congressional increase for the High Performance Computing Modernization Program.		
Congressional Adds Subtotals	45.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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)*

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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	-	13.425	17.451	17.948	-	17.948	13.097	13.232	13.908	14.095	-	-
608: *Countermine & Bar Dev*	-	11.518	15.465	15.957	-	15.957	11.104	11.238	11.873	12.018	-	-
683: *Area Denial Sensors*	-	1.907	1.986	1.991	-	1.991	1.993	1.994	2.035	2.077	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates sensors, 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. 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 United States (U.S.) Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	13.966	17.451	18.659	-	18.659
Current President's Budget	13.425	17.451	17.948	-	17.948
Total Adjustments	-0.541	0.000	-0.711	-	-0.711
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.541	-			
• Adjustments to Budget Years	0.000	0.000	-0.750	-	-0.750

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
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*			
• Civ Pay Adjustments	0.000	0.000	0.039	-	0.039

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
608: *Countermine & Bar Dev*	-	11.518	15.465	15.957	-	15.957	11.104	11.238	11.873	12.018	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for finding and neutralizing explosive hazards in varying vegetation, soil, and weather conditions at varying times of day. Activities include standoff and close-in detection and neutralization of explosive threats with technology integrated onto both air and ground platforms and in dismounted operations. 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Ground Vehicle Explosive Hazard Detection	11.518	15.465	15.957
Description: This project improves detection, marking, and defeat of low metal/low contrast explosive threats buried in the road and along the sides of roads, Improvised Explosive Devices (IEDs) and antitank landmines. 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 2016 Accomplishments: Matured target detection algorithms for digital ground penetrating radar (GPR) array for identification of explosive hazards in roads and for precision marking; matured forward looking electro-optical / infrared (EO/IR) sensor suite with optimized spatial and spectral resolutions, multi-step target detection algorithms and automated decision making tools to provide integrated capabilities; integrated 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); demonstrated Light Detection and Ranging (LIDAR) sensor to image and identify side attack targets and threats and base lined 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;			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will demonstrate and evaluate an integrated forward looking EO/IR sensor suite with multi-step target detection algorithms and automated decision making tools in relevant outdoor environments; demonstrate real-time on-the-move forward looking EO/IR to down looking GPR sensor cueing with integrated graphical user interface; demonstrate and evaluate LIDAR sensor capability to identify side attack targets using vehicle test bed; validate optimized target detection algorithms to detect in-road and road side explosive hazards.			
Accomplishments/Planned Programs Subtotals	11.518	15.465	15.957

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
683: *Area Denial Sensors*	-	1.907	1.986	1.991	-	1.991	1.993	1.994	2.035	2.077	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates surveillance and command, and control technology components for anti-access area denial systems that inform maneuver elements and minimize the risk 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 human-in-the-loop threat confirmation. 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Area Denial Sensors	1.907	1.986	1.991
Description: This effort matures and demonstrates networked sensor and sensor fusion technology efforts to provide detection, identification, and classification of remotely delivered sensor systems and area denial munitions. Key technologies to be matured and demonstrated include deployable multi-mode sensors, fused sensor information, and local area network communications to meet requirements for human-in-the-loop command and control.			
FY 2016 Accomplishments: Matured deployable multi-mode sensor architecture that can be integrated into remote delivery munitions, focusing on harsh shock environments; and matured 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.			
FY 2018 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Will demonstrate scatterable deployed sensor fields, develop image and data processing techniques to improve data management to decision cycle time; demonstrate sensor target data connection to fire control, optimize sensor performance and coordinate interfaces with Fires elements.			
Accomplishments/Planned Programs Subtotals	1.907	1.986	1.991

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: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603607A / *Joint Service Small Arms Program*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	4.903	5.839	5.796	-	5.796	5.885	6.004	6.124	6.249	-	-
627: *Jt Svc Sa Prog (JSSAP)*	-	4.903	5.839	5.796	-	5.796	5.885	6.004	6.124	6.249	-	-

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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	5.105	5.839	5.787	-	5.787
Current President's Budget	4.903	5.839	5.796	-	5.796
Total Adjustments	-0.202	0.000	0.009	-	0.009
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.202	-			
• Civ Pay Adjustment	0.000	0.000	0.009	-	0.009

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
627: *Jt Svc Sa Prog (JSSAP)*	-	4.903	5.839	5.796	-	5.796	5.885	6.004	6.124	6.249	-	-

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 2016	FY 2017	FY 2018
Title: Advanced Small Unit (Squad) Small Arms Technology Demonstration	0.387	-	-
Description: Identify, advance, and demonstrate advanced technologies leading to the ability to improve Small Unit level effectiveness and utilize new small arms technological concepts to improve range overmatch capability against like-sized threat elements. ***FY 2016 Accomplishments:*** Demonstrated a closed loop fire control weapon modification kit to compensate for dismounted shooter wobble. User-interface components were 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	1.629	-	-
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 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Demonstrated 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; achieved Technology Readiness Level (TRL) 6 for matured technologies; and transitioned Technical Data Package (TDP) formulation.			
Title: Volume Effects ***Description:*** This effort addresses the maturation and demonstration of emerging small arms technologies from PE 0602623A efforts into current and next generation weapon systems to address Volume (sustained suppressive and lethal fires for area targets) capability gaps for improved effectiveness at extended ranges. ***FY 2016 Accomplishments:*** Matured 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 provided the capability to achieve desired accuracy and incapacitating effects with volume fire. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will continue to support technology development for NGSAR requirements; investigate weapon systems, fire control, and ammunition technologies to increase the current performance of the lightweight medium machine gun.	0.960	2.362	2.373
Title: Precision Effects ***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 Accomplishments:*** Matured and demonstrated 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:***	0.582	1.582	1.428

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will optimize and demonstrate precision ammunition technologies to support precision ammunition requirements for extended range, accuracy and terminal effects required to perforate toughest targets and implement highly efficient aerodynamics.			
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:*** 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. ***FY 2018 Plans:*** Will continue to increase lethality capabilities and assess small arms effectiveness.	-	0.395	0.495
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 2016 Accomplishments:*** Matured a strategy for technology development in small arms weapon systems and enablers to increase the performance of small arms weapon systems in the hands of the Soldier, Marine, Sailor, Airman, or Coast Guardsman. Strategy applied to both the design and development of specific technologies, as well as the development of assessment methods and tools to measure or assess the performance of such technologies. ***FY 2017 Plans:*** 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	1.345	1.500	1.500

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
development and eventual fielding; conduct long range plans and optimize strategies for joint applications; influence international small arms activities. ***FY 2018 Plans:*** Will continue to manage Joint Services Small Arms Programs; continue technology developmental efforts on material solutions for transitioning to small arms programs of record; continue to influence small arms technology maturation activities in collaboration with North Atlantic Treaty Organization (NATO) partners.			
Accomplishments/Planned Programs Subtotals	4.903	5.839	5.796

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	39.329	44.468	47.135	-	47.135	61.419	63.343	54.054	55.292	-	-
K70: *Night Vision Adv Tech*	-	25.691	27.293	21.529	-	21.529	32.793	36.122	36.337	37.068	-	-
K86: *Night Vision, Abn Sys*	-	13.638	17.175	25.606	-	25.606	28.626	27.221	17.717	18.224	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates sensor technologies that increase Warfighter situational understanding, 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 understanding imagery to multiple pilots/crew members independently for enhanced operations in day/night/adverse weather conditions.

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

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

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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603710A / *Night Vision Advanced Technology*		
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	40.929	44.468	40.635	-	40.635
Current President's Budget	39.329	44.468	47.135	-	47.135
Total Adjustments	-1.600	0.000	6.500	-	6.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.600	-			
• Adjustments to Budget Years	0.000	0.000	6.450	-	6.450
• Civ Pay Adjustment	0.000	0.000	0.050	-	0.050

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
K70: *Night Vision Adv Tech*	-	25.691	27.293	21.529	-	21.529	32.793	36.122	36.337	37.068	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates high-performance sensor technologies and architectures that enhance situational understanding, increase target detection and identification ranges, reduce target acquisition (TA) timelines, enable threat detection and mitigation and support operations in degraded environments against threats that are partially obscured by terrain, weather or other features. Provides improved capabilities for mounted and dismounted Soldiers and tactical vehicles.

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 United States (U.S.) Army Communications-Electronics Research, Development, and Engineering Center (CERDEC) /Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Advanced Sensors for Precision	11.118	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 matures and integrates advanced Infrared (IR) imaging technology, 3-Dimensional (3D) imaging sensor techniques, emerging laser technologies and precise far target location technology to increase situational understanding and enable early warning, Hostile Fire Detection (HFD), and active countermeasure capabilities. This provides increased protection against current and emerging threats. Follow on work for Fiscal Year (FY) 17 is also captured in “Advanced Wide Area Search Sensors”.			
FY 2016 Accomplishments: Demonstrated uncooled IR camera for situational awareness (SA) and muzzle flash detection and on the move performance of ground HFD and algorithms; optimized design for detection of hostile uncooled and cooled IR sensors prior to threat engagement; demonstrated hostile fire clutter rejection techniques for reduced false alarms and threat sensor point of origin determination, and assessed performance for an expanded threat set; validated laser technologies and limitations for pre-shot suppression of threat sensors; demonstrated stationary pre-shot detection/suppression of threat imaging sensors at objective ranges; performed perception experiments on pre-shot suppression to determine metrics and system requirements.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 sensor 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 2016 Accomplishments:*** Developed methodologies for sensor interoperability and appropriate data flow across security classification domains; developed approaches to tailoring data request results that minimize network bandwidth requirements; improved 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. ***FY 2018 Plans:*** Will mature dynamic discovery of sensor systems on a network and techniques for sensor planning and management to maximize sensor capability; mature and demonstrate methods to provide sensor interoperability and fault tolerance across Enterprise and Tactical networks; mature and provide application layer reliability; provide data aggregation and summary; support data for disconnected sensor nodes; improve service on demand for networked sensors, including sensor data, location of video feeds, and collaboration between sensors; demonstrate simplified integration strategies for non-integrated sensor architecture (non-ISA) assets to improve situational understanding and exploit sensor capability, to include joint and multinational assets.	3.362	2.500	3.004
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	0.978	1.005	1.001

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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, PE 060315A/Project S28, and PE 0603004A/Project 232. ***FY 2016 Accomplishments:*** Evaluated measures of effectiveness (MOE) and measures of performance (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. ***FY 2018 Plans:*** Will update 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, and provide data to populate database for Library of Soldier (LOS) reference documentation; support development of framework, models and systems engineering processes and tools for the Soldier Research and Development (R&D) community.			
Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE)	4.650	5.897	5.112
Description: This effort provides uncooled IR sensor technologies to improve survivability through increased SA in all conditions and environments, to include DVE, for manned and unmanned ground vehicle systems. Current uncooled IR requires improvement in sensitivity and development of signal processing techniques to penetrate obscurants. Integration of improved sensors, signal processing algorithms, and data fusion will maintain mission capabilities in DVE (e.g. smoke, dust, fog). Demonstration of scalable, multi-function (360 degree SA, HFD, Aided Driving), low cost SA systems with in-vehicle displays that can be tailored to the ground platform and mission requirements will bring timely and useful information to the vehicle crew and squad. Joint effort with the Tank Automotive Research, Development and Engineering Center (TARDEC) under PE 0602601/ Project C05 and PE 0603005/Project 221. Fully coordinated with PE 0602709/Project H95. ***FY 2016 Accomplishments:*** Assessed 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
scalable, multi-function sensor capabilities that can be applied to tactical vehicles and combat platforms; explored industry approaches for automotive driving aids for automated personnel and obstacle detection with applicability to military environments. ***FY 2017 Plans:*** 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. ***FY 2018 Plans:*** Will integrate sensors, driving aids and DVE processing on vehicle platform and conduct on the move (OTM) field experiment to evaluate real time driving and maneuver capabilities in DVEs; assess alternate UCIR sensor to improve sensitivity and reduce sensor noise; provide focal plane array (FPA) performance requirements to inform next generation of uncooled infrared (UCIR) sensors; validate suitability of fusing commercial off-the-shelf (COTS) and government off-the-shelf (GOTS) active sensors, to include millimeter wave (MMW)/Radar, to supplement UCIR imagery and provide low latency cues suitable for driving; evaluate low latency region based local area processing and generic dictionary convex programming techniques to provide operationally suitable imagery in real time under various DVEs; continue definition of real time region based processing and optimal sensor system parameters, such as sensitivity, instantaneous field of view (IFOV), frame rate, to enable remote sensing and navigation in heavy DVEs.			
Title: Soldier Maneuver and Lethality Sensors ***Description:*** This effort matures and demonstrates dismounted Soldier capabilities that improve Soldier mobility, maneuver, situational understanding, 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 Accomplishments:*** Designed head mounted High Definition (HD) color displays to replace heavier and larger prism based devices to enable use with protective eyewear; incorporated improved display components for injection node and holograms to increase brightness and reduce image distortion for day/night usability; improved Soldier target engagement by evaluating crosswind profile measurement, automated bore sighting 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 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	5.583	5.935	2.892

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will validate head mounted wide FOV, see thru, HD color display with high brightness for daytime operation; integrate augmented reality for improved situational understanding and dismounted mobility and interfaces with existing Soldier equipment to include the Nett Warrior End User Device, Enhanced Night Vision Goggle, and Family of Weapon Sights.			
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. ***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.	-	7.707	-
Title: Augmented Reality for Tactical Operations ***Description:*** This effort will mature and demonstrate an integrated mounted and dismounted tactical Augmented Reality (AR) capability that provides a Common Operating Picture (COP) for mounted and dismounted elements, increased maneuverability and survivability, and enhanced situational understanding by integrating sensor imagery, geo-location information, accurate real time Situational Understanding (SU) and command and control information for all warfighter operational environments. Leverages work performed in PE 0602709A/Project H95, PE 0602784A/Project 855, and PE 0602784A/Project T42. ***FY 2018 Plans:***	-	-	2.002

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Will conduct analyses and trade studies to support a display agnostic augmented reality capability for Dismounted and Mounted Warfighters; establish specifications for a common SU hardware approach and information presentation to the mounted and dismounted Soldiers; initiate design of a common operating picture.			
Title: New Long Range Advanced Scout Surveillance System (LRAS3) ***Description:*** This effort matures and demonstrates sensor technologies that provide reconnaissance crews the ability to rapidly detect, identify, and respond to hybrid threats beyond their current tactical capability to include integration of third-generation forward looking infrared (FLIR) with low cost optics, multi-function laser module enabling range finding, marking and pointing, rapid detection of threat optical systems, precision target location, and advanced image processing and aided target recognition algorithms. ***FY 2018 Plans:*** Will perform predictive range performance modeling to refine the third-generation FLIR optical system design to maximize performance; develop multi-spectral/multi-function laser technologies for threat detection, target handoff, range-finding, and threat jamming; define threat sets and evaluate sensor susceptibility to detection and jamming techniques. Design and validate a demonstrator digital read-out integrated circuit (DROIC) long wave infrared (LWIR) camera in an environmentally sealed closure.	-	-	5.412
Title: Down Range Electro-Optical Wind Sensing ***Description:*** This effort will integrate crosswind sensing and range measurement with real time compensation of the aim-point offset for a shooter to rapidly and accurately engage targets from effective weapon ranges. The program will develop sensing and imaging technologies to measure path integrated crosswinds and range to provide an aim-point compensation of the bullet trajectory to increase the first round probability of hit. ***FY 2018 Plans:*** Will conduct systems analysis and complete design for an integrated down range electro-optical (EO) wind sensing system with weapon sight and reticle aim point adjustment; validate design approach to meet system performance specifications and begin fabrication of system demonstrator.	-	-	2.106
Accomplishments/Planned Programs Subtotals	25.691	27.293	21.529

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
K86: *Night Vision, Abn Sys*	-	13.638	17.175	25.606	-	25.606	28.626	27.221	17.717	18.224	-	-

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 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) in day/night, obscured, smoke, adverse weather and other degraded visual environment. 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 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) and PE 0603003A (Aviation Advanced Technology).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Multifunction Imagers for Rotary Wing	9.616	-	-
Description: This effort matures and demonstrates an economical sensor capability by developing multifunction sensor modules for increased performance of pilotage capability in a Degraded Visual Environment (DVE) at lower total life cycle cost than separate sensor systems. Work in this effort is coordinated with DVE efforts in PE 0602211A, Aviation Technology, Project 47A. ***FY 2016 Accomplishments:*** Completed integration of dual-purpose infrared (IR) sensors with other low-light night vision technology; characterized performance of threat warning algorithms and pilotage sensor under brownout and rain DVE through a series of laboratory, performed field and flight test measurements; identified performance issues and optimize threat warning algorithms and pilotage sensors.			
Title: Local Area Intelligence, Surveillance, and Reconnaissance (ISR) for Tactical Small Units	2.022	5.050	5.089
Description: This effort develops and demonstrates sensors enabling simultaneous display of wide and narrow field-of-view (FOV) infrared imagery for enhanced situational awareness/targeting and multi-band image fusion and the ability to image battlefield laser spot locations for improved targeting accuracy and reduced fratricide caused by laser misalignment.			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Completed design to retrofit existing turret with optical components to provide simultaneous wide FOV and independently steerable narrow FOV capability; demonstrated 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. ***FY 2018 Plans:*** Will integrate 3-band camera module into the Common Sensor Payload (CSP) turret to demonstrate the ability to see battlefield lasers; finalize design of optical components for simultaneous wide and independently steerable narrow field of view and integrate into CSP turret; verify functionality of turret modifications.			
Title: Pilotage Sensor Fusion ***Description:*** This effort develops and matures sensor fusion utilizing combinations of sensing modalities (active and/or passive) and associated real-time processing algorithms and architectures to produce synthetic scene representations that provide increased information content as opposed to scenes produced from existing single mode sensor solutions. ***FY 2016 Accomplishments:*** Validated exploitable features associated with multiple sensing modalities to aid with operations under DVE; demonstrated algorithm approach for fusion of two sensor modalities that provides increased situational awareness to the pilot as compared to either single sensor modality.	2.000	-	-
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 Long wave 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	-	12.125	9.257

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
0603003A, Aviation Advanced Technology, Project 313. ***FY 2017 Plans:*** Will mature and demonstrate fusion and DAS approaches utilizing Passive and Active IR, and Radio Detection And Ranging (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 (DROIC) technology to develop a D-ROIC longwave infrared camera to address DVE requirements. ***FY 2018 Plans:*** Will quantify performance of multi-modal fusion approaches operating on previously collected airborne DVE data sets; assess the impacts of varying sensor performance levels on the fused data product; implement DAS scene rendering approaches that decrease processing latency; generate a coherent three-dimensional (3D) world model that may be queried by other related flight control and cueing systems. Demonstrate synthetic vision scene rendering in a real-time environment and implement advanced navigation and location algorithms such as simultaneous localization and mapping (SLAM) and 3D feature matching to refine aircraft navigation/location solutions. Finalize designs for real-time computing hardware and architectures to support flight test and experimentation. Complete fabrication and test of large well-capacity, high-sensitivity cooled LWIR sensors and wide field of view uncooled infrared sensors for inclusion in the DVE DAS/Fusion system.			
Title: Digital Dual Use Sensors (DDUS) ***Description:*** This program will develop the core camera technology for a multi-spectral, multi-mode distributed aperture pilotage system while supporting aircraft survivability. This synergistic single sensor technology will support aircraft survivability by providing hostile fire and missile warning cues while simultaneously providing pilotage and situational understanding in degraded visual environments. It leverages technology from the Dual Band Infrared Focal Plane Arrays (IRFPA) ManTech as well as from the 3D DROIC Science and Technology Objective (STO) to fabricate the digital multi-function readout circuit to enable the multi-function capability. ***FY 2018 Plans:*** Will initiate the development and fabrication of a dual band (millimeter wave infrared (MWIR) and long wave infrared (LWIR)) small pitch 2K x 2K pixel Focal Plane Arrays (FPA) and a multi-function DROIC matched to the dual color FPA to provide the frame rates and data quality required to support aperture sharing element (ASE) function as well as sensitivity and resolution for	-	-	11.260

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
pilotage in DVE; initiate and evaluate dewar designs to employ advanced optical data feed though technology which is necessary to enable the high data rates associated with the multi-function capability of the sensor.			
Accomplishments/Planned Programs Subtotals	13.638	17.175	25.606

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	14.533	11.137	10.421	-	10.421	10.624	10.840	11.056	11.284	-	-
002: *Environmental Compliance Technology*	-	3.225	3.262	2.203	-	2.203	2.353	2.455	2.503	2.554	-	-
025: *Pollution Prevention Technology*	-	1.430	1.489	1.488	-	1.488	1.488	1.488	1.518	1.549	-	-
03E: *Environmental Restoration Technology*	-	5.878	6.386	6.730	-	6.730	6.783	6.897	7.035	7.181	-	-
03F: *Environmental Quality Tech Demonstrations (CA)*	-	4.000	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 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 PE 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 United States (U.S.) Army Research, Development, and Engineering Command, Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	14.727	11.137	10.382	-	10.382
Current President's Budget	14.533	11.137	10.421	-	10.421
Total Adjustments	-0.194	0.000	0.039	-	0.039
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.194	-			
• Civ Pay Adjustments	0.000	0.000	0.039	-	0.039

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 03F: *Environmental Quality Tech Demonstrations (CA)*		
Congressional Add: *Program Increase*	4.000	-
Congressional Add Subtotals for Project: 03F	4.000	-
Congressional Add Totals for all Projects	4.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
002: *Environmental Compliance Technology*	-	3.225	3.262	2.203	-	2.203	2.353	2.455	2.503	2.554	-	-

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 violations 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 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 2016	FY 2017	FY 2018
Title: Sustainable Ranges and Lands	0.859	0.909	1.099
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 2016 Accomplishments: Matured and validated 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 United States (U.S.) Army Public Health Command and U.S. Army Test and Evaluation Command safety and performance approval for fully integrated grey water reuse system for contingency bases.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will integrate and mature methodologies for high-resolution permafrost/ground-ice mapping for improved risk characterization. Will extend permafrost heat transfer models to account for near surface ground heterogeneity and provide a real-time feedback system for early warning of ground stability, including permafrost change development, for existing infrastructure.			
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 an additive construction system utilizing cementitious materials. ***FY 2016 Accomplishments:*** Integrated 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. Assessed the cementitious material requirements and characteristics required for automated additive construction that will be assessed utilizing a rudimentary pre-development 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. ***FY 2018 Plans:*** Will mature and validate representative hardware and software to assess the relative risk associated with autonomous construction activities, and the degree to which risk may be mitigated through the employment of innovative robotic construction methods.	2.366	2.353	1.104
Accomplishments/Planned Programs Subtotals	3.225	3.262	2.203

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
025: *Pollution Prevention Technology*	-	1.430	1.489	1.488	-	1.488	1.488	1.488	1.518	1.549	-	-

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 2016	FY 2017	FY 2018
Title: Pollution Prevention Technology	1.430	1.489	1.488
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 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Conventional Ammunition: Qualified lead-free primary explosive from full-scale production lot; Pyrotechnics: Conducted testing for chromate- and lead-free gasless delay formulations in a relevant end item; Toxic Metal Reduction: Conducted 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. ***FY 2018 Plans:*** Will mature and characterize nanoporous silicon-based energetic materials as potential alternatives to lead-based primary explosives; will demonstrate the use of Chemical Agent Resistant Coating formulations that replace hazardous isocyanate compounds with polysiloxane-based resins; will demonstrate alternative refrigerants with low global warming potential in military environmental control unit applications.			
Accomplishments/Planned Programs Subtotals	1.430	1.489	1.488

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
03E: *Environmental Restoration Technology*	-	5.878	6.386	6.730	-	6.730	6.783	6.897	7.035	7.181	-	-

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 Project 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 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 2016	FY 2017	FY 2018
Title: Sustainable Ordnance Mitigation and Management	1.280	-	-
Description: This effort develops real time detection and discrimination methodologies for unique and emerging non-metallic unexploded ordinance (UXO). ***FY 2016 Accomplishments:*** Validated algorithms for the detection and discrimination of intermediate electrically conductive material (IECM) munitions; and conducted 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	1.100	2.090	1.398

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 2016 Accomplishments:*** Matured 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. ***FY 2018 Plans:*** Will demonstrate a novel passive chemical sensor to detect multiple contaminants (copper, arsenic, and nitrate) in water to provide sensing devices that are rapid, robust, and cost-efficient for real time water quality monitoring.			
Title: Technologies for Sustainable and Green Operations and Acquisition	2.048	1.908	3.331
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 2016 Accomplishments:*** Validated computational tools to predict the physical and chemical properties and toxicity of insensitive munitions to assess hazard potentials and health effects of insensitive munitions. Matured predictive models and computational tools to assess surface water characterization and contamination potential in austere environments. ***FY 2017 Plans:*** Will validate novel treatment approaches with reactive membrane materials and mature an operational effluent treatment system that will minimize water demand and minimize decontaminated waste. ***FY 2018 Plans:*** Will demonstrate an operational field effluent treatment system that will minimize water demand, decontaminated waste, and reduce logistic demands. Will validate computationally developed environmentally relevant physical and chemical properties of emerging and traditional munitions compounds essential to predict their fate and transport in natural water. Will validate an			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
artificial intelligence model that will predict adverse outcomes based on chemical-biological interactions for assessment of military compounds.			
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 2016 Accomplishments:*** Matured experimental protocols and characterization factors in new small arms formulations for environmental risk determination; matured and demonstrated 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. ***FY 2018 Plans:*** Will validate an environmental lifecycle forecasting tool designed to provide quantitative environmental impact assessment for emerging materials and technologies. Will mature qualitative and quantitative methods for assessing synthetic biology environmental impacts of military relevance.	1.450	2.388	2.001
Accomplishments/Planned Programs Subtotals	5.878	6.386	6.730

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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
03F: *Environmental Quality Tech Demonstrations (CA)*	-	4.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Program Increase	4.000	-
FY 2016 Accomplishments: Program increase. Developed unique partnerships between Army and Industry for determining approaches to mitigate risks associated with nanotechnology or advanced materials products. Conducted field evaluation and validation of a combined physical and soil leaching system for removal of depleted uranium (DU) contamination in soils.		
Congressional Adds Subtotals	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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	26.247	20.684	32.448	-	32.448	25.864	26.236	26.701	27.186	-	-
T08: *Combat Eng Systems*	-	19.547	20.684	32.448	-	32.448	25.864	26.236	26.701	27.186	-	-
T13: *Stationary Power & Energy Tech Demonstrations (CA)*	-	2.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	4.200	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) 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 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: FY 2018 Army	Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	26.845	20.684	22.416	-	22.416
Current President's Budget	26.247	20.684	32.448	-	32.448
Total Adjustments	-0.598	0.000	10.032	-	10.032
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.598	-			
• Adjustments to Budget Years	0.000	0.000	3.000	-	3.000
• Other Adjustments 1	0.000	0.000	6.996	-	6.996
• Civ Pay Adjustments	0.000	0.000	0.036	-	0.036

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
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	-

Change Summary Explanation

Fiscal Year 2018 funds increase for Extend Map-Based Planning Services to include Joint mission planning capabilities. Human Geography demonstrations to extend the means to characterize Warfighter-relevant social, cultural, and economic geography indicators to the tactical edge.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
T08: *Combat Eng Systems*	-	19.547	20.684	32.448	-	32.448	25.864	26.236	26.701	27.186	-	-

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. Project components, systems, system of systems, and decision aids enable ground vehicle mobility (freedom of movement), including force projection, and counter-mobility to impede movement of threat forces. Additional components, systems, system of systems for survivability support protection of personnel, facilities, and assets through design and reinforcement of structures, and for force protection to detect, assess, and defend against threats for troops deployed at smaller bases and in complex and urban environments, which may include subterranean challenges. 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 of 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. Methods to characterize and visualize behavior and population dynamics mature and validate efforts to portray the operational environment including culture, demographics, terrain, climate, and infrastructure, into geospatial frameworks.

Force protection activities are focused on filling critical gaps in protecting forces operating at smaller, remote bases, or in urban environments, 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; and passive protection to mitigate blasts, direct, and indirect fire effects using rapidly deployable protection systems and retrofits to existing structures. Force protection activities are also focused on protection of critical assets and infrastructure required to project forces into denied access areas. 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 supports 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, including autonomous ground resupply. 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.

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) 0603832/Project D8Z.

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). Autonomous ground resupply activities are coordinated with PEs 0603005A/Project 515 and PE 0602601A/Project H77 and 0602601A/H91 in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC), PE 0603001A/Project 543, PE 0603639A/ Project EC3, and PE 0605805A/Project 297 with the Armament Research Development and Engineering Center (ARDEC).

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

Work in this Project is led, managed or performed by the Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Geo-Enabled Mission Command Enterprise	2.407	-	-
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 the Department of Defense (DoD) and increases situational awareness of the operational environment in support of mission planning and operations. ***FY 2016 Accomplishments:*** Enhanced digital plans and orders capability to drive course of action (COA) simulation and modeling; evaluated initial plan development and COA development capabilities within Map-based planning testbed environment; and evaluated and demonstrated mature geospatial research on the representative computing environment systems within the common operating environment.			
Title: Map-Based Planning Services (MBPS)	-	1.807	9.637
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 provided by the 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 0602784A/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). ***FY 2018 Plans:*** Will demonstrate a globally accessible, collaborative, map-based web environment which enables simultaneous viewing, editing, and sharing of information within and between military planners enabling a digitally supported military decision making process including supporting analytics and services; mature and demonstrate capability to collect, process, store, display, and share authoritative data from Joint sources in a map-based environment; mature and demonstrate Joint mission planning capabilities			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
that will allow concurrent and collaborative planning by operational, logistics, and intelligences staffs to crate, compile, and consolidate Operational Plans.			
Title: GeoIntelligence - Enabling Technology Demonstration ***Description:*** This effort provides demonstration of analytic tools and algorithms that use multi-source (e.g. optical, Light detection and ranging (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. ***FY 2018 Plans:*** Will mature and demonstrate an environmental scenario generator to provide weather and terrain effects to mobility and sensor performance models when exercising analysis of multiple courses of action within the military decision making process; develop and enhance tactical decision aid execution operating on three dimensional terrain datasets within a browser-based visualization environment.	-	0.750	2.002
Title: Human Geography Demonstration ***Description:*** This effort matures and demonstrates the integration of behavior and population dynamics research and analysis into geospatial frameworks to depict aspects of the operational environment including culture, demographics, terrain, climate, and infrastructure. Efforts include exploitation of existing open source text, leveraging multi-media and cartographic materials, and data collection methods from the tactical edge to characterize parameters of social, cultural, and economic geography of special interest to the Warfighter. ***FY 2018 Plans:*** Will demonstrate high-resolution population modeling, including adaptation of urban growth models, supporting Army Component Command major consequence assessments, and generating analysis of populations affected by catastrophic events.	-	-	1.001
Title: Austere Entry and Maneuver Support Demonstrations	4.645	6.319	6.865

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Description: This effort matures and demonstrates improved means for achieving Force Projection in in austere and complex estuary and riverine environments and integrated sensing and simulation systems for predicting physical conditions in these operational environments. This effort matures work in PE 0602784A/Project T40. This work also supports: PE 0603005A/ Project 515, PE 0602601A/Project H77, and PE 0602601/Project H91 in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC)); and PE 0603001A/Project 543, PE 0603639A/Project EC3, and PE 0605805A/ Project 297 in collaboration with the Armament Research Development and Engineering Center (ARDEC). ***FY 2016 Accomplishments:*** Validated technologies for planning and conducting Anti-Access/Area Denial (A2/AD) entry operations with non-existent, damaged, or destroyed infrastructure; demonstrated 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. ***FY 2018 Plans:*** Will demonstrate technologies for planning and conducting A2/AD entry operations without airfields/ports and with damaged/ destroyed airfields/ports; optimize and provide persistent monitoring technologies and an integrated seismic-infrasound-acoustic-meteorological (SIAM) array for remote structural health monitoring to produce near-real-time awareness of critical infrastructure and connecting lines of communication; and mature and demonstrate simulation and decision support tools to ensure both manned and unmanned ground vehicle mobility in complex, urban, and constantly changing environments.			
Title: Adaptive Protection Demonstrations ***Description:*** This effort validates 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	7.495	6.808	7.938

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
technologies for force protection basing to include planning and expedient protective construction for combat outposts and rapidly deployable protective measures, and retrofit technologies for use in urban environments. ***FY 2016 Accomplishments:*** Optimized force protection technologies to reduce manpower and logistics for combat outpost and personnel base construction and operation and demonstrated life cycle planning tools; and demonstrated 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 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. ***FY 2018 Plans:*** Will demonstrate modeling & simulation tools to predict structural response/damage to support regional tradespace analysis; provide an initial version of an urban building protection assessment tool and will mature rapidly deployable protective technologies for dismounted urban operations; demonstrate camouflage, concealment, and deception countermeasures that hinder target acquisition, thus interrupting the threat system kill-chain of advanced threat systems; optimize linear sensing systems (LSS) for perimeter security in complex geo-environments; and mature technologies to detect tunnels and subterranean activities for protection of forces and critical assets.			
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. The Engineered Resilient Systems (ERS) initiative has been identified as a Science and Technology 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, on 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. ***FY 2016 Accomplishments:***	5.000	5.000	5.005

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Matured and demonstrated environmental scenario generation "tool-set one" based on a select set of missions within a geographical area and Army systems of interest; identified and crafted 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; evolved and matured 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. ***FY 2018 Plans:*** Will provide a simulation workflow manager tool that facilitates the linkages between data sources and computational models during simulation; validate design and tradespace analysis implementation tools; and conduct tradespace analyses of candidate sensors to demonstrate environmental effects on sensor performance among other analyses in support of Warfighter systems development.			
Accomplishments/Planned Programs Subtotals	19.547	20.684	32.448

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
T13: *Stationary Power & Energy Tech Demonstrations (CA)*	-	2.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2016	FY 2017
Congressional Add: Natural Gas Research	2.500	-
FY 2016 Accomplishments: 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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	4.200	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

These is a Congressional Interest Item for Military Engineering Technology Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017
Congressional Add: Program Increase	4.200	-
FY 2016 Accomplishments: 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: FY 2018 Army											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	36.658	44.239	52.206	-	52.206	48.151	50.614	52.135	50.420	-	-
101: *Tactical Command and Control*	-	14.415	17.997	22.228	-	22.228	21.922	23.848	24.781	22.230	-	-
243: *Sensors And Signals Processing*	-	22.243	26.242	29.978	-	29.978	26.229	26.766	27.354	28.190	-	-

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 complements 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 is coordinated with PE 0602783A (Computer and Software 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 Communications-Electronics Research, Development, and Engineering, Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	38.147	44.239	52.496	-	52.496
Current President's Budget	36.658	44.239	52.206	-	52.206
Total Adjustments	-1.489	0.000	-0.290	-	-0.290
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.489	-			
• Adjustments to Budget Years	0.000	0.000	-0.371	-	-0.371
• Civ Pay Adjustment	0.000	0.000	0.081	-	0.081

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
101: *Tactical Command and Control*	-	14.415	17.997	22.228	-	22.228	21.922	23.848	24.781	22.230	-	-

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.

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 Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Integrated Mission Command (MC)	10.012	9.421	6.425
Description: This effort matures and demonstrates technologies to simplify MC software and data architectures 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. Beginning in Fiscal Year (FY) 18, work supporting expeditionary mission command is moved to an “Expeditionary MC” program.			
FY 2016 Accomplishments: Matured and demonstrated modular extensible common hardware, commander focused MC software applications and next generation tactical software architectures resulting in smaller, simpler, and less complex command; demonstrated 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; demonstrated both CP and vehicle instantiations of the mission equipment package to examine strengths/weaknesses and trade-offs between the two; and matured and demonstrated 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:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will integrate and demonstrate software that provides the commander with information regardless of the commander's location, (e.g., command post (CP), mounted vehicle, or dismounted); demonstrate enhanced collaboration software tools that enable a mobile force to use voice, gestures, and text to interact with MC systems and services on the move; complete and demonstrate a collaborative, flexible environment that distributes data to the point of need, and supports rapid and effective decision support tools; and mature and demonstrate a human computer interface that provides a common user experience and adapts to differing screen sizes and device capabilities (phones, tablets, laptops, and computers) to enable enhanced situational understanding and decision making in CP, mounted and dismounted environments.			
Title: Expeditionary Mission Command ***Description:*** This effort matures and demonstrates hardware and software command post (CP) enabling technologies to support expeditionary maneuver and effective, uninterrupted MC operations. Work accomplished under PE 0602782A/project 779 complements this effort. This effort continues expeditionary MC work previously reported under Integrated MC. ***FY 2018 Plans:*** Will complete development and integration of innovative Army CP concept technology demonstrators to enable expeditionary maneuver and effective uninterrupted MC operations; demonstrate integrated CPs and configuration standards that can be customized to meet unique mission needs and enable rapid deployment and remote operations; complete and demonstrate tactical server hardware to minimize CP network setup time and lessen task burden on administrators while simplifying CP computing environment architecture and applications; complete and demonstrate a CP display system capability that reduces clutter; demonstrate expeditionary CP components that improve collaboration, decrease complexity, size, weight, and power (SWaP) - cost; demonstrate CP nodes to inform and validate CP requirements that explore new concepts for minimalistic solutions	-	-	6.147

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
for Initial Entry Operations, Forcible Entry Operations, and agile solutions for Main CP and Tactical CP pairings; and conduct field based demonstrations focused on risk reduction and informing future CP requirements and Army Concepts.			
Title: Assured Positioning, Navigation and Timing (A-PNT) (formerly titled Battle Space Awareness and Positioning)	4.403	6.576	7.651
Description: This effort matures, demonstrates and performs modeling and simulation (M&S) of PNT technologies to provide access to trusted PNT information in global positioning system (GPS)-denied or degraded environments. Work being accomplished under PE 0602782A/Project 779 complements this effort. ***FY 2016 Accomplishments:*** Matured multiple sensor fusion techniques to improve overall system performance for PNT on mounted, dismounted, and unmanned platforms; demonstrated 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; matured 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; validated Military Code (M-Code) GPS receiver component performance for integration into PNT systems; and optimized and improved 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. ***FY 2018 Plans:*** Will integrate M-Code GPS into mounted and dismounted PNT systems including systems utilizing Multi Global Navigation Satellite Systems (multi-GNSS) signals (signals from foreign nation navigation satellite systems); mature and integrate			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
enhanced pseudolite capabilities to improve system performance and reduce reliance on GPS signals; improve upon the system performance of the Mounted Assured PNT System by integrating additional aiding sensors such as vision navigation and reduced SWAP-C inertial measurement units; assess technologies for PNT applications for autonomous systems to improve their navigation capabilities and reduce the overall cost of the platform sensor package; evaluate autonomous systems to integrate PNT technologies such as radio frequency (RF) ranging beacons for in-building navigation to augment PNT solutions for mounted and dismounted platforms; optimize improved atomic clocks and two way time transfer methods as solutions that will provide accurate time to tactical users and systems in the absence of GPS; mature and code advanced M&S of PNT sensors, systems, and platforms to support Joint analysis of effects of PNT and PNT based attacks to Joint United States (U.S.) forces; begin integration of vision navigation systems into dismounted and mounted PNT systems; And integrate radio frequency ranging and motion characterization algorithms into dismounted PNT system.			
Title: Advanced Intelligent Power Management & Distribution	-	2.000	2.005
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 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. ***FY 2018 Plans:*** Mature, demonstrate and validate advanced renewable, alternative or high fuel-efficiency power systems such as optimizing the performance of a hybrid (generator, plus batteries, plus solar) power trailer as part of a microgrid to improve performance of base power systems while reducing logistics footprint; mature, code and demonstrate optimized software and algorithms to provide power situational awareness to unit commander and staff with the ability to identify faults and errors in power generation and assess timely mission power and energy status; validate predictive-analysis modeling of energy sources, to be used during the planning and execution mission phases, to determine if they are efficient and integrated systems for managing operational			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
power attached to a tactical power grid system; And integrate new hybrid power trailer with Joint and supporting systems (legacy generator based microgrids).			
Accomplishments/Planned Programs Subtotals	14.415	17.997	22.228

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: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
243: *Sensors And Signals Processing*	-	22.243	26.242	29.978	-	29.978	26.229	26.766	27.354	28.190	-	-

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.

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 Communications - Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Collaborative Intelligence, Surveillance and Reconnaissance (ISR) Sensor processing and analytics (formerly titled Collaborative Intelligence, Surveillance and Reconnaissance (ISR) Sensors)	5.426	3.318	3.746
Description: This effort develops software that gathers data from multi-function Airborne ISR sensor sources into a single common operating environment to streamline analysts processing, exploitation and dissemination (PED) workflows. The focus centers on developing scalable software that provides a near real time PED capability on board the platform with applicability at the ground stations and reach back for forensics and pattern analysis. It will increase the utility of moving target indicator (MTI) radar to the greater multi-INT picture for better origin-to-destination tracking, which is crucial to understanding the higher-level threat picture and increases the effectiveness and action-ability of battlespace awareness/intelligence data throughout an area of operations. This effort implements an open architecture extensible throughout the tactical enterprise, allowing for growth to include future ISR sensors. Work being accomplished under PE 0602270/Project 906 complements this effort.			
FY 2016 Accomplishments: Examined methods for enriching meta-data from MTI tracks and developed quality standards for MTI track data that will be used to quantify track confidence and information content; enhanced existing algorithms to improve tracks by correlating data from other sources (SIGINT, full motion video, etc.) with MTI track data; conducted 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; configured necessary interfaces to integrate radar capabilities with EO/IR pre-shot detection sensors;			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
and encoded and matured software to implement the Army Mode 5 Level 2-Broadcast Identify Friend or Foe (IFF) capability, integrated it on existing ground based radar platforms and performed 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. ***FY 2018 Plans:*** Will evaluate, and integrate advanced processing modules and modify/mature existing on platform activity detection algorithms using spatial and temporal correlation of full motion video, electronic warfare (EW), and MTI data that trigger operator and analyst alerts to be executable at ground stationand reachback to operations centers for forensics and pattern analysis; assess fusion algorithms against baseline analyst workflows to document performance improvements; mature and code algorithms for alerting, analytics, time and position correlation and correlation with data collected through EW to enhance existing Distributed Common Ground Station-Army (DCGS-A) program of record capabilities; and begin integration activities to generically align all developed algorithms (i.e., platform, ground station and reachback for use in the PED framework for utilization throughout the tactical enterprise to support distributed fusion.			
Title: Omni-directional Situational Awareness (SA) Airborne radar technologies ***Description:*** This effort matures and demonstrates multi-function SA sensors for small unmanned air systems and other aircraft to improve sensing and detection capabilities in support of wide-area persistent surveillance. ***FY 2016 Accomplishments:*** Matured modeling and simulation (M&S) of subsystem and component level designs for the Ground Moving Target Indicator (GMTI) penetrating radar system; identified standards and interface requirements necessary to facilitate integration into a next generation airborne intelligence, surveillance and reconnaissance platform; matured and analyzed radar modes in synthetic aperture radar and GMTI for optimized utility under anticipated operational conditions; and identified 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	4.344	4.425	4.753

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will complete final subsystem and system level radar hardware and software designs and brassboard demonstrator; analyze radar modes and operations and conduct detailed system design review; perform M&S of the radar's full processing chain; perform laboratory and field assessments of technical performance; and refine human, vehicle, animal and clutter (HVAC) identification techniques and algorithms for feature-aided discrimination and tracking within the integrated radar system.			
Title: Counter-concealment Moving Target Indicator (MTI) Airborne Radar Demonstration ***Description:*** This effort will mature antenna design and signal processing and define the architecture to ensure simplified integration on a Multi-Int platform to deliver an advanced generation of airborne MTI radars. This will allow for third party mode development and exploitation techniques, with emphasis on automated target declaration and tracking. Efforts focus on antenna and signal processing advancements that allow the detection/tracking of targets despite camouflage, concealment and deception and a well-defined systems architecture to cover large areas and persistently scan named areas of interest. This effort leverages work being completed under the Omni-directional SA Airborne radar technologies effort in Fiscal Year (FY) 18. ***FY 2018 Plans:*** Will mature and implement a well-defined system processing architecture; conduct radar system derived requirements review and developmental system preliminary design review; develop detailed specifications and drawings for critical radar components and interfaces, including transmitter, receiver, advanced scalable robust polarimetric synthetic aperture radar (SAR)/MTI antenna, beam former, and processor; and integrate heating, ventilation, and air conditioning (HVAC) discrimination and tracking techniques into the system processor.	-	-	5.355
Title: Advanced All Source Fusion ***Description:*** This effort develops software technologies for intelligence/mission command (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 Program Element (PE) 0602270A/ Project 906 complements this effort. ***FY 2016 Accomplishments:*** Developed integration specifications for a virtualized, automated, full spectrum analytic agent for big data sources; integrated and matured 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; and matured intelligence	4.746	4.055	4.953

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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 enterprise; mature and demonstrate the application programming interfaces necessary for efficient intelligence data integration and alignment with the framework. ***FY 2018 Plans:*** Will integrate Multi-Int tracking, data fusion and analysis software capabilities into the PED framework; mature and demonstrate the architectures' scalability, ability to move data across the enterprise, to include air sensors and platforms, ground stations and the DCGS-A, and cloud/reach-back PED sites, to create an ISR common operational picture (COP) from the distributed fusion process; and develop and evaluate the software interfaces that will provide a "virtual analyst" for collaboration, visualization, alerting and dissemination capabilities across multiple nodes within the enterprise COP.			
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 Accomplishments:*** Developed and matured 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; and developed 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	7.727	7.644	5.967

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
and electronic warfare data) and track unmanned aerial systems and demonstrate capability in a relevant environment during a maneuver and fires integration exercise. ***FY 2018 Plans:*** Will complete an open radar architecture processing environment for algorithm/mode design, and demonstrate capability to implement third party modes (e.g., including multi-mission and electronic protection); design interface definitions and demonstrate integration of radar antenna and processor hardware using the basic counter-fire target acquisition (CTA) mode to assess integration of software at the signal processor level; develop architecture definitions to reduce software dependence on processing hardware (not tied to speed/performance) to increased portability and upgradability; perform advanced radar concept M&S to refine concepts and requirements.			
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 radar integration efforts into a multiple sensor system (i.e., radar, light detection and ranging (LIDAR), electro-optic infrared) DVE demonstrator. ***FY 2018 Plans:*** Will complete integrated software mode development for high resolution SAR, DVE mapping (real beam imaging) and MTI/ dismount detection; complete integration and laboratory/tower assessments and data collection; integrate radar onto surrogate aircraft platform and conduct initial flight testing and data collection; and co-locate radar with additional imaging sensors for integrated sensor data collection.	-	4.800	5.204
Title: Intelligence Processing and Architecture Modernization ***Description:*** This effort will leverage Intelligence Community 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.	-	2.000	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
In FY18 efforts supporting Intelligence Processing and Architecture Modernization are being realigned to PE 0603270A/Project K15 as work within that PE better reflects the nature of the technology being developed under 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.			
Accomplishments/Planned Programs Subtotals	22.243	26.242	29.978

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: FY 2018 Army											Date: May 2017	
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*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	36.339	35.775	33.426	-	33.426	28.795	34.369	38.451	38.321	-	-
EL4: *Tactical Comms and Networking Technology Int*	-	22.319	19.769	17.346	-	17.346	13.343	18.430	20.927	21.397	-	-
EL5: *Secure Tactical Information Integration*	-	14.020	16.006	16.080	-	16.080	15.452	15.939	17.524	16.924	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates technologies to address the integrated tactical communications challenge with distributed, secure, mobile, wireless, and self-organizing communications networks and networked transceivers that must operate reliably in diverse and complex terrains and 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 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 complements 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), PE 0603270A (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 Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	37.816	35.775	36.880	-	36.880
Current President's Budget	36.339	35.775	33.426	-	33.426
Total Adjustments	-1.477	0.000	-3.454	-	-3.454
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.477	-			
• Adjustments to Budget Years	0.000	0.000	-3.500	-	-3.500
• Civ Pay Adjustments	0.000	0.000	0.046	-	0.046

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
EL4: *Tactical Comms and Networking Technology Int*	-	22.319	19.769	17.346	-	17.346	13.343	18.430	20.927	21.397	-	-

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.

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 Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Antenna and Hardware Technologies	3.908	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. In FY18 a majority of these efforts, along with several efforts currently under Communications Networking Technologies, are reported under a new thrust area entitled “Networking to Improve Maneuver and Expeditionary Operations” in order to better focus related and evolving technologies. A few of the efforts herein are reported under another new thrust area entitled “Uninterrupted Communications”.			
FY 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Performed extensive assessments and demonstrated 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; finalized a Government standard architecture for distributed SATCOM arrays to enable interoperability between various transceivers and antenna arrays; and developed and matured 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 ***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. In FY18 this effort is reported under a new thrust area entitled “Networking to Improve Maneuver and Expeditionary Operations” in order to better focus related and evolving technology developments. ***FY 2016 Accomplishments:*** Completed 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; continued 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); and provided 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;	1.320	4.144	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
mature reference architecture for RF hardware/software convergence, addressing distribution of RF components across the vehicle; implement Vehicle Integration for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (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: Enabling C4ISR Infrastructure, (formerly called C4ISR On the Move (OTM))	8.501	7.849	8.631
Description: This effort provides a venue for the demonstration of new and emerging C4ISR technologies. This venue performs field based risk reduction (FBRR) and technology 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 Army S&T, CERDEC Thrust Areas, Army Warfighting Challenges, Training and Doctrine Command (TRADOC) key technology imperatives, and the overall development of the Mission Command Network of 2025 and beyond. ***FY 2016 Accomplishments:*** Assessed and demonstrated 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; applied field based risk reduction techniques to the integration of new S&T technologies as well as adapted/adopted the best industry products to provide rigorously evaluated demonstrator systems for Soldier assessment; assessed new S&T systems and provided 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 provided technical risk reduction to assure that any issues are identified early enough to be corrected before formal testing; and evaluated both Mission Command and Actionable Intelligence S&T products from a performance perspective and validated 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;			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will provide event-driven FBRR demonstrations at Joint Base McGuire-Dix-Lakehurst (JB-MDL), NJ; provide early performance feedback to S&T efforts that require robust tactical networks; 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; conduct several events in a Cyber Blitz campaign of learning, teaming with TRADOC, operational units, Program Executive Officer and Project Manager partners in an operationally relevant setting to inform cyber doctrine and requirements and investment decisions as well as demonstrate the technical and operational value of Army cyber S&T capabilities (e.g., Tactical Public Key Infrastructure, Cyber Electromagnetic Activities Situational Awareness Tactical Analytics Framework Science and Technology Objective, cyber analytics, and cyber framework); conduct an Uninterrupted Communications event (i.e., resilient in a contested and congensted environment), exercising advanced directional networking technologies, communications in a global positioning system (GPS)-denied environment, interference management technologies for integrated electronic warfare/communications systems, and other related technologies; and conduct an integrated Networking to Improve Maneuver/Expeditionary event (i.e. communications technologies that improve capability while on the move), exercising cellular-enabled communications, Intra-Soldier Wireless, and software-defined network technologies at the tactical edge, and other related technologies.			
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 PE 0603794A/Project EL5 complements this effort. In FY18 a majority of these efforts, along with several efforts currently under Antenna and Hardware Technologies, are now reported under a new thrust area entitled “Uninterrupted Communications” in order to better focus related and evolving technologies. A few of the efforts herein are now reported under a new thrust area entitled “Networking to Improve Maneuver and Expeditionary Operations”. ***FY 2016 Accomplishments:*** Investigated and matured 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; continued 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;	5.708	2.781	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
continued to mature and began implementation of suitable routing protocols to increase performance of the network; and developed and matured feasible approaches to enable networking in 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.			
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. In FY18 this effort is reported under a new thrust area entitled “Networking to Improve Maneuver and Expeditionary Operations” in order to better focus related and evolving technologies. ***FY 2016 Accomplishments:*** Completed evaluations of WPAN system designs for performance, reliability and security; finalized specification and architecture development of WPAN hardware interfaces and software; informed WPAN standards for security and interface development; fabricated and coded several candidate WPAN designs; validated WPAN designs for electromagnetic compatibility, low probability of intercept and low probability of detection in the laboratory and RF chamber; and conducted 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.	2.882	1.000	-
Title: Networking to Improve Maneuver and Expeditionary Operations ***Description:*** This effort matures and demonstrates technologies and capabilities to provide a range of robust, reliable, scalable, interoperable and resource efficient communications capabilities to expeditionary forces and troops on the move. These capabilities will allow forces to conduct early entry operations, develop situational understanding, and sustain operations while maintaining freedom of movement. In FY18 this new trust area continues efforts formerly reported under RF Interoperability	-	-	4.054

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
Through Convergence, Networking technologies for WPAN and the majority of efforts formerly reported under Antenna and Hardware Technologies, the remainder of which have moved to the new thrust area Uninterrupted Communications. ***FY 2018 Plans:*** Will complete the design, coding and fabrication of an ISW personal area networking device providing a seamless, wireless capability to the dismounted Soldier in a tactical environment; complete the design for a cellular enabled communications capability that will overcome the current vulnerabilities and limitations of using commercial Long Term Evolution (LTE) cellular technology for tactical operations in an active adversarial RF environment; design a system to enhance the non-SATCOM beyond line of sight (troposcatter) capabilities in terms of expanded RF range, increased data range, robustness, stability, automated antenna alignment and setup; and complete an architecture design for a software defined network (SDN) in support of Army tactical edge networks.			
Title: Uninterrupted Communications ***Description:*** This effort matures and demonstrates components, software, algorithms and technologies that enable Army tactical wireless networks to operate more efficiently in congested, contested and competitive electromagnetic environments across a multi-domain architecture for mission success. The capabilities developed in this effort provide assured uninterrupted access to critical communications and information links. Efforts will result in robust, reliable and secure terrestrial and satellite communication networks in austere, congested and hostile electromagnetic environments using cost-effective solutions while ensuring that the capability is interoperable and resource efficient. Work accomplished under PE 0602782A/Project H92 complements this effort. In FY18 this new trust area continues efforts formerly reported under Communication Networking Technologies and a few of the efforts formerly reported under Antenna and Hardware Technologies, the remainder of which have moved to the new thrust area Networking to Improve Maneuver and Expeditionary Operations. ***FY 2018 Plans:*** Will mature advanced Satellite Communication signal processing techniques and algorithms to provide interference suppression for enterprise and tactical ground terminals; mature techniques to improve tactical radio communications by implementing interference cancellation algorithms to provide electronic protection from enemy and unintentional blue force interference; design and brassboard conformal antenna apertures for directional beamforming and integrate them with signal processing algorithms for beamforming to demonstrate them in a simulation environment; mature and demonstrate reduced size, weight, power and cost directional networking beam switching distributed antenna array and mast mounted antenna with network controller; mature modules and algorithms for Highband Networking Waveform version 3.0; mature and implement protocols and algorithms to improve robustness of LTE cellular based tactical communications systems; mature and implement a next generation robust narrowband waveform that operates in RF congested and contested environments; mature a multi-mission networking waveform framework to enable integrated cooperative communication, electronic warfare, position navigation and timing and signal	-	-	4.661

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
intelligence functionalities; and implement spectrally efficient algorithms with low out-of-band emissions to support dense channel assignments, flexible resource allocation, variable data rate, anti-jam, and low probability of interception and low probability of detection capabilities.			
Accomplishments/Planned Programs Subtotals	22.319	19.769	17.346

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: FY 2018 Army										Date: May 2017		
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
EL5: *Secure Tactical Information Integration*	-	14.020	16.006	16.080	-	16.080	15.452	15.939	17.524	16.924	-	-

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 and cyber electromagnetic activities (CEMA) situational awareness (SA)/situational understanding (SU), 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.

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 Communications Electronics Research Development and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Tactical Defensive Cyber	14.020	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 0602782/Project H92, PE 0602783/Project Y10 and PE 0603794A/Project EL4 complement this effort. Work being accomplished in this effort is fully coordinated with the Army Research Lab Cyber Security Collaborative Research Alliance, PE 0601104A/ Project EA6. In FY18 a majority of these efforts will be organized under a thrust entitled “Cyber /CEMA Operations, Tactical Cyber Resilient Architectures & Platforms” in order to better focus related and evolving technology developments.			
FY 2016 Accomplishments: Integrated and matured 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			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
weapons being employed against United States (U.S.) Military assets, and enable network adaptation to ensure commander intent can be exercised in theater; designed, fabricated, coded and matured 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 (NSA) Crypto Modernization Initiative and the Key Management Infrastructure Program of Record; assessed, developed and matured novel network attack/defense behavior models for tactical radio routing; matured and integrated novel tactical radio cyber behavior sensors to provide cyber situational awareness for military radio networks; performed 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; matured and optimized precision polarization concepts to optimize communications system security by employing multiple communications paths and bandwidth expansion techniques; performed modeling, simulation and emulation of network systems to assess performance in contested environments; and designed and developed 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/CEMA Operations, CEMA Situational Awareness/Understanding (formerly titled Cyber Electromagnetic Activity (CEMA) Situational Awareness (SA)) ***Description:*** This effort matures and demonstrates software and algorithms that facilitate actionable decision making through mission critical CEMA information knowledge and by applying analysis and judgment to relevant information to help determine the relationships among the operational and mission variables across cyberspace. ***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 awareness; mature and optimize Defensive Cyber Operations (DCO) analytic algorithms and software tools to identify and	-	4.000	3.004

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
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. ***FY 2018 Plans:*** Will code and mature secure data transfer algorithms to efficiently move defensive cyber sensor data across tactical networks for incorporation into common data stores; mature and integrate efficient analytic capabilities to tailor analysis for cyber SA visualization; mature correlation algorithms to fuse defensive cyber, spectrum management, offensive cyber, and Department of Defense Information Network (DoDIN) Operations data to enable brigade combat team (BCT) analysts to perform hunt operations for cyber actors in an incident response friendly environment; mature spectrum and DoDIN operations awareness algorithms to support CEMA domain information fusion and course of action development; mature models and algorithms to reason on adversary intent and predict next action; and mature and implement cyber analysis algorithms to improve SA/SU of cyber threats and their impacts to mission success for all CEMA elements (electronic warfare (EW), cyber and spectrum management) and allow actionable decisions and enable self-defending qualities within Army networks that can absorb, deflect, evade, and deceive adversarial cyber actions.			
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 0602782/Project H92 and PE 0602783/Project Y10 complement this effort. In FY18 these efforts will be organized under a thrust entitled “Cyber /CEMA Operations, Trusted Networks” in order to better focus related and evolving technology developments. ***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	-
Title: Cyber /CEMA Operations, Tactical Cyber Resilient Architectures & Platforms ***Description:*** This effort matures and demonstrates software, architectures and frameworks to allow systems and networks to withstand cyber-attacks, sustain or recover critical functions, and dynamically reshape cyber systems as conditions/goals change to escape harm. ***FY 2018 Plans:*** Will mature, integrate and demonstrate virtual containers on blue force networks to protect mission command applications and prevent the spread of malicious cyber effects and block and restrict the spread of malware within tactical mission command applications; mature, code and fabricate a NSA Type 1 certifiable anti-tamper, reprogrammable cryptographic engine with	-	-	9.070

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
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 2016	FY 2017	FY 2018
integrated information security (INFOSEC) functions; mature capabilities to map cyber threats to mission impact to provide traceability between intruder actions and BCT networks, systems, and applications; mature and code algorithms to secure tactical SATCOM against cyber-attacks; mature and integrate tactical radio wide band networking waveform anomalous behavior detection techniques into tactical radio waveforms; mature and integrate anomalous behavior and insider threat detection techniques and algorithms into tactical radio waveforms; design and mature an integrated security architecture that supports convergence across the intelligence, network operations, cyber, electronic warfare operations, fires, and information operations functions within a tactical Command Post; code and mature cyber behavior monitoring algorithms and models for anomalous cyber behavior detection across Soldier Radio Waveform (SRW) and Wideband networking Waveform (WNW) tactical radio networks; and mature a security architecture to support diversity and protection for tactical SATCOM to improve resistance to cyber-attacks.			
Title: Cyber/CEMA Operations, Trusted Self Defending Networks & Systems ***Description:*** This effort matures and demonstrates software, architectures and frameworks to support establishment of a known degree of assurance that devices, networks and cyber dependent functions perform as expected, despite attack or error and allow the Warfighter to maintain confidence in network information, resources, and identities. ***FY 2018 Plans:*** Will mature and demonstrate derived virtual identity token and robust wearable non-intrusive tattooed token (removable tattoo worn on the Soldier's skin) to eliminate physical hardware tokens for secure authentication to tactical networks; mature a tactical identity and access control management capability and techniques supporting both physical and virtual tokens; mature and demonstrate physical and behavioral biometric algorithms to detect and identify malicious insider threat actors and activities; mature robust two factor (i.e. token plus password, password plus biometric, etc.) identity and network access capabilities; mature common tactical public key infrastructure architecture for certificate validation service and token lifecycle management functions (i.e. issue tokens, revoke tokens, reset personal identification number for tokens) and non-person (e.g. computer, router, sensor and etc.) entity lifecycle management capability; and mature data provenance algorithms to track information flows and maintain assured pedigree.	-	-	4.006
Accomplishments/Planned Programs Subtotals	14.020	16.006	16.080

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL5 / *Secure Tactical Information Integration*

E. Performance Metrics

N/A

Intentionally Left Blank