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**Department of Defense
Fiscal Year (FY) 2019 Budget Estimates**

February 2018



Army

Justification Book of

Research, Development, Test & Evaluation, Army

RDT&E – Volume I, Budget Activity 3

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Army • Budget Estimates FY 2019 • RDT&E Program

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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, \$10,484,483,000.00 to remain available for obligation until September 30, 2020.

The following Justification Books were prepared at a cost of \$226,413: Aircraft (ACFT), Missile (MSLS), Weapons & Tracked Combat Vehicles (WTCV), Ammunition (AMMO), Other Procurement Army (OPA) 1 - Tactical & Support Vehicles, Other Procurement Army (OPA) 2 – Communications & Electronics, Other Procurement Army (OPA) 3 & 4 - Other Support Equipment & Spares, Research, Development, Test and Evaluation (RDTE) for: Budget Activity 1, Budget Activity 2, Budget Activity 3, Budget Activity 4, Budget Activity 5A, Budget Activity 5B, Budget Activity 6, and Budget Activity 7.

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 Exhibit R-1 FY 2019 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

18 Jan 2018

<u>Appropriation</u>	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests+ with CR Adj OCO
Research, Development, Test & Eval, Army	8,852,507	8,273,447	8,273,447	342,356	342,356
Total Research, Development, Test & Evaluation	8,852,507	8,273,447	8,273,447	342,356	342,356

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Appropriation	FY 2018	FY 2018	FY 2018	FY 2018	FY 2018	
	Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Remaining Req Emergency	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	Remaining Req with CR Adj Base + OCO + Emergency
Research, Development, Test & Eval, Army	20,700	-20,700		8,636,503	-20,700	8,615,803
Total Research, Development, Test & Evaluation	20,700	-20,700		8,636,503	-20,700	8,615,803

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<u>Appropriation</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Research, Development, Test & Eval, Army	10,159,379	325,104	10,484,483
Total Research, Development, Test & Evaluation	10,159,379	325,104	10,484,483

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	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests* with CR Adj OCO
<u>Summary Recap of Budget Activities</u>					
Basic Research	473,216	430,022	430,022		
Applied Research	1,196,132	889,182	889,182		
Advanced Technology Development	1,351,035	1,070,977	1,070,977		
Advanced Component Development & Prototypes	619,976	890,889	890,889	18,000	18,000
System Development & Demonstration	2,502,560	3,012,840	3,012,840	57,840	57,840
RDT&E Management Support	1,413,481	1,253,845	1,253,845		
Operational Systems Development	1,296,107	1,877,685	1,877,685	43,528	43,528
Undistributed		-1,151,993	-1,151,993	222,988	222,988
Total Research, Development, Test & Evaluation	8,852,507	8,273,447	8,273,447	342,356	342,356
<u>Summary Recap of FYDP Programs</u>					
General Purpose Forces	611,072	710,401	710,401	15,000	15,000
Intelligence and Communications	342,648	370,519	370,519	29,728	29,728
Research and Development	7,826,372	8,215,942	8,215,942	74,640	74,640
Central Supply and Maintenance	59,891	60,877	60,877		
Administration and Associated Activities	7,899	-1,151,993	-1,151,993	222,988	222,988
Space		60,547	60,547		
Classified Programs	4,625	7,154	7,154		
Total Research, Development, Test & Evaluation	8,852,507	8,273,447	8,273,447	342,356	342,356

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	FY 2018 Emergency Requests**	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + Emergency
<u>Summary Recap of Budget Activities</u>						
Basic Research				430,022		430,022
Applied Research				889,182		889,182
Advanced Technology Development	12,000	-12,000		1,082,977	-12,000	1,070,977
Advanced Component Development & Prototypes	8,700	-8,700		917,589	-8,700	908,889
System Development & Demonstration				3,070,680		3,070,680
RDT&E Management Support				1,253,845		1,253,845
Operational Systems Development				1,921,213		1,921,213
Undistributed				-929,005		-929,005
Total Research, Development, Test & Evaluation	20,700	-20,700		8,636,503	-20,700	8,615,803
<u>Summary Recap of FYDP Programs</u>						
General Purpose Forces				725,401		725,401
Intelligence and Communications				400,247		400,247
Research and Development	20,700	-20,700		8,311,282	-20,700	8,290,582
Central Supply and Maintenance				60,877		60,877
Administration and Associated Activities				-929,005		-929,005
Space				60,547		60,547
Classified Programs				7,154		7,154
Total Research, Development, Test & Evaluation	20,700	-20,700		8,636,503	-20,700	8,615,803

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Summary Recap of Budget Activities	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Basic Research	445,895		445,895
Applied Research	919,609		919,609
Advanced Technology Development	1,026,698		1,026,698
Advanced Component Development & Prototypes	1,329,393	28,500	1,357,893
System Development & Demonstration	3,192,689	236,863	3,429,552
RDT&E Management Support	1,322,481		1,322,481
Operational Systems Development	1,922,614	59,741	1,982,355
Undistributed			
Total Research, Development, Test & Evaluation	10,159,379	325,104	10,484,483
 Summary Recap of FYDP Programs			
General Purpose Forces	783,464	10,000	793,464
Intelligence and Communications	313,112	40,613	353,725
Research and Development	8,775,582	274,491	9,050,073
Central Supply and Maintenance	53,958		53,958
Administration and Associated Activities			
Space	227,308		227,308
Classified Programs	5,955		5,955
Total Research, Development, Test & Evaluation	10,159,379	325,104	10,484,483

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	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests+ with CR Adj OCO
<u>Summary Recap of Budget Activities</u>					
Basic Research	473,216	430,022	430,022		
Applied Research	1,196,132	889,182	889,182		
Advanced Technology Development	1,351,035	1,070,977	1,070,977		
Advanced Component Development & Prototypes	619,976	890,889	890,889	18,000	18,000
System Development & Demonstration	2,502,560	3,012,840	3,012,840	57,840	57,840
RDT&E Management Support	1,413,481	1,253,845	1,253,845		
Operational Systems Development	1,296,107	1,877,685	1,877,685	43,528	43,528
Undistributed		-1,151,993	-1,151,993	222,988	222,988
Total Research, Development, Test & Evaluation	8,852,507	8,273,447	8,273,447	342,356	342,356
<u>Summary Recap of FYDP Programs</u>					
General Purpose Forces	611,072	710,401	710,401	15,000	15,000
Intelligence and Communications	342,648	370,519	370,519	29,728	29,728
Research and Development	7,826,372	8,215,942	8,215,942	74,640	74,640
Central Supply and Maintenance	59,891	60,877	60,877		
Administration and Associated Activities	7,899	-1,151,993	-1,151,993	222,988	222,988
Space		60,547	60,547		
Classified Programs	4,625	7,154	7,154		
Total Research, Development, Test & Evaluation	8,852,507	8,273,447	8,273,447	342,356	342,356

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	FY 2018 Emergency Requests** Emergency	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + Emergency
<u>Summary Recap of Budget Activities</u>						
Basic Research				430,022		430,022
Applied Research				889,182		889,182
Advanced Technology Development	12,000	-12,000		1,082,977	-12,000	1,070,977
Advanced Component Development & Prototypes	8,700	-8,700		917,589	-8,700	908,889
System Development & Demonstration				3,070,680		3,070,680
RDT&E Management Support				1,253,845		1,253,845
Operational Systems Development				1,921,213		1,921,213
Undistributed				-929,005		-929,005
Total Research, Development, Test & Evaluation	20,700	-20,700		8,636,503	-20,700	8,615,803
<u>Summary Recap of FYDP Programs</u>						
General Purpose Forces				725,401		725,401
Intelligence and Communications				400,247		400,247
Research and Development	20,700	-20,700		8,311,282	-20,700	8,290,582
Central Supply and Maintenance				60,877		60,877
Administration and Associated Activities				-929,005		-929,005
Space				60,547		60,547
Classified Programs				7,154		7,154
Total Research, Development, Test & Evaluation	20,700	-20,700		8,636,503	-20,700	8,615,803

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Summary Recap of Budget Activities	FY 2019 Base	FY 2019 OCO	FY 2019 Total
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Applied Research	919,609		919,609
Advanced Technology Development	1,026,698		1,026,698
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System Development & Demonstration	3,192,689	236,863	3,429,552
RDT&E Management Support	1,322,481		1,322,481
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Undistributed			
Total Research, Development, Test & Evaluation	10,159,379	325,104	10,484,483
Summary Recap of FYDP Programs			
General Purpose Forces	783,464	10,000	793,464
Intelligence and Communications	313,112	40,613	353,725
Research and Development	8,775,582	274,491	9,050,073
Central Supply and Maintenance	53,958		53,958
Administration and Associated Activities			
Space	227,308		227,308
Classified Programs	5,955		5,955
Total Research, Development, Test & Evaluation	10,159,379	325,104	10,484,483

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

Line No	Program Element Number	Item	Act	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests+ with CR Adj OCO	S e c
1	0601101A	In-House Laboratory Research	01	11,936	12,010	12,010			U
2	0601102A	Defense Research Sciences	01	286,086	263,590	263,590			U
3	0601103A	University Research Initiatives	01	66,506	67,027	67,027			U
4	0601104A	University and Industry Research Centers	01	108,688	87,395	87,395			U
		Basic Research		473,216	430,022	430,022			
5	0602105A	Materials Technology	02	81,950	29,640	29,640			U
6	0602120A	Sensors and Electronic Survivability	02	50,574	35,730	35,730			U
7	0602122A	TRACTOR HIP	02	6,995	8,627	8,627			U
8	0602126A	TRACTOR JACK	02						U
9	0602211A	Aviation Technology	02	67,593	66,086	66,086			U
10	0602270A	Electronic Warfare Technology	02	34,528	27,144	27,144			U
11	0602303A	Missile Technology	02	66,173	43,742	43,742			U
12	0602307A	Advanced Weapons Technology	02	52,766	22,785	22,785			U
13	0602308A	Advanced Concepts and Simulation	02	29,767	28,650	28,650			U
14	0602601A	Combat Vehicle and Automotive Technology	02	89,852	67,232	67,232			U
15	0602618A	Ballistics Technology	02	103,484	85,309	85,309			U
16	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	3,772	4,004	4,004			U
17	0602623A	Joint Service Small Arms Program	02	5,331	5,615	5,615			U

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Line No	Program Element Number	Item	Act	FY 2018 Emergency Requests**	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + Emergency	S
1	0601101A	In-House Laboratory Independent Research	01				12,010		12,010	U
2	0601102A	Defense Research Sciences	01				263,590		263,590	U
3	0601103A	University Research Initiatives	01				67,027		67,027	U
4	0601104A	University and Industry Research Centers	01				87,395		87,395	U
		Basic Research					430,022		430,022	
5	0602105A	Materials Technology	02				29,640		29,640	U
6	0602120A	Sensors and Electronic Survivability	02				35,730		35,730	U
7	0602122A	TRACTOR HIP	02				8,627		8,627	U
8	0602126A	TRACTOR JACK	02							U
9	0602211A	Aviation Technology	02				66,086		66,086	U
10	0602270A	Electronic Warfare Technology	02				27,144		27,144	U
11	0602303A	Missile Technology	02				43,742		43,742	U
12	0602307A	Advanced Weapons Technology	02				22,785		22,785	U
13	0602308A	Advanced Concepts and Simulation	02				28,650		28,650	U
14	0602601A	Combat Vehicle and Automotive Technology	02				67,232		67,232	U
15	0602618A	Ballistics Technology	02				85,309		85,309	U
16	0602622A	Chemical, Smoke and Equipment Defeating Technology	02				4,004		4,004	U
17	0602623A	Joint Service Small Arms Program	02				5,615		5,615	U

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Line No	Program Element Number	Item	Act	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Se
1	0601101A	In-House Laboratory Independent Research	01	11,585		11,585	U
2	0601102A	Defense Research Sciences	01	276,912		276,912	U
3	0601103A	University Research Initiatives	01	65,283		65,283	U
4	0601104A	University and Industry Research Centers	01	92,115		92,115	U
		Basic Research		445,895		445,895	
5	0602105A	Materials Technology	02	28,600		28,600	U
6	0602120A	Sensors and Electronic Survivability	02	32,366		32,366	U
7	0602122A	TRACTOR HIP	02	8,674		8,674	U
8	0602126A	TRACTOR JACK	02	400		400	U
9	0602211A	Aviation Technology	02	64,847		64,847	U
10	0602270A	Electronic Warfare Technology	02	25,571		25,571	U
11	0602303A	Missile Technology	02	50,183		50,183	U
12	0602307A	Advanced Weapons Technology	02	29,502		29,502	U
13	0602308A	Advanced Concepts and Simulation	02	28,500		28,500	U
14	0602601A	Combat Vehicle and Automotive Technology	02	70,450		70,450	U
15	0602618A	Ballistics Technology	02	75,541		75,541	U
16	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	5,032		5,032	U
17	0602623A	Joint Service Small Arms Program	02	12,394		12,394	U

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Line No	Program Element Number	Item	Act	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests* with CR Adj OCO	S e c
18	0602624A	Weapons and Munitions Technology	02	118,068	41,455	41,455			U
19	0602705A	Electronics and Electronic Devices	02	72,979	58,352	58,352			U
20	0602709A	Night Vision Technology	02	34,762	34,723	34,723			U
21	0602712A	Countermines Systems	02	29,495	26,190	26,190			U
22	0602716A	Human Factors Engineering Technology	02	23,359	24,127	24,127			U
23	0602720A	Environmental Quality Technology	02	21,553	21,678	21,678			U
24	0602782A	Command, Control, Communications Technology	02	36,396	33,123	33,123			U
25	0602783A	Computer and Software Technology	02	13,452	14,041	14,041			U
26	0602784A	Military Engineering Technology	02	92,140	67,720	67,720			U
27	0602785A	Manpower/Personnel/Training Technology	02	23,475	20,216	20,216			U
28	0602786A	Warfighter Technology	02	59,327	39,559	39,559			U
29	0602787A	Medical Technology	02	78,341	83,434	83,434			U
		Applied Research		1,196,132	889,182	889,182			
30	0603001A	Warfighter Advanced Technology	03	50,004	44,863	44,863			U
31	0603002A	Medical Advanced Technology	03	106,040	67,780	67,780			U
32	0603003A	Aviation Advanced Technology	03	111,654	160,746	160,746			U
33	0603004A	Weapons and Munitions Advanced Technology	03	198,245	84,079	84,079			U
34	0603005A	Combat Vehicle and Automotive Advanced Technology	03	163,501	125,537	125,537			U

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Line No	Program Element Number	Item	Act	FY 2018 Emergency Requests**	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + Emergency	S
18	0602624A	Weapons and Munitions Technology	02				41,455		41,455	U
19	0602705A	Electronics and Electronic Devices	02				58,352		58,352	U
20	0602709A	Night Vision Technology	02				34,723		34,723	U
21	0602712A	Countermine Systems	02				26,190		26,190	U
22	0602716A	Human Factors Engineering Technology	02				24,127		24,127	U
23	0602720A	Environmental Quality Technology	02				21,678		21,678	U
24	0602782A	Command, Control, Communications Technology	02				33,123		33,123	U
25	0602783A	Computer and Software Technology	02				14,041		14,041	U
26	0602784A	Military Engineering Technology	02				67,720		67,720	U
27	0602785A	Manpower/Personnel/Training Technology	02				20,216		20,216	U
28	0602786A	Warfighter Technology	02				39,559		39,559	U
29	0602787A	Medical Technology	02				83,434		83,434	U
	Applied Research						889,182		889,182	
30	0603001A	Warfighter Advanced Technology	03				44,863		44,863	U
31	0603002A	Medical Advanced Technology	03				67,780		67,780	U
32	0603003A	Aviation Advanced Technology	03				160,746		160,746	U
33	0603004A	Weapons and Munitions Advanced Technology	03				84,079		84,079	U
34	0603005A	Combat Vehicle and Automotive Advanced Technology	03				125,537		125,537	U

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

Line No	Program Element Number	Item	Act	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Se c
18	0602624A	Weapons and Munitions Technology	02	40,444		40,444	U
19	0602705A	Electronics and Electronic Devices	02	58,283		58,283	U
20	0602709A	Night Vision Technology	02	29,582		29,582	U
21	0602712A	Countermine Systems	02	21,244		21,244	U
22	0602716A	Human Factors Engineering Technology	02	24,131		24,131	U
23	0602720A	Environmental Quality Technology	02	13,242		13,242	U
24	0602782A	Command, Control, Communications Technology	02	55,003		55,003	U
25	0602783A	Computer and Software Technology	02	14,958		14,958	U
26	0602784A	Military Engineering Technology	02	78,159		78,159	U
27	0602785A	Manpower/Personnel/Training Technology	02	21,862		21,862	U
28	0602786A	Warfighter Technology	02	40,566		40,566	U
29	0602787A	Medical Technology	02	90,075		90,075	U
		Applied Research		919,609		919,609	
30	0603001A	Warfighter Advanced Technology	03	39,338		39,338	U
31	0603002A	Medical Advanced Technology	03	62,496		62,496	U
32	0603003A	Aviation Advanced Technology	03	124,958		124,958	U
33	0603004A	Weapons and Munitions Advanced Technology	03	102,686		102,686	U
34	0603005A	Combat Vehicle and Automotive Advanced Technology	03	119,739		119,739	U

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35	0603006A	Space Application Advanced Technology	03	3,787	12,231	12,231			U
36	0603007A	Manpower, Personnel and Training Advanced Technology	03	12,110	6,466	6,466			U
37	0603009A	TRACTOR HIKE	03	21,374	28,552	28,552			U
38	0603015A	Next Generation Training & Simulation Systems	03	18,238	16,434	16,434			U
39	0603020A	TRACTOR ROSE	03	11,910					U
40	0603125A	Combating Terrorism - Technology Development	03	33,553	26,903	26,903			U
41	0603130A	TRACTOR NAIL	03	2,340	4,880	4,880			U
42	0603131A	TRACTOR EGGS	03	2,470	4,326	4,326			U
43	0603270A	Electronic Warfare Technology	03	40,819	31,296	31,296			U
44	0603313A	Missile and Rocket Advanced Technology	03	113,683	62,850	62,850			U
45	0603322A	TRACTOR CAGE	03	11,107	12,323	12,323			U
46	0603461A	High Performance Computing Modernization Program	03	215,462	182,331	182,331			U
47	0603606A	Landmine Warfare and Barrier Advanced Technology	03	16,798	17,948	17,948			U
48	0603607A	Joint Service Small Arms Program	03	5,615	5,796	5,796			U
49	0603710A	Night Vision Advanced Technology	03	42,798	47,135	47,135			U
50	0603728A	Environmental Quality Technology Demonstrations	03	21,415	10,421	10,421			U

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35	0603006A	Space Application Advanced Technology	03				12,231		12,231	U
36	0603007A	Manpower, Personnel and Training Advanced Technology	03				6,466		6,466	U
37	0603009A	TRACTOR HIKE	03	12,000	-12,000		40,552	-12,000	28,552	U
38	0603015A	Next Generation Training & Simulation Systems	03				16,434		16,434	U
39	0603020A	TRACTOR ROSE	03							U
40	0603125A	Combating Terrorism - Technology Development	03				26,903		26,903	U
41	0603130A	TRACTOR NAIL	03				4,880		4,880	U
42	0603131A	TRACTOR EGGS	03				4,326		4,326	U
43	0603270A	Electronic Warfare Technology	03				31,296		31,296	U
44	0603313A	Missile and Rocket Advanced Technology	03				62,850		62,850	U
45	0603322A	TRACTOR CAGE	03				12,323		12,323	U
46	0603461A	High Performance Computing Modernization Program	03				182,331		182,331	U
47	0603606A	Landmine Warfare and Barrier Advanced Technology	03				17,948		17,948	U
48	0603607A	Joint Service Small Arms Program	03				5,796		5,796	U
49	0603710A	Night Vision Advanced Technology	03				47,135		47,135	U
50	0603728A	Environmental Quality Technology Demonstrations	03				10,421		10,421	U

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35	0603006A	Space Application Advanced Technology	03	13,000		13,000	U
36	0603007A	Manpower, Personnel and Training Advanced Technology	03	8,044		8,044	U
37	0603009A	TRACTOR HIKE	03	22,631		22,631	U
38	0603015A	Next Generation Training & Simulation Systems	03	25,682		25,682	U
39	0603020A	TRACTOR ROSE	03				U
40	0603125A	Combating Terrorism - Technology Development	03	3,762		3,762	U
41	0603130A	TRACTOR NAIL	03	4,896		4,896	U
42	0603131A	TRACTOR EGGS	03	6,041		6,041	U
43	0603270A	Electronic Warfare Technology	03	31,491		31,491	U
44	0603313A	Missile and Rocket Advanced Technology	03	61,132		61,132	U
45	0603322A	TRACTOR CAGE	03	16,845		16,845	U
46	0603461A	High Performance Computing Modernization Program	03	183,322		183,322	U
47	0603606A	Landmine Warfare and Barrier Advanced Technology	03	11,104		11,104	U
48	0603607A	Joint Service Small Arms Program	03	5,885		5,885	U
49	0603710A	Night Vision Advanced Technology	03	61,376		61,376	U
50	0603728A	Environmental Quality Technology Demonstrations	03	9,136		9,136	U

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51	0603734A	Military Engineering Advanced Technology	03	59,101	32,448	32,448			U
52	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	52,572	52,206	52,206			U
53	0603794A	C3 Advanced Technology	03	36,439	33,426	33,426			U
		Advanced Technology Development		1,351,035	1,070,977	1,070,977			
54	0603305A	Army Missile Defense Systems Integration	04	39,395	9,634	9,634			U
55	0603308A	Army Space Systems Integration	04	32,278					U
56	0603327A	Air and Missile Defense Systems Engineering	04	6,100	33,949	33,949	15,000	15,000	U
57	0603619A	Landmine Warfare and Barrier - Adv Dev	04	65,062	72,909	72,909			U
58	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	43,177	7,135	7,135			U
59	0603639A	Tank and Medium Caliber Ammunition	04	47,745	41,452	41,452			U
60	0603645A	Armored System Modernization - Adv Dev	04		32,739	32,739			U
61	0603747A	Soldier Support and Survivability	04	13,607	10,157	10,157	3,000	3,000	U
62	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	15,730	27,733	27,733			U
63	0603774A	Night Vision Systems Advanced Development	04	9,930	12,347	12,347			U
64	0603779A	Environmental Quality Technology - Dem/Val	04	7,480	10,456	10,456			U

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				Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Remaining Req	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs		Remaining Req with CR Adj Base + OCO + Emergency
51	0603734A	Military Engineering Advanced Technology	03				32,448		32,448	U
52	0603772A	Advanced Tactical Computer Science and Sensor Technology	03				52,206		52,206	U
53	0603794A	C3 Advanced Technology	03				33,426		33,426	U
		Advanced Technology Development		12,000	-12,000		1,082,977	-12,000	1,070,977	
54	0603305A	Army Missile Defense Systems Integration	04				9,634		9,634	U
55	0603308A	Army Space Systems Integration	04							U
56	0603327A	Air and Missile Defense Systems Engineering	04	8,700	-8,700		57,649	-8,700	48,949	U
57	0603619A	Landmine Warfare and Barrier - Adv Dev	04				72,909		72,909	U
58	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04				7,135		7,135	U
59	0603639A	Tank and Medium Caliber Ammunition	04				41,452		41,452	U
60	0603645A	Armored System Modernization - Adv Dev	04				32,739		32,739	U
61	0603747A	Soldier Support and Survivability	04				13,157		13,157	U
62	0603766A	Tactical Electronic Surveillance System - Adv Dev	04				27,733		27,733	U
63	0603774A	Night Vision Systems Advanced Development	04				12,347		12,347	U
64	0603779A	Environmental Quality Technology - Dem/Val	04				10,456		10,456	U

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51	0603734A	Military Engineering Advanced Technology	03	25,864		25,864	U
52	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	34,883		34,883	U
53	0603794A	C3 Advanced Technology	03	52,387		52,387	U
		Advanced Technology Development		1,026,698		1,026,698	
54	0603305A	Army Missile Defense Systems Integration	04	10,777		10,777	U
55	0603308A	Army Space Systems Integration	04				U
56	0603327A	Air and Missile Defense Systems Engineering	04	42,802	1,000	43,802	U
57	0603619A	Landmine Warfare and Barrier - Adv Dev	04	45,254		45,254	U
58	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	22,700	1,500	24,200	U
59	0603639A	Tank and Medium Caliber Ammunition	04	41,974		41,974	U
60	0603645A	Armored System Modernization - Adv Dev	04	119,395		119,395	U
61	0603747A	Soldier Support and Survivability	04	8,746	3,000	11,746	U
62	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	35,667		35,667	U
63	0603774A	Night Vision Systems Advanced Development	04	7,350		7,350	U
64	0603779A	Environmental Quality Technology - Dem/Val	04	14,749		14,749	U

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65	0603790A	NATO Research and Development	04	2,211	2,588	2,588			U
66	0603801A	Aviation - Adv Dev	04	7,702	14,055	14,055			U
67	0603804A	Logistics and Engineer Equipment - Adv Dev	04	17,445	35,333	35,333			U
68	0603807A	Medical Systems - Adv Dev	04	47,336	33,491	33,491			U
69	0603827A	Soldier Systems - Advanced Development	04	54,497	20,239	20,239			U
70	0604017A	Robotics Development	04		39,608	39,608			U
71	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04						U
72	0604100A	Analysis Of Alternatives	04	6,354	9,921	9,921			U
73	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04						U
74	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	33,780	76,728	76,728			U
75	0604115A	Technology Maturation Initiatives	04	57,737	115,221	115,221			U
76	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04		20,000	20,000			U
77	0604118A	TRACTOR BEAM	04		10,400	10,400			U
78	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	83,074	164,967	164,967			U
79	0604121A	Synthetic Training Environment Refinement & Prototyping	04		1,600	1,600			U

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65	0603790A	NATO Research and Development	04				2,588		2,588	U
66	0603801A	Aviation - Adv Dev	04				14,055		14,055	U
67	0603804A	Logistics and Engineer Equipment - Adv Dev	04				35,333		35,333	U
68	0603807A	Medical Systems - Adv Dev	04				33,491		33,491	U
69	0603827A	Soldier Systems - Advanced Development	04				20,239		20,239	U
70	0604017A	Robotics Development	04				39,608		39,608	U
71	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04							U
72	0604100A	Analysis Of Alternatives	04				9,921		9,921	U
73	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04							U
74	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04				76,728		76,728	U
75	0604115A	Technology Maturation Initiatives	04				115,221		115,221	U
76	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04				20,000		20,000	U
77	0604118A	TRACTOR BEAM	04				10,400		10,400	U
78	0604120A	Assured Positioning, Navigation and Timing (PNT)	04				164,967		164,967	U
79	0604121A	Synthetic Training Environment Refinement & Prototyping	04				1,600		1,600	U

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65	0603790A	NATO Research and Development	04	3,687		3,687	U
66	0603801A	Aviation - Adv Dev	04	10,793		10,793	U
67	0603804A	Logistics and Engineer Equipment - Adv Dev	04	14,248		14,248	U
68	0603807A	Medical Systems - Adv Dev	04	34,284		34,284	U
69	0603827A	Soldier Systems - Advanced Development	04	18,044		18,044	U
70	0604017A	Robotics Development	04	95,660		95,660	U
71	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04	38,000		38,000	U
72	0604100A	Analysis Of Alternatives	04	9,765		9,765	U
73	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04	12,393		12,393	U
74	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	120,374		120,374	U
75	0604115A	Technology Maturation Initiatives	04	95,347		95,347	U
76	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04	95,085	23,000	118,085	U
77	0604118A	TRACTOR BEAM	04	52,894		52,894	U
78	0604120A	Assured Positioning, Navigation and Timing (PNT)	04				U
79	0604121A	Synthetic Training Environment Refinement & Prototyping	04	77,939		77,939	U

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80	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04		11,303	11,303			U
81	0305251A	Cyberspace Operations Forces and Force Support	04	29,336	56,492	56,492			U
82	1206120A	Assured Positioning, Navigation and Timing (PNT)	04						U
83	1206308A	Army Space Systems Integration	04		20,432	20,432			U
		Advanced Component Development & Prototypes		619,976	890,889	890,889	18,000	18,000	
84	0604201A	Aircraft Avionics	05	54,915	30,153	30,153			U
85	0604270A	Electronic Warfare Development	05	33,419	71,671	71,671			U
86	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	9,363	10,589	10,589			U
87	0604321A	All Source Analysis System	05	11,958	4,774	4,774			U
88	0604328A	TRACTOR CAGE	05	12,525	17,252	17,252			U
89	0604601A	Infantry Support Weapons	05	63,842	87,643	87,643			U
90	0604604A	Medium Tactical Vehicles	05		6,039	6,039			U
91	0604611A	JAVELIN	05	19,241	21,095	21,095			U
92	0604622A	Family of Heavy Tactical Vehicles	05	10,989	10,507	10,507			U
93	0604633A	Air Traffic Control	05	3,326	3,536	3,536			U
94	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	32,315					U
95	0604642A	Light Tactical Wheeled Vehicles	05	476	7,000	7,000			U

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				Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Remaining Req Emergency	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs		Remaining Req with CR Adj Base + OCO + Emergency
80	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04				11,303		11,303	U
81	0305251A	Cyberspace Operations Forces and Force Support	04				56,492		56,492	U
82	1206120A	Assured Positioning, Navigation and Timing (PNT)	04							U
83	1206308A	Army Space Systems Integration	04				20,432		20,432	U
	Advanced Component Development & Prototypes			8,700	-8,700		917,589	-8,700	908,889	
84	0604201A	Aircraft Avionics	05				30,153		30,153	U
85	0604270A	Electronic Warfare Development	05				71,671		71,671	U
86	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05				10,589		10,589	U
87	0604321A	All Source Analysis System	05				4,774		4,774	U
88	0604328A	TRACTOR CAGE	05				17,252		17,252	U
89	0604601A	Infantry Support Weapons	05				87,643		87,643	U
90	0604604A	Medium Tactical Vehicles	05				6,039		6,039	U
91	0604611A	JAVELIN	05				21,095		21,095	U
92	0604622A	Family of Heavy Tactical Vehicles	05				10,507		10,507	U
93	0604633A	Air Traffic Control	05				3,536		3,536	U
94	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05							U
95	0604642A	Light Tactical Wheeled Vehicles	05				7,000		7,000	U

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80	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	51,030		51,030	U
81	0305251A	Cyberspace Operations Forces and Force Support	04	65,817		65,817	U
82	1206120A	Assured Positioning, Navigation and Timing (PNT)	04	146,300		146,300	U
83	1206308A	Army Space Systems Integration	04	38,319		38,319	U
		Advanced Component Development & Prototypes		1,329,393	28,500	1,357,893	
84	0604201A	Aircraft Avionics	05	32,293		32,293	U
85	0604270A	Electronic Warfare Development	05	78,699		78,699	U
86	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05				U
87	0604321A	All Source Analysis System	05				U
88	0604328A	TRACTOR CAGE	05	17,050	12,000	29,050	U
89	0604601A	Infantry Support Weapons	05	83,155		83,155	U
90	0604604A	Medium Tactical Vehicles	05	3,704		3,704	U
91	0604611A	JAVELIN	05	10,623		10,623	U
92	0604622A	Family of Heavy Tactical Vehicles	05	11,950		11,950	U
93	0604633A	Air Traffic Control	05	12,347		12,347	U
94	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05				U
95	0604642A	Light Tactical Wheeled Vehicles	05	8,212		8,212	U

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Line No	Program Element Number	Item	Act	FY 2017 (Base + OCO)	FY 2018 PB Request with CR Adj Base	FY 2018 Total PB Requests* with CR Adj Base	FY 2018 PB Request with CR Adj OCO	FY 2018 Total PB Requests+ with CR Adj OCO	S e c
96	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05	9,306	36,242	36,242			U
97	0604710A	Night Vision Systems - Eng Dev	05	76,491	108,504	108,504			U
98	0604713A	Combat Feeding, Clothing, and Equipment	05	1,975	3,702	3,702			U
99	0604715A	Non-System Training Devices - Eng Dev	05	33,888	43,575	43,575			U
100	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	200,205	28,726	28,726			U
101	0604742A	Constructive Simulation Systems Development	05	17,363	18,562	18,562			U
102	0604746A	Automatic Test Equipment Development	05	8,503	8,344	8,344			U
103	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	10,150	11,270	11,270			U
104	0604768A	Brilliant Anti-Armor Submunition (BAT)	05		10,000	10,000			U
105	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	14,538	18,566	18,566			U
106	0604798A	Brigade Analysis, Integration and Evaluation	05	101,927	145,360	145,360			U
107	0604802A	Weapons and Munitions - Eng Dev	05	75,845	145,232	145,232			U
108	0604804A	Logistics and Engineer Equipment - Eng Dev	05	76,374	90,965	90,965			U
109	0604805A	Command, Control, Communications Systems - Eng Dev	05	4,166	9,910	9,910			U

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Line No	Program Element Number	Item	Act	FY 2018 Emergency Requests**	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + e Emergency	S c
96	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05				36,242		36,242	U
97	0604710A	Night Vision Systems - Eng Dev	05				108,504		108,504	U
98	0604713A	Combat Feeding, Clothing, and Equipment	05				3,702		3,702	U
99	0604715A	Non-System Training Devices - Eng Dev	05				43,575		43,575	U
100	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05				28,726		28,726	U
101	0604742A	Constructive Simulation Systems Development	05				18,562		18,562	U
102	0604746A	Automatic Test Equipment Development	05				8,344		8,344	U
103	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05				11,270		11,270	U
104	0604768A	Brilliant Anti-Armor Submunition (BAT)	05				10,000		10,000	U
105	0604780A	Combined Arms Tactical Trainer (CATT) Core	05				18,566		18,566	U
106	0604798A	Brigade Analysis, Integration and Evaluation	05				145,360		145,360	U
107	0604802A	Weapons and Munitions - Eng Dev	05				145,232		145,232	U
108	0604804A	Logistics and Engineer Equipment - Eng Dev	05				90,965		90,965	U
109	0604805A	Command, Control, Communications Systems - Eng Dev	05				9,910		9,910	U

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96	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05	393,613		393,613	U
97	0604710A	Night Vision Systems - Eng Dev	05	139,614		139,614	U
98	0604713A	Combat Feeding, Clothing, and Equipment	05	4,507		4,507	U
99	0604715A	Non-System Training Devices - Eng Dev	05	49,436		49,436	U
100	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	95,172	119,300	214,472	U
101	0604742A	Constructive Simulation Systems Development	05	22,628		22,628	U
102	0604746A	Automatic Test Equipment Development	05	13,297		13,297	U
103	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	9,145		9,145	U
104	0604768A	Brilliant Anti-Armor Submunition (BAT)	05	9,894		9,894	U
105	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	21,964		21,964	U
106	0604798A	Brigade Analysis, Integration and Evaluation	05	49,288		49,288	U
107	0604802A	Weapons and Munitions - Eng Dev	05	183,100		183,100	U
108	0604804A	Logistics and Engineer Equipment - Eng Dev	05	79,706		79,706	U
109	0604805A	Command, Control, Communications Systems - Eng Dev	05	15,970		15,970	U

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110	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	36,237	39,238	39,238			U
111	0604808A	Landmine Warfare/Barrier - Eng Dev	05	32,069	34,684	34,684			U
112	0604818A	Army Tactical Command & Control Hardware & Software	05	169,375	164,409	164,409			U
113	0604820A	Radar Development	05	15,368	32,968	32,968			U
114	0604822A	General Fund Enterprise Business System (GFEBs)	05	11,044	49,554	49,554			U
115	0604823A	Firefinder	05	6,177	45,605	45,605			U
116	0604827A	Soldier Systems - Warrior Dem/Val	05	11,929	16,127	16,127			U
117	0604852A	Suite of Survivability Enhancement Systems - EMD	05		98,600	98,600			U
118	0604854A	Artillery Systems - EMD	05	1,689	1,972	1,972			U
119	0605013A	Information Technology Development	05	70,104	81,776	81,776			U
120	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	149,597	172,361	172,361			U
121	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	177,133	199,778	199,778			U
122	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05	4,789	4,418	4,418			U
123	0605030A	Joint Tactical Network Center (JTNC)	05	14,463	15,877	15,877			U
124	0605031A	Joint Tactical Network (JTN)	05	16,430	44,150	44,150			U
125	0605032A	TRACTOR TIRE	05	27,254	34,670	34,670	5,000	5,000	U

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				Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Remaining Req	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs		Remaining Req with CR Adj Base + OCO + Emergency
110	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05				39,238		39,238	U
111	0604808A	Landmine Warfare/Barrier - Eng Dev	05				34,684		34,684	U
112	0604818A	Army Tactical Command & Control Hardware & Software	05				164,409		164,409	U
113	0604820A	Radar Development	05				32,968		32,968	U
114	0604822A	General Fund Enterprise Business System (GFEBS)	05				49,554		49,554	U
115	0604823A	Firefinder	05				45,605		45,605	U
116	0604827A	Soldier Systems - Warrior Dem/Val	05				16,127		16,127	U
117	0604852A	Suite of Survivability Enhancement Systems - EMD	05				98,600		98,600	U
118	0604854A	Artillery Systems - EMD	05				1,972		1,972	U
119	0605013A	Information Technology Development	05				81,776		81,776	U
120	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05				172,361		172,361	U
121	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05				199,778		199,778	U
122	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05				4,418		4,418	U
123	0605030A	Joint Tactical Network Center (JTNC)	05				15,877		15,877	U
124	0605031A	Joint Tactical Network (JTN)	05				44,150		44,150	U
125	0605032A	TRACTOR TIRE	05				39,670		39,670	U

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110	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	44,542		44,542	U
111	0604808A	Landmine Warfare/Barrier - Eng Dev	05	50,817		50,817	U
112	0604818A	Army Tactical Command & Control Hardware & Software	05	178,693		178,693	U
113	0604820A	Radar Development	05	39,338		39,338	U
114	0604822A	General Fund Enterprise Business System (GFEBs)	05	37,851		37,851	U
115	0604823A	Firefinder	05	45,473		45,473	U
116	0604827A	Soldier Systems - Warrior Dem/Val	05	10,395		10,395	U
117	0604852A	Suite of Survivability Enhancement Systems - EMD	05	69,204		69,204	U
118	0604854A	Artillery Systems - EMD	05	1,781		1,781	U
119	0605013A	Information Technology Development	05	113,758		113,758	U
120	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	166,603		166,603	U
121	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	118,239		118,239	U
122	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05	3,211		3,211	U
123	0605030A	Joint Tactical Network Center (JTNC)	05	15,889		15,889	U
124	0605031A	Joint Tactical Network (JTN)	05	41,972		41,972	U
125	0605032A	TRACTOR TIRE	05	41,166	66,760	107,926	U

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126	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05	4,838	5,207	5,207			U
127	0605034A	Tactical Security System (TSS)	05	2,792	4,727	4,727			U
128	0605035A	Common Infrared Countermeasures (CIRCM)	05	90,685	105,778	105,778	21,540	21,540	U
129	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	2,008	6,927	6,927			U
130	0605037A	Evidence Collection and Detainee Processing	05		214	214			U
131	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05		16,125	16,125			U
132	0605041A	Defensive CYBER Tool Development	05	32,535	55,165	55,165			U
133	0605042A	Tactical Network Radio Systems (Low-Tier)	05	14,198	20,076	20,076			U
134	0605047A	Contract Writing System	05	19,868	20,322	20,322			U
135	0605049A	Missile Warning System Modernization (MWSM)	05		55,810	55,810			U
136	0605051A	Aircraft Survivability Development	05	121,530	30,879	30,879	30,100	30,100	U
137	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	80,781	175,069	175,069			U
138	0605053A	Ground Robotics	05		70,760	70,760			U
139	0605054A	Emerging Technology Initiatives	05						U

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				Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Remaining Req Emergency	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	
126	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05				5,207	5,207	U
127	0605034A	Tactical Security System (TSS)	05				4,727	4,727	U
128	0605035A	Common Infrared Countermeasures (CIRCM)	05				127,318	127,318	U
129	0605036A	Combating Weapons of Mass Destruction (CWMD)	05				6,927	6,927	U
130	0605037A	Evidence Collection and Detainee Processing	05				214	214	U
131	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05				16,125	16,125	U
132	0605041A	Defensive CYBER Tool Development	05				55,165	55,165	U
133	0605042A	Tactical Network Radio Systems (Low-Tier)	05				20,076	20,076	U
134	0605047A	Contract Writing System	05				20,322	20,322	U
135	0605049A	Missile Warning System Modernization (MWSM)	05				55,810	55,810	U
136	0605051A	Aircraft Survivability Development	05				60,979	60,979	U
137	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05				175,069	175,069	U
138	0605053A	Ground Robotics	05				70,760	70,760	U
139	0605054A	Emerging Technology Initiatives	05						U

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126	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05	5,175		5,175	U
127	0605034A	Tactical Security System (TSS)	05	4,496		4,496	U
128	0605035A	Common Infrared Countermeasures (CIRCM)	05	51,178	2,670	53,848	U
129	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	11,311		11,311	U
130	0605037A	Evidence Collection and Detainee Processing	05				U
131	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05	17,154		17,154	U
132	0605041A	Defensive CYBER Tool Development	05	36,626		36,626	U
133	0605042A	Tactical Network Radio Systems (Low-Tier)	05	3,829		3,829	U
134	0605047A	Contract Writing System	05	41,928		41,928	U
135	0605049A	Missile Warning System Modernization (MWSM)	05	28,276		28,276	U
136	0605051A	Aircraft Survivability Development	05	21,965	34,933	56,898	U
137	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	157,710		157,710	U
138	0605053A	Ground Robotics	05	86,167		86,167	U
139	0605054A	Emerging Technology Initiatives	05	42,866		42,866	U

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140	0605380A	AMF Joint Tactical Radio System (JTRS)	05	4,088	8,965	8,965			U
141	0605450A	Joint Air-to-Ground Missile (JAGM)	05	47,446	34,626	34,626			U
142	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	273,240	336,420	336,420			U
143	0605766A	National Capabilities Integration (MIP)	05	4,955	6,882	6,882			U
144	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	11,086	23,467	23,467			U
145	0605830A	Aviation Ground Support Equipment	05	2,060	6,930	6,930			U
146	0210609A	Paladin Integrated Management (PIM)	05	39,902	6,112	6,112			U
147	0303032A	TROJAN - RH12	05	4,273	4,431	4,431	1,200	1,200	U
148	0303267A	Auctioned Spectrum Relocation Fund	05	34,967					U
149	0303367A	Spectrum Access Research and Development	05	66,125					U
150	0304270A	Electronic Warfare Development	05	18,425	14,616	14,616			U
151	1205117A	Tractor Bears	05		17,928	17,928			U
		System Development & Demonstration		2,502,560	3,012,840	3,012,840	57,840	57,840	
152	0604256A	Threat Simulator Development	06	28,883	22,862	22,862			U
153	0604258A	Target Systems Development	06	18,518	13,902	13,902			U
154	0604759A	Major T&E Investment	06	93,668	102,901	102,901			U
155	0605103A	Rand Arroyo Center	06	19,863	20,140	20,140			U

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				Emergency Requests**	Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	Emergency	Total PB Requests* with CR Adj Base + OCO + Emergency**	Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs		Remaining Req with CR Adj Base + OCO + Emergency
140	0605380A	AMF Joint Tactical Radio System (JTRS)	05				8,965		8,965	U
141	0605450A	Joint Air-to-Ground Missile (JAGM)	05				34,626		34,626	U
142	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05				336,420		336,420	U
143	0605766A	National Capabilities Integration (MIP)	05				6,882		6,882	U
144	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05				23,467		23,467	U
145	0605830A	Aviation Ground Support Equipment	05				6,930		6,930	U
146	0210609A	Paladin Integrated Management (PIM)	05				6,112		6,112	U
147	0303032A	TROJAN - RH12	05				5,631		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				14,616		14,616	U
151	1205117A	Tractor Bears	05				17,928		17,928	U
		System Development & Demonstration					3,070,680		3,070,680	
152	0604256A	Threat Simulator Development	06				22,862		22,862	U
153	0604258A	Target Systems Development	06				13,902		13,902	U
154	0604759A	Major T&E Investment	06				102,901		102,901	U
155	0605103A	Rand Arroyo Center	06				20,140		20,140	U

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140	0605380A	AMF Joint Tactical Radio System (JTRS)	05	15,984		15,984	U
141	0605450A	Joint Air-to-Ground Missile (JAGM)	05	11,773		11,773	U
142	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	277,607		277,607	U
143	0605766A	National Capabilities Integration (MIP)	05	12,340		12,340	U
144	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	2,686		2,686	U
145	0605830A	Aviation Ground Support Equipment	05	2,706		2,706	U
146	0210609A	Paladin Integrated Management (PIM)	05				U
147	0303032A	TROJAN - RH12	05	4,521	1,200	5,721	U
148	0303267A	Auctioned Spectrum Relocation Fund	05				U
149	0303367A	Spectrum Access Research and Development	05				U
150	0304270A	Electronic Warfare Development	05	8,922		8,922	U
151	1205117A	Tractor Bears	05	23,170		23,170	U
		System Development & Demonstration		3,192,689	236,863	3,429,552	
152	0604256A	Threat Simulator Development	06	12,835		12,835	U
153	0604258A	Target Systems Development	06	12,135		12,135	U
154	0604759A	Major T&E Investment	06	82,996		82,996	U
155	0605103A	Rand Arroyo Center	06	19,821		19,821	U

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156	0605301A	Army Kwajalein Atoll	06	219,271	246,663	246,663			U
157	0605326A	Concepts Experimentation Program	06	24,668	29,820	29,820			U
158	0605502A	Small Business Innovative Research	06	230,691					U
159	0605601A	Army Test Ranges and Facilities	06	305,238	307,588	307,588			U
160	0605602A	Army Technical Test Instrumentation and Targets	06	70,523	49,242	49,242			U
161	0605604A	Survivability/Lethality Analysis	06	38,245	41,843	41,843			U
162	0605606A	Aircraft Certification	06	4,486	4,804	4,804			U
163	0605702A	Meteorological Support to RDT&E Activities	06	6,793	7,238	7,238			U
164	0605706A	Materiel Systems Analysis	06	21,510	21,890	21,890			U
165	0605709A	Exploitation of Foreign Items	06	12,415	12,684	12,684			U
166	0605712A	Support of Operational Testing	06	49,580	51,040	51,040			U
167	0605716A	Army Evaluation Center	06	55,460	56,246	56,246			U
168	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	7,653	1,829	1,829			U
169	0605801A	Programwide Activities	06	50,971	55,060	55,060			U
170	0605803A	Technical Information Activities	06	29,905	33,934	33,934			U
171	0605805A	Munitions Standardization, Effectiveness and Safety	06	63,983	43,444	43,444			U
172	0605857A	Environmental Quality Technology Mgmt Support	06	2,048	5,087	5,087			U

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156	0605301A	Army Kwajalein Atoll	06				246,663		246,663	U
157	0605326A	Concepts Experimentation Program	06				29,820		29,820	U
158	0605502A	Small Business Innovative Research	06							U
159	0605601A	Army Test Ranges and Facilities	06				307,588		307,588	U
160	0605602A	Army Technical Test Instrumentation and Targets	06				49,242		49,242	U
161	0605604A	Survivability/Lethality Analysis	06				41,843		41,843	U
162	0605606A	Aircraft Certification	06				4,804		4,804	U
163	0605702A	Meteorological Support to RDT&E Activities	06				7,238		7,238	U
164	0605706A	Materiel Systems Analysis	06				21,890		21,890	U
165	0605709A	Exploitation of Foreign Items	06				12,684		12,684	U
166	0605712A	Support of Operational Testing	06				51,040		51,040	U
167	0605716A	Army Evaluation Center	06				56,246		56,246	U
168	0605718A	Army Modeling & Sim X-Command Collaboration & Integ	06				1,829		1,829	U
169	0605801A	Programwide Activities	06				55,060		55,060	U
170	0605803A	Technical Information Activities	06				33,934		33,934	U
171	0605805A	Munitions Standardization, Effectiveness and Safety	06				43,444		43,444	U
172	0605857A	Environmental Quality Technology Mgmt Support	06				5,087		5,087	U

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156	0605301A	Army Kwajalein Atoll	06	246,574		246,574	U
157	0605326A	Concepts Experimentation Program	06	30,430		30,430	U
158	0605502A	Small Business Innovative Research	06				U
159	0605601A	Army Test Ranges and Facilities	06	305,759		305,759	U
160	0605602A	Army Technical Test Instrumentation and Targets	06	62,379		62,379	U
161	0605604A	Survivability/Lethality Analysis	06	40,496		40,496	U
162	0605606A	Aircraft Certification	06	3,941		3,941	U
163	0605702A	Meteorological Support to RDT&E Activities	06	9,767		9,767	U
164	0605706A	Materiel Systems Analysis	06	21,226		21,226	U
165	0605709A	Exploitation of Foreign Items	06	13,026		13,026	U
166	0605712A	Support of Operational Testing	06	52,718		52,718	U
167	0605716A	Army Evaluation Center	06	57,049		57,049	U
168	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	2,801		2,801	U
169	0605801A	Programwide Activities	06	60,942		60,942	U
170	0605803A	Technical Information Activities	06	29,050		29,050	U
171	0605805A	Munitions Standardization, Effectiveness and Safety	06	42,332		42,332	U
172	0605857A	Environmental Quality Technology Mgmt Support	06	3,216		3,216	U

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173	0605898A	Army Direct Report Headquarters - R&D - MHA	06	49,287	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	0606003A	CounterIntel and Human Intel Modernization	06						U
177	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06						U
178	0303260A	Defense Military Deception Initiative	06	1,923	1,779	1,779			U
179	0909980A	Judgment Fund Reimbursement	06	7,893					U
180	0909999A	Financing for Cancelled Account Adjustments	06	6					U
		RDT&E Management Support		1,413,481	1,253,845	1,253,845			
181	0603778A	MLRS Product Improvement Program	07	34,391	8,929	8,929			U
182	0603813A	TRACTOR PULL	07	3,960	4,014	4,014			U
183	0605024A	Anti-Tamper Technology Support	07	3,498	4,094	4,094			U
184	0607131A	Weapons and Munitions Product Improvement Programs	07	19,969	15,738	15,738			U
185	0607133A	TRACTOR SMOKE	07	4,479	4,513	4,513			U
186	0607134A	Long Range Precision Fires (LRPF)	07	36,322	102,014	102,014			U
187	0607135A	Apache Product Improvement Program	07	60,995	59,977	59,977			U

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173	0605898A	Army Direct Report Headquarters - R&D - MHA	06				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	0606003A	CounterIntel and Human Intel Modernization	06							U
177	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06							U
178	0303260A	Defense Military Deception Initiative	06				1,779		1,779	U
179	0909980A	Judgment Fund Reimbursement	06							U
180	0909999A	Financing for Cancelled Account Adjustments	06							U
		RDT&E Management Support					1,253,845		1,253,845	
181	0603778A	MLRS Product Improvement Program	07				8,929		8,929	U
182	0603813A	TRACTOR PULL	07				4,014		4,014	U
183	0605024A	Anti-Tamper Technology Support	07				4,094		4,094	U
184	0607131A	Weapons and Munitions Product Improvement Programs	07				15,738		15,738	U
185	0607133A	TRACTOR SMOKE	07				4,513		4,513	U
186	0607134A	Long Range Precision Fires (LRPF)	07				102,014		102,014	U
187	0607135A	Apache Product Improvement Program	07				59,977		59,977	U

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173	0605898A	Army Direct Report Headquarters - R&D - MHA	06	54,145		54,145	U
174	0606001A	Military Ground-Based CREW Technology	06	4,896		4,896	U
175	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06	63,011		63,011	U
176	0606003A	CounterIntel and Human Intel Modernization	06	2,636		2,636	U
177	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06	88,300		88,300	U
178	0303260A	Defense Military Deception Initiative	06				U
179	0909980A	Judgment Fund Reimbursement	06				U
180	0909999A	Financing for Cancelled Account Adjustments	06				U
		RDT&E Management Support		1,322,481		1,322,481	
181	0603778A	MLRS Product Improvement Program	07	8,886		8,886	U
182	0603813A	TRACTOR PULL	07	4,067		4,067	U
183	0605024A	Anti-Tamper Technology Support	07	4,254		4,254	U
184	0607131A	Weapons and Munitions Product Improvement Programs	07	16,022	2,548	18,570	U
185	0607133A	TRACTOR SMOKE	07	4,577	7,780	12,357	U
186	0607134A	Long Range Precision Fires (LRPF)	07	186,475		186,475	U
187	0607135A	Apache Product Improvement Program	07	31,049		31,049	U

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188	0607136A	Blackhawk Product Improvement Program	07	44,966	34,416	34,416			U
189	0607137A	Chinook Product Improvement Program	07	88,314	194,567	194,567			U
190	0607138A	Fixed Wing Product Improvement Program	07	765	9,981	9,981			U
191	0607139A	Improved Turbine Engine Program	07	111,638	204,304	204,304			U
192	0607140A	Emerging Technologies from NIE	07	2,278	1,023	1,023			U
193	0607141A	Logistics Automation	07	1,542	1,504	1,504			U
194	0607142A	Aviation Rocket System Product Improvement and Development	07		10,064	10,064			U
195	0607143A	Unmanned Aircraft System Universal Products	07		38,463	38,463			U
196	0607665A	Family of Biometrics	07	11,632	6,159	6,159			U
197	0607865A	Patriot Product Improvement	07	48,073	90,217	90,217			U
198	0202429A	Aerostat Joint Project - COCOM Exercise	07	6,178	6,749	6,749			U
199	0203728A	Joint Automated Deep Operation Coordination System (JADOCs)	07	29,412	33,520	33,520			U
200	0203735A	Combat Vehicle Improvement Programs	07	340,353	343,175	343,175			U
201	0203740A	Maneuver Control System	07	3,943	6,639	6,639			U
202	0203743A	155mm Self-Propelled Howitzer Improvements	07		40,784	40,784			U
203	0203744A	Aircraft Modifications/Product Improvement Programs	07	32,397	39,358	39,358			U

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188	0607136A	Blackhawk Product Improvement Program	07				34,416		34,416	U
189	0607137A	Chinook Product Improvement Program	07				194,567		194,567	U
190	0607138A	Fixed Wing Product Improvement Program	07				9,981		9,981	U
191	0607139A	Improved Turbine Engine Program	07				204,304		204,304	U
192	0607140A	Emerging Technologies from NIE	07				1,023		1,023	U
193	0607141A	Logistics Automation	07				1,504		1,504	U
194	0607142A	Aviation Rocket System Product Improvement and Development	07				10,064		10,064	U
195	0607143A	Unmanned Aircraft System Universal Products	07				38,463		38,463	U
196	0607665A	Family of Biometrics	07				6,159		6,159	U
197	0607865A	Patriot Product Improvement	07				90,217		90,217	U
198	0202429A	Aerostat Joint Project - COCOM Exercise	07				6,749		6,749	U
199	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07				33,520		33,520	U
200	0203735A	Combat Vehicle Improvement Programs	07				343,175		343,175	U
201	0203740A	Maneuver Control System	07				6,639		6,639	U
202	0203743A	155mm Self-Propelled Howitzer Improvements	07				40,784		40,784	U
203	0203744A	Aircraft Modifications/Product Improvement Programs	07				39,358		39,358	U

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188	0607136A	Blackhawk Product Improvement Program	07	35,240		35,240	U
189	0607137A	Chinook Product Improvement Program	07	157,822		157,822	U
190	0607138A	Fixed Wing Product Improvement Program	07	4,189		4,189	U
191	0607139A	Improved Turbine Engine Program	07	192,637		192,637	U
192	0607140A	Emerging Technologies from NIE	07				U
193	0607141A	Logistics Automation	07				U
194	0607142A	Aviation Rocket System Product Improvement and Development	07	60,860		60,860	U
195	0607143A	Unmanned Aircraft System Universal Products	07	52,019		52,019	U
196	0607665A	Family of Biometrics	07	2,400		2,400	U
197	0607865A	Patriot Product Improvement	07	65,369		65,369	U
198	0202429A	Aerostat Joint Project - COCOM Exercise	07	1		1	U
199	0203728A	Joint Automated Deep Operation Coordination System (JADOCs)	07	30,954		30,954	U
200	0203735A	Combat Vehicle Improvement Programs	07	411,927		411,927	U
201	0203740A	Maneuver Control System	07				U
202	0203743A	155mm Self-Propelled Howitzer Improvements	07	40,676		40,676	U
203	0203744A	Aircraft Modifications/Product Improvement Programs	07	17,706		17,706	U

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204	0203752A	Aircraft Engine Component Improvement Program	07	249	145	145			U
205	0203758A	Digitization	07	6,234	4,803	4,803			U
206	0203801A	Missile/Air Defense Product Improvement Program	07	24,925	2,723	2,723	15,000	15,000	U
207	0203802A	Other Missile Product Improvement Programs	07	8,283	5,000	5,000			U
208	0203808A	TRACTOR CARD	07	20,333	37,883	37,883			U
209	0205402A	Integrated Base Defense - Operational System Dev	07	3,450					U
210	0205410A	Materials Handling Equipment	07	119	1,582	1,582			U
211	0205412A	Environmental Quality Technology - Operational System Dev	07		195	195			U
212	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	61,449	78,926	78,926			U
213	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	21,196	102,807	102,807			U
214	0208053A	Joint Tactical Ground System	07	12,649					U
216	0303028A	Security and Intelligence Activities	07	15,719	13,807	13,807			U
217	0303140A	Information Systems Security Program	07	36,892	132,438	132,438			U
218	0303141A	Global Combat Support System	07	26,176	64,370	64,370			U
219	0303142A	SATCOM Ground Environment (SPACE)	07	18,761					U
220	0303150A	WWMCCS/Global Command and Control System	07	4,536	10,475	10,475			U

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204	0203752A	Aircraft Engine Component Improvement Program	07				145		145	U
205	0203758A	Digitization	07				4,803		4,803	U
206	0203801A	Missile/Air Defense Product Improvement Program	07				17,723		17,723	U
207	0203802A	Other Missile Product Improvement Programs	07				5,000		5,000	U
208	0203808A	TRACTOR CARD	07				37,883		37,883	U
209	0205402A	Integrated Base Defense - Operational System Dev	07							U
210	0205410A	Materials Handling Equipment	07				1,582		1,582	U
211	0205412A	Environmental Quality Technology - Operational System Dev	07				195		195	U
212	0205456A	Lower Tier Air and Missile Defense (AMD) System	07				78,926		78,926	U
213	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07				102,807		102,807	U
214	0208053A	Joint Tactical Ground System	07							U
216	0303028A	Security and Intelligence Activities	07				13,807		13,807	U
217	0303140A	Information Systems Security Program	07				132,438		132,438	U
218	0303141A	Global Combat Support System	07				64,370		64,370	U
219	0303142A	SATCOM Ground Environment (SPACE)	07							U
220	0303150A	WWMCCS/Global Command and Control System	07				10,475		10,475	U

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204	0203752A	Aircraft Engine Component Improvement Program	07	146		146	U
205	0203758A	Digitization	07	6,316		6,316	U
206	0203801A	Missile/Air Defense Product Improvement Program	07	1,643	2,000	3,643	U
207	0203802A	Other Missile Product Improvement Programs	07	4,947		4,947	U
208	0203808A	TRACTOR CARD	07	34,050		34,050	U
209	0205402A	Integrated Base Defense - Operational System Dev	07		8,000	8,000	U
210	0205410A	Materials Handling Equipment	07	1,464		1,464	U
211	0205412A	Environmental Quality Technology - Operational System Dev	07	249		249	U
212	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	79,283		79,283	U
213	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	154,102		154,102	U
214	0208053A	Joint Tactical Ground System	07				U
216	0303028A	Security and Intelligence Activities	07	12,280	23,199	35,479	U
217	0303140A	Information Systems Security Program	07	68,533		68,533	U
218	0303141A	Global Combat Support System	07	68,619		68,619	U
219	0303142A	SATCOM Ground Environment (SPACE)	07				U
220	0303150A	WWMCCS/Global Command and Control System	07	2,034		2,034	U

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223	0305172A	Combined Advanced Applications	07		1,100	1,100			U
224	0305179A	Integrated Broadcast Service (IBS)	07						U
225	0305204A	Tactical Unmanned Aerial Vehicles	07	8,218	9,433	9,433	7,492	7,492	U
226	0305206A	Airborne Reconnaissance Systems	07	11,799	5,080	5,080	15,000	15,000	U
227	0305208A	Distributed Common Ground/Surface Systems	07	32,284	24,700	24,700			U
228	0305219A	MQ-1C Gray Eagle UAS	07	13,470	9,574	9,574			U
229	0305232A	RQ-11 UAV	07	1,613	2,191	2,191			U
230	0305233A	RQ-7 UAV	07	4,597	12,773	12,773			U
231	0307665A	Biometrics Enabled Intelligence	07	8,854	2,537	2,537	6,036	6,036	U
232	0310349A	Win-T Increment 2 - Initial Networking	07	4,680	4,723	4,723			U
233	0708045A	End Item Industrial Preparedness Activities	07	59,891	60,877	60,877			U
234	1203142A	SATCOM Ground Environment (SPACE)	07		11,959	11,959			U
235	1208053A	Joint Tactical Ground System	07		10,228	10,228			U
9999	9999999999	Classified Programs		4,625	7,154	7,154			U
		Operational Systems Development		1,296,107	1,877,685	1,877,685	43,528	43,528	
236	0901560A	Continuing Resolution Programs	20		-1,151,993	-1,151,993	222,988	222,988	U
		Undistributed			-1,151,993	-1,151,993	222,988	222,988	
Total Research, Development, Test & Eval, Army				8,852,507	8,273,447	8,273,447	342,356	342,356	

R-119PB: FY 2019 President's Budget (Published Version), as of January 18, 2018 at 15:06:20

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Department of the Army
 FY 2019 President's Budget
 Exhibit R-1 FY 2019 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

18 Jan 2018

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

Line No	Program Element Number	Item	Act	FY 2018 Emergency Requests**	FY 2018 Less Enacted Div B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req Emergency	FY 2018 Total PB Requests* with CR Adj Base + OCO + Emergency**	FY 2018 Less Enacted DIV B P.L.115-96*** MDDE + Ship Repairs	FY 2018 Remaining Req with CR Adj Base + OCO + Emergency	S
223	0305172A	Combined Advanced Applications	07				1,100		1,100	U
224	0305179A	Integrated Broadcast Service (IBS)	07							U
225	0305204A	Tactical Unmanned Aerial Vehicles	07				16,925		16,925	U
226	0305206A	Airborne Reconnaissance Systems	07				20,080		20,080	U
227	0305208A	Distributed Common Ground/Surface Systems	07				24,700		24,700	U
228	0305219A	MQ-1C Gray Eagle UAS	07				9,574		9,574	U
229	0305232A	RQ-11 UAV	07				2,191		2,191	U
230	0305233A	RQ-7 UAV	07				12,773		12,773	U
231	0307665A	Biometrics Enabled Intelligence	07				8,573		8,573	U
232	0310349A	Win-T Increment 2 - Initial Networking	07				4,723		4,723	U
233	0708045A	End Item Industrial Preparedness Activities	07				60,877		60,877	U
234	1203142A	SATCOM Ground Environment (SPACE)	07				11,959		11,959	U
235	1208053A	Joint Tactical Ground System	07				10,228		10,228	U
9999	9999999999	Classified Programs					7,154		7,154	U
		Operational Systems Development					1,921,213		1,921,213	
236	0901560A	Continuing Resolution Programs	20				-929,005		-929,005	U
		Undistributed					-929,005		-929,005	
Total Research, Development, Test & Eval, Army				20,700	-20,700		8,636,503	-20,700	8,615,803	

R-119PB: FY 2019 President's Budget (Published Version), as of January 18, 2018 at 15:06:20

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Department of the Army
 FY 2019 President's Budget
 Exhibit R-1 FY 2019 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

18 Jan 2018

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

Line No	Program Element Number	Item	Act	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Se
223	0305172A	Combined Advanced Applications	07	1,500		1,500	U
224	0305179A	Integrated Broadcast Service (IBS)	07	450		450	U
225	0305204A	Tactical Unmanned Aerial Vehicles	07	6,000		6,000	U
226	0305206A	Airborne Reconnaissance Systems	07	12,416	14,000	26,416	U
227	0305208A	Distributed Common Ground/Surface Systems	07	38,667		38,667	U
228	0305219A	MQ-1C Gray Eagle UAS	07				U
229	0305232A	RQ-11 UAV	07	6,180		6,180	U
230	0305233A	RQ-7 UAV	07	12,863		12,863	U
231	0307665A	Biometrics Enabled Intelligence	07	4,310	2,214	6,524	U
232	0310349A	Win-T Increment 2 - Initial Networking	07				U
233	0708045A	End Item Industrial Preparedness Activities	07	53,958		53,958	U
234	1203142A	SATCOM Ground Environment (SPACE)	07	12,119		12,119	U
235	1208053A	Joint Tactical Ground System	07	7,400		7,400	U
9999	9999999999	Classified Programs		5,955		5,955	U
		Operational Systems Development		1,922,614	59,741	1,982,355	
236	0901560A	Continuing Resolution Programs	20				U
		Undistributed					
Total Research, Development, Test & Eval, Army				10,159,379	325,104	10,484,483	

R-119PB: FY 2019 President's Budget (Published Version), as of January 18, 2018 at 15:06:20

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Army • Budget Estimates FY 2019 • RDT&E Program

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

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31	03	0603002A	Medical Advanced Technology.....	23
32	03	0603003A	Aviation Advanced Technology.....	48
33	03	0603004A	Weapons and Munitions Advanced Technology.....	60
34	03	0603005A	Combat Vehicle and Automotive Advanced Technology.....	79
35	03	0603006A	Space Application Advanced Technology.....	100
36	03	0603007A	Manpower, Personnel and Training Advanced Technology.....	103
37	03	0603009A	Tractor Hike.....	108
38	03	0603015A	Next Generation Training & Simulation Systems.....	111
39	03	0603020A	TRACTOR ROSE.....	120
40	03	0603125A	Combating Terrorism - Technology Development.....	121
41	03	0603130A	TRACTOR NAIL.....	129
42	03	0603131A	TRACTOR EGGS.....	130
43	03	0603270A	Electronic Warfare Technology.....	131
44	03	0603313A	Missile and Rocket Advanced Technology.....	144
45	03	0603322A	TRACTOR CAGE.....	159

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

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47	03	0603606A	Landmine Warfare and Barrier Advanced Technology.....	169
48	03	0603607A	Joint Service Small Arms Program.....	175
49	03	0603710A	Night Vision Advanced Technology.....	179
50	03	0603728A	Environmental Quality Technology Demonstrations.....	191
51	03	0603734A	Military Engineering Advanced Technology.....	202
52	03	0603772A	Advanced Tactical Computer Science and Sensor Technology.....	211
53	03	0603794A	C3 Adv Technology.....	224

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

Program Element Title	Program Element Number	Line #	BA	Page
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Aviation Advanced Technology	0603003A	32	03.....	48
C3 Adv Technology	0603794A	53	03.....	224
Combat Vehicle and Automotive Advanced Technology	0603005A	34	03.....	79
Combating Terrorism - Technology Development	0603125A	40	03.....	121
Electronic Warfare Technology	0603270A	43	03.....	131
Environmental Quality Technology Demonstrations	0603728A	50	03.....	191
High Performance Computing Modernization Program	0603461A	46	03.....	160
Joint Service Small Arms Program	0603607A	48	03.....	175
Landmine Warfare and Barrier Advanced Technology	0603606A	47	03.....	169
Manpower, Personnel and Training Advanced Technology	0603007A	36	03.....	103
Medical Advanced Technology	0603002A	31	03.....	23
Military Engineering Advanced Technology	0603734A	51	03.....	202
Missile and Rocket Advanced Technology	0603313A	44	03.....	144
Next Generation Training & Simulation Systems	0603015A	38	03.....	111
Night Vision Advanced Technology	0603710A	49	03.....	179
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Program Element Title	Program Element Number	Line #	BA	Page
TRACTOR CAGE	0603322A	45	03.....	159
TRACTOR EGGS	0603131A	42	03.....	130
TRACTOR NAIL	0603130A	41	03.....	129
TRACTOR ROSE	0603020A	39	03.....	120
Tractor Hike	0603009A	37	03.....	108
Warfighter Advanced Technology	0603001A	30	03.....	1
Weapons and Munitions Advanced Technology	0603004A	33	03.....	60

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FY 2019 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 2019.

2. **Relationship of the FY 2019 Budget Submitted to Congress to the FY 2018 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
02	0602126A / XW8	TRACTOR JACK
02	0602787A / XV5	Medical Capabilities to Support Dispersed Ops
04	0604020A / CF1	CFT Advanced Development & Prototyping
04	0604113A / EX8	Future Tactical Unmanned Aircraft System (FTUAS)
06	0605898A / FJ2	Army SHARP RDTE
06	0606942A / FL2	Cyber Vulnerabilities Assessments and Evaluations
07	0305179A / EF4	Integrated Broadcast System
07	0305206A / EH7	Guardrail Common Sensor (GRCS) Payloads (MIP)
07	0305206A / EH2	EMARSS ADV DEV (MIP)

B. Program Element/Project Restructures:

Budget Activity	Old OSDPE / Project: Title	New OSDPE / Project: Title
02	0602105A / H84: Materials	0602105A / XW4: Manufacturing Science
02	0602270A / 906: Tactical Electronic Warfare Applied Research	0602270A / CYB: Applied Offensive Cyber
02	0602782A / 779: Command, Control And Platform Electronics Tech	0602782A / CY2: Applied Defensive Cyber
02	0602782A / H92: Communications Technology	0602782A / CY2: Applied Defensive Cyber
02	0602786A / 283: Airdrop Adv Tech	0602786A / XW5: Small Unit Expeditionary Maneuver Technology
02	0602786A / H99: Joint Service Combat Feeding Technology	0602786A / XW5: Small Unit Expeditionary Maneuver Technology
02	0602786A / VT4: Expeditionary Mobile Base Camp Technology	0602786A / XW5: Small Unit Expeditionary Maneuver Technology
03	0603001A / C07: Joint Service Combat Feeding Tech Demo	0603001A / XW6: Small Unit Expeditionary Maneuver
03	0603001A / VT5: Expeditionary Mobile Base Camp Demonstration	0603001A / XW6: Small Unit Expeditionary Maneuver
03	0603001A / 242: Airdrop Equipment	0603001A / XW6: Small Unit Expeditionary Maneuver
03	0603270A / K15: Advanced Comm Ecm Demo	0603270A / CY3: Offensive Cyber Demonstration
03	0603270A / K16: Non-Commo Ecm Tech Dem	0603270A / CY3: Offensive Cyber Demonstration
04	0603639A / EL7: Reduced Range Ammunition	0604802A / EP3: Reduced Range Ammunition - Small Caliber
04	0603639A / EL8: LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER	0607131A / ER6: Direct Fire Technology
04	0603639A / EU1: Enhanced Lethality Cannon Munitions	0604802A / EU7: Enhanced Lethality Cannon Munitions
04	0603639A / EU1: Enhanced Lethality Cannon Munitions	0604802A / EU6: 155mm HE Rocket Assist Project Extended Range
04	0604120A / ED5: Assured Positioning, Navigation and Timing (PNT)	1206120A / FJ8: Assured Positioning, Navigation and Timing (PNT)
04	0604120A / EH8: DISMOUNTED	1206120A / FJ9: Dismounted A-PNT
04	0604120A / EH9: PSEUDOLITES	1206120A / FK1: Pseudolites
04	0604120A / EJ2: MOUNTED	1206120A / FK2: Mounted A-PNT
04	0604120A / EJ3: ANTI-JAM ANTENNA	1206120A / FK3: Anti-Jam Antenna
05	0210609A / ED8: Paladin Integrated Management (PIM)	0203743A / FF9: PIM Improvement Program
05	0604798A / FG7: Emerging Technology Initiatives	0604798A / FI3: Rapid Capability Development and Maturation
05	0604827A / S65: Platoon Power Generator	0604827A / EY3: Soldier Power Generator
05	0605053A / FB4: Common Robotic Systems	0605053A / FG8: Common Robotic Controller
07	0303028A / FG2: Counterintelligence & Human Intel Modernization	0606003A / FI9: Counterl Intel and Human Intel Modernization
07	0205402A / EF2: Integrated Base Defense	0605029A / EQ2: IntegGrdSecSurvRespC(IGSSR-C)
07	0205402A / EF2: Integrated Base Defense	0605033A / EQ3: Grnd-Based Opnl Surv Sys -Exped (GBOSS-E)
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 / EK8: Enroute Mission Command	1203142A / FE4: Enroute Mission Command

C. Program Terminations:

<u>Budget Activity</u>	<u>OSDPE / Project</u>	<u>OSDPE Title / Project Title</u>
01	0601103A / V72	University Research Initiatives / Minerva; project ends
01	0601104A / H50	University and Industry Research Centers / Network Sciences Cta; project ends
01	0601104A / H53	University and Industry Research Centers / Army High Performance Computing Research Center; project ends
01	0601104A / H54	University and Industry Research Centers / Micro-Autonomous Systems Technology (MAST) CTA; project ends
02	0602105A / H7G	Materials Technology / Nanomaterials Applied Research; project ends
02	0602120A / SA2	Sensors and Electronic Survivability / Biotechnology Applied Research; project ends
02	0602705A / H17	Electronics and Electronic Devices / Flexible Display Center; project ends
02	0602720A / 895	Environmental Quality Technology / Pollution Prevention; project ends
03	0603001A / 543	Warfighter Advanced Technology / Ammunition Logistics; project ends
03	0603015A / S28	Next Generation Training & Simulation Systems / Immersive Learning Environments; project ends
03	0603020A / DB1	TRACTOR ROSE / DDB1; project ends
03	0603606A / 683	Landmine Warfare and Barrier Advanced Technology / Area Denial Sensors; project ends
03	0603728A / 025	Environmental Quality Technology Demonstrations / Pollution Prevention Technology; project ends
04	0604115A / EX3	Technology Maturation Initiatives / Ground Vehicle Prototyping; project ends
05	0604290A / DW1	Mid-tier Networking Vehicular Radio (MNVR) / Mid-Tier Wideband Networking Vehicular Radio Mnv; project ends
05	0604321A / B41	All Source Analysis System / CI/HUMINT Software Products (MIP); project ends
05	0604321A / B51	All Source Analysis System / Machine - Foreign Language Translation System; project ends
05	0604818A / 334	Army Tactical Command & Control Hardware & Software / Common Software; project ends
06	0303260A / FA9	Defense Military Deception Initiative / Security Initiatives; project ends
06	0604759A / FA4	Major T&E Investment / Warrior Injury Assessment Manikin (WIAMan); transitions to procurement
07	0202429A / EP8	Aerostat Joint Project - COCOM Exercise / COCOM Exercise; project ends
07	0203740A / 484	Maneuver Control System / Maneuver Control System; project ends
07	0303142A / EA3	SATCOM Ground Environment (SPACE) / Transportable Tactical Cmd Comms (T2C2); transitions to procurement
07	0303150A / EA5	WWMCCS/Global Command and Control System / Strategic and Joint Mission Command; transitions to procurement
07	0305219A / MQ1	MQ-1 Gray Eagle UAV / MQ-1 Gray Eagle - Army UAV (MIP); project ends
07	0607140A / ES7	Emerging Technologies from NIE / Emerging Technologies from NIE; project ends
07	0607141A / DY1	Logistics Automation / Logistics Information Warehouse (LIW); project ends

- 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603001A / Warfighter Advanced Technology
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	50.004	44.863	39.338	-	39.338	38.238	40.127	39.932	40.733	0.000	293.235
242: Airdrop Equipment	-	3.479	5.681	1.630	-	1.630	1.930	2.000	1.800	1.836	0.000	18.356
543: Ammunition Logistics	-	2.196	2.326	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.522
C07: Joint Service Combat Feeding Tech Demo	-	2.134	2.177	1.219	-	1.219	0.771	1.375	1.123	1.298	0.000	10.097
FF6: Individual Protection	-	0.000	6.352	11.614	-	11.614	10.986	11.277	10.347	10.554	0.000	61.130
J50: Future Warrior Technology Integration	-	25.613	24.894	22.114	-	22.114	18.994	20.413	20.800	21.215	0.000	154.043
J52: WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	-	12.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	12.500
VT5: Expeditionary Mobile Base Camp Demonstration	-	4.082	3.433	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.515
XW6: Small Unit Expeditionary Maneuver	-	0.000	0.000	2.761	-	2.761	5.557	5.062	5.862	5.830	0.000	25.072

Note

The cited work is consistent with the S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. As such, funding in FY19 for some projects was either merged into XW6 (VT5) or funding reduced from prior years (242) due to shifts in the Army S&T portfolio that emphasizes far term investments as well as consideration of the successful contributions of these projects to current Army Readiness that allow shifts to higher priority investment areas.

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, rapid ammunition/munitions deployability and resupply, combat rations and combat feeding equipment, combat clothing and personal equipment (including protective equipment such as personal armor, helmets, and eyewear), and expeditionary base camps with an emphasis on emerging operating environments and missions that require expeditionary maneuver. The Projects focus on the challenge of integrating clothing and individual equipment on the Soldier to effectively bridge the gap between humans, technology, and equipment design. 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>
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Efforts in this PE support the Army Science and Technology Soldier, Lethality, and Ground Maneuver Portfolios.

Work in this PE is related to, and fully coordinated with, PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603015A (Next Generation Training and Simulation Systems), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0603710A (Night Vision Advanced Technology), PE 0602784A (Military Engineering Technology), and PE 0603734A (Military Engineering Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

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

Work is led, performed, and/or managed by the U.S. Army Research, Development, and Engineering Command (RDECOM).

B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	38.831	44.863	34.213	-	34.213
Current President's Budget	50.004	44.863	39.338	-	39.338
Total Adjustments	11.173	0.000	5.125	-	5.125
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	12.500	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.310	-			
• Adjustments to Budget Years	-	-	5.125	-	5.125
• FFRDC	-0.017	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*

Congressional Add: *Program Increase*

Congressional Add Subtotals for Project: J52

	FY 2017	FY 2018
	12.500	-
	12.500	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2017	FY 2018
Congressional Add Totals for all Projects	12.500	-

Change Summary Explanation

FY17 Congressional increase in J52 Warfighter Advanced Technology Initiatives

FY19 funding increase supports the acceleration of efforts that support senior leader priorities for Soldier Lethality.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>				Project (Number/Name) 242 / <i>Airdrop Equipment</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
242: <i>Airdrop Equipment</i>	-	3.479	5.681	1.630	-	1.630	1.930	2.000	1.800	1.836	0.000	18.356

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 Portfolio.

Work in this Project is fully coordinated with Program Element (PE) 0602786A (Warfighter Technology).

The cited work is consistent with the S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. As such, funding in FY19 is reduced from prior years due to shifts in the Army S&T portfolio that emphasizes far term investments as well as consideration of the contributions of this project to current Army Readiness.

This work supports Anti-Access/Area Denial (A2/AD) and manned-unmanned teaming (MUM-T) operational concepts by demonstrating precision aerial delivery and airdrop from non-traditional platforms.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Airdrop/Aerial Delivery	3.479	5.681	1.630
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, and supporting Anti-Access/Area Denial (A2/AD) and manned-unmanned teaming (MUM-T) operational concepts by demonstrating airdrop from non-traditional platforms.			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) 242 / <i>Airdrop Equipment</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2018 Plans:</i> Optimize autonomously guided system technologies to reduce system cost and to support accurate and survivable landings in urban and jungle environments. Technologies 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.</p> <p><i>FY 2019 Plans:</i> Will demonstrate precision aerial delivery software and hardware components in a GPS denied/degraded environment as well as in Dense, Urban, Complex Terrain.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Precision aerial delivery demonstration efforts in FY19 are being reduced to support senior leader priorities for Soldier Lethality.</p>			
Accomplishments/Planned Programs Subtotals	3.479	5.681	1.630

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>				Project (Number/Name) 543 / <i>Ammunition Logistics</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
543: <i>Ammunition Logistics</i>	-	2.196	2.326	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.522

Note

This project completes in FY18

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.

This effort completed in FY18.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Automated Supply Point-Scalable	FY 2017	FY 2018	FY 2019
Description: This effort demonstrates globally responsive supply point operations capable of meeting predictive demand through automated cargo identification, handling, and movement technologies.	2.196	2.326	-
FY 2018 Plans: 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.			
FY 2018 to FY 2019 Increase/Decrease Statement: Effort was realigned to higher priority Army Modernization efforts.			
Accomplishments/Planned Programs Subtotals	2.196	2.326	-

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) 543 / <i>Ammunition Logistics</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) C07 / <i>Joint Service Combat Feeding Tech Demo</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>C07: Joint Service Combat Feeding Tech Demo</i>	-	2.134	2.177	1.219	-	1.219	0.771	1.375	1.123	1.298	0.000	10.097

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 S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Joint Service Combat Feeding Technical Demonstration	2.134	2.177	1.219
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 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 2018 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) C07 / <i>Joint Service Combat Feeding Tech Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>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 grey-water 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.</p> <p>FY 2019 Plans: Will mature and demonstrate ration components to improve readiness, performance and recovery from strenuous exercise to prevent energy deficits that negatively impact mission outcomes; validate food pathogen enrichment methods to identify food pathogens prior to consumption; demonstrate prototype refrigeration technologies to reduce the use of conventional refrigerants.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: The funding reduction in FY19 is due to the refrigerant work that supports cold storage and the reduction in water demand work all coming to an end.</p>			
Accomplishments/Planned Programs Subtotals	2.134	2.177	1.219

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>				Project (Number/Name) FF6 / <i>Individual Protection</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
FF6: <i>Individual Protection</i>	-	0.000	6.352	11.614	-	11.614	10.986	11.277	10.347	10.554	0.000	61.130

A. Mission Description and Budget Item Justification

This Project matures, demonstrates, and integrates Soldier protective clothing and equipment required to enhance Soldier survivability from multiple battlefield threats, impact unit readiness, and potentially debilitate Soldiers. Threats are characterized as combat threats (e.g. flame and thermal, blast and ballistic, multispectral sensors, and laser threats), environmental threats (e.g. cold, heat, wet, vector, water contamination, concealment, antimicrobial, etc.), and Soldier system components and system limitations (e.g. size, weight, and bulk). This effort includes the demonstration and validation of integrated technologies, novel subsystems/systems, and test methods related to the development of personnel armor, helmets, hearing protection, eyewear, uniforms, hand-wear, footwear, and other clothing and individual equipment items. Efforts apply human systems integration principles and practices to protective equipment designs to advance the understanding of trade-offs between protection, lethality and mobility.

Efforts in this Project support the Army Science and Technology Soldier 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 S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Soldier/Small Unit Multi-Threat Protection	-	6.352	4.214
<p>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.</p> <p>FY 2018 Plans: 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</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) FF6 / <i>Individual Protection</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>newly optimized cold clothing ensemble; demonstrate anthropometrically correct flame resistant hand and head test equipment 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 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/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.</p> <p>FY 2019 Plans: Will demonstrate an optimized material solution specifically designed to maximize Soldier protection in austere and extreme cold environments to enable Soldiers to operate effectively for extended mission durations and reduce traumatic injury induced by extreme cold climates; will optimize materiel solutions for thermal signature management that reduces the probability of Soldier detection in response to the increase of sensors and Soldier-borne technologies; will optimize and demonstrate performance of advanced textile printing capabilities at the component level that can impart multiple functionalities (signature management, vector protection, flame resistance, etc.) in a single, more cost-effective process and more durable capability; will advance insect vector repellent testing capabilities in order to assess vector protection material performance at the system level quantify operational effectiveness to mitigate transmission of infectious diseases; will develop novel scientific-based test methods to correlate material, system and Soldier performance to inform future requirements.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Funding realigned to higher Army priorities.</p>			
<p>Title: Soldier Ballistic and Blast Protection</p> <p>Description: This effort focuses on maturing and demonstrating ballistic and blast personal protection capabilities worn by the individual Soldier and validating advanced test methods of personal protective equipment against small arms, fragmentation and blast threats. These developmental efforts focus on the objective of significantly increase the survivability afforded by Soldier individual protective equipment by increasing sub-system and system material performance against intended threats, reduce sub-system and system weight and inform future requirements linking threat lethality to Soldier survivability. 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.</p> <p>FY 2019 Plans: Will optimize and mature helmet forming processes, material layups, and architectures to manufacture helmets with state of the art, high performance polyethylene materials to demonstrate ballistic performance improvements in prototype helmets designed</p>	-	-	7.400

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) FF6 / <i>Individual Protection</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>for small arms threats; exploit ballistic fiber, tape and sheet goods materials in helmet processing techniques to control material layup to reduce inefficiencies in standard processing and exploit gains in ballistic protection and weight reduction; continue the development of an innovative ballistic helmet test methodology to improve behind-helmet blunt trauma measurement capabilities and correlate data with head/brain injury to inform future survivability requirements for protective helmets; develop helmet and torso non-destructive safety evaluation technology to produce a capability that will assess personal protective equipment efficacy; optimize and mature head-borne shock tube test methodology as a means to improve blast-over pressure profiles that can be correlated to operational blast environment conditions; integrate hearing protection into eyewear platforms to enhance individual Soldier hearing protection and maximize operational situational awareness in head-borne protection platforms; exploit existing and emerging ballistic resistant materials in new system designs and architectures against emerging small arms threats to define near term performance trade space.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Increase funding to support the acceleration of ballistic and blast protection designs and architectures.</p>			
Accomplishments/Planned Programs Subtotals	-	6.352	11.614

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) J50 / <i>Future Warrior Technology Integration</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>J50: Future Warrior Technology Integration</i>	-	25.613	24.894	22.114	-	22.114	18.994	20.413	20.800	21.215	0.000	154.043

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 protection and mobility systems. This Project also invests in understanding the trade-offs of integrating state-of-the-art technology with Soldiers' personal protection, electronics connectivity, power and energy, user interfaces and display content, and other mission specific equipment that seeks to reduce physical weight, cognitive burden, and sustainment needs of the small unit. This Project develops, matures, and maintains a Soldier Systems Engineering Architecture (SSEA) framework that represents human factors consideration in development of major Army platforms. Efforts in this Project focus on integrating and demonstrating system-level personal protection, durable Soldier protective clothing and individual equipment, environmental threats, and power management solutions. In addition, special focus is on understanding and demonstrating the impacts of physical and cognitive load on Soldier mission performance by implementing strategies to reduce load and/or optimize loads to reduce injuries, and the creation of user interfaces that mitigate the impact of increasing technologies and sensors worn and carried by Soldiers. 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 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 S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs (\$ in Millions)

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
Title: Soldier/Small Unit Ballistic and Blast Protection	4.202	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) J50 / <i>Future Warrior Technology Integration</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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.</p>			
<p>Title: Soldier/Small Unit Multi-Threat Protection</p> <p>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.</p>	4.836	-	-
<p>Title: Soldier Systems Engineering Architecture (SSEA)</p> <p>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. This framework effort will end in FY18 and transition to human systems integrators for Soldier system development and design.</p> <p>FY 2018 Plans: 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</p>	10.858	14.285	-

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) J50 / <i>Future Warrior Technology Integration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
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. FY 2018 to FY 2019 Increase/Decrease Statement: Effort is complete in FY18.				
Title: Soldier and Small Unit Mission Command/Situational Awareness (SA) and Power and Energy Integration Description: This effort matures and demonstrates mission command and power and energy technologies for the dismounted Soldier and small unit. The goal is to fully support the situational awareness mission information tools and power needs of a dismounted mission in an electronically equipped battlefield. This effort is fully coordinated with PE 0602705A/Project H11, PE0602705A/Project H94, and PE 0603710A/Project K70. FY 2018 Plans: 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. FY 2019 Plans: Will mature Soldier wearable power sources and energy harvesting components to reduce the overall weight of Soldier carried power equipment; will characterize the power profile of Soldier-worn electronic component technologies within a Soldier system level configuration and against approved mission scenarios; will demonstrate advanced Global Positioning System (GPS) denied navigation and environmental sensing algorithms for Soldier borne sensor platforms; will mature and demonstrate highly mobile expeditionary maneuver platform technology that includes signature management/decoy and high mobility mission command applications that enable on-demand resupply capabilities. FY 2018 to FY 2019 Increase/Decrease Statement: Funding increase to support additional research in the areas of Soldier Power and Energy and Situational Awareness in order to meet senior leader priorities.		2.359	5.936	7.478
Title: Soldier Interfaces (formerly Soldier and Small Unit Human Systems Performance)		3.358	4.673	7.454

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) J50 / <i>Future Warrior Technology Integration</i>

B. Accomplishments/Planned Programs (\$ in Millions)

Description: This effort matures and demonstrates low-cognitive workload user interfaces for display and control of dismounted Soldier mission command systems to enhance interactions of Soldiers and systems required to react effectively on the battlefield. Applies human systems engineering principles to develop design guidelines and techniques for integrating Soldiers and complex technical systems by assessing Soldier responses and capabilities in operational contexts. Matures and validates human performance metrics to design/assess systems and user interfaces to ensure that interactions between humans and machines provides effective operation and control to aid Soldier decision-making processes. 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. The title of this effort in 0603001/J50 changes from Soldier and Small Unit Human Systems Performance to Soldier Interfaces in FY19.

FY 2018 Plans:

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 and interfaces.

FY 2019 Plans:

Will validate single joint (ankle) exoskeleton for reduced metabolic cost and demonstrate operational efficacy for utilization in loaded walking/running; mature single and/or multi-joint exo systems for enhanced mobility and endurance; mature exoskeleton technologies for Soldier tasks such as Logistics (e.g. low mobility lift assist technology) and Infantry (high mobility tactical maneuvering for dismount application); demonstrate Soldier/squad optimization utilizing novel technologies/platforms with validated measures/metrics of human performance by demonstrating the operational impact of decreasing metabolic cost with a device that assists propulsion during locomotion while carrying an external load; provide knowledge product with findings from study that examined tactical timelines for measures of human and operational performance at the small unit level to inform future system development aimed at optimizing Soldier performance.

FY 2018 to FY 2019 Increase/Decrease Statement:

Funding increase to support the acceleration of exoskeleton capabilities which directly support senior leader priorities.

Title: Soldier Sensors and Robotics Architectures

Description: This effort builds and matures architectures that link dismounted Soldiers to air and ground robotics platforms. Enables small Soldiers-borne and operated autonomous systems that function as scouts, load carriers, resupply platforms, and/or communication nodes to enable greater reach and expeditionary dismounted maneuver. Applies complex Human Soldier

FY 2017	FY 2018	FY 2019
-	-	7.182

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) J50 / <i>Future Warrior Technology Integration</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>Integration principles to air and ground control and teleoperation for emerging robotic vehicles and sensors display content. Integrates reconnaissance and surveillance sensors and robotics with Nett Warrior system. 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 Soldier Systems architecture and Systems Integration Laboratory environment. This effort is new to 0603001A/J50 in FY19.</p> <p><i>FY 2019 Plans:</i> Will mature and demonstrate sensors and robotics architectures that enable dismounted linkages and ease of integration for existing and emerging ground and aerial robots; will mature Soldier-organic data management and distribution technologies for integration into Soldier-borne electronic devices, sensors, and robotics; will develop an integration architecture of sensors and robotics for the Nett Warrior system to increase situational awareness and stand-off protection; will identify common sensors that convey alerts and summary data within a sensor configuration that synthesizes data from multiple sensors; will increase image and sensing product quality and timeliness from small unit sensors and robotic platforms; will identify commercial virtual environment software to assess Nett Warrior and sensor and robotic interfaces in a dynamic mission context.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Effort supports Army S&T strategy priorities of autonomous systems operated or worn by Soldiers.</p>			
Accomplishments/Planned Programs Subtotals	25.613	24.894	22.114

<p><u>C. Other Program Funding Summary (\$ in Millions)</u> N/A</p> <p><u>Remarks</u></p> <p><u>D. Acquisition Strategy</u> N/A</p> <p><u>E. Performance Metrics</u> N/A</p>
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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>				Project (Number/Name) J52 / <i>WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
J52: <i>WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)</i>	-	12.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	12.500

Note

Congressional increase for program increase

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Advanced Technology development.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	12.500	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	12.500	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>				Project (Number/Name) VT5 / <i>Expeditionary Mobile Base Camp Demonstration</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
VT5: <i>Expeditionary Mobile Base Camp Demonstration</i>	-	4.082	3.433	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.515

Note

In FY19, work is realigned from Project VT5 (Expeditionary Mobile Base Camp Demonstration) to Project XW6 (Small Unit Expeditionary Maneuver).

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 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 S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

In FY19, this project merges into XW6, Small Unit Expeditionary Maneuver, along with 242 , Airdrop Equipment.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Expeditionary Base Camp (EBC) Technology Demonstrations	FY 2017	FY 2018	FY 2019
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	4.082	3.433	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) VT5 / <i>Expeditionary Mobile Base Camp Demonstration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
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 T40, PE 0603734A/Project T08, PE 0603004A/Project L97, PE 0603005A/Project 497, PE 0603125A/Project DF5, and PE 0603772A/Project 101.				
FY 2018 Plans: 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.				
FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, this effort merges into Project XW6, accomplishment title Small Unit Expeditionary Maneuver, in order to meet senior leader priorities for Expeditionary Maneuver.				
Accomplishments/Planned Programs Subtotals		4.082	3.433	-
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) XW6 / <i>Small Unit Expeditionary Maneuver</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>XW6: Small Unit Expeditionary Maneuver</i>	-	0.000	0.000	2.761	-	2.761	5.557	5.062	5.862	5.830	0.000	25.072

Note

In FY19, work is realigned from Projects VT5 (Expeditionary Mobile Base Camp Demonstration) to Project XW6 (Small Unit Expeditionary Maneuver) to create an integrated expeditionary maneuver research focus.

A. Mission Description and Budget Item Justification

This Project funds the maturation, validation and demonstration of innovative technologies which provide maneuver capabilities such as precision aerial delivery of cargo and personnel and expeditionary maneuver platforms to enable and enhance mission command and human performance in response to emerging operational environments that require expeditionary logistics for aggregated and disaggregated Soldiers and units. Technologies that allow dismounted units to move to positions of advantage rapidly, and then to operate for hours, days, weeks without resupply while sustaining a high tempo for periods of up to seven days. Efforts funded in this Project support all Military Services, the Special Operations Command, and the Defense Logistics Agency. Demonstrated technologies transition to a variety of partners, including Product Manager Force Sustainment Systems (PdM-FSS), Product Manager Combat Support Equipment (PM CSE), and/or Naval Sea Systems Command (NAVSEA)/Naval Supply Systems Command (NAVSUP).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Small Unit Expeditionary Maneuver	-	-	2.761
Description: This effort optimizes technologies that enable Soldier and Small Unit survivability, mission readiness and effectiveness during highly mobile, dispersed operations that may occur in the absence of conventional logistics support. This effort matures and demonstrates technologies that enhance equipment, materiel, and personnel aerial delivery in an Anti-Access/Area Denial (A2/AD) environment; stabilization techniques and nutrient compositions to maximize the Warfighter's physical and cognitive performance; and technologies to enhance field detection and identification capabilities of chemical and biological threats in foods.			
FY 2019 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / <i>Warfighter Advanced Technology</i>	Project (Number/Name) XW6 / <i>Small Unit Expeditionary Maneuver</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
Will demonstrate and support the transition of advanced personnel airdrop safety technologies and cargo airdrop from non-traditional platforms in support of interoperability with manned-unmanned teaming (MUM-T) assets.			
<i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> In FY19, Project VT5, accomplishment title Expeditionary Base Camp (EBC) Technology Demonstrations will be moved under Project XW6, accomplishment title Small Unit Expeditionary Maneuver in order to meeting senior leader priorities for Expeditionary Maneuver capabilities.			
Accomplishments/Planned Programs Subtotals	-	-	2.761

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	106.040	67.780	62.496	-	62.496	59.386	64.195	68.515	70.418	0.000	498.830
810: <i>Ind Base Id Vacc&Drug</i>	-	16.414	17.888	16.788	-	16.788	17.755	21.044	21.405	21.834	0.000	133.128
814: <i>NEUROFIBROMATOSIS</i>	-	15.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000
840: <i>Combat Injury Mgmt</i>	-	18.631	19.716	19.785	-	19.785	21.645	21.872	23.972	24.986	0.000	150.607
945: <i>BREAST CANCER STAMP PROCEEDS</i>	-	0.594	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.594
97T: <i>NEUROTOXIN EXPOSURE TREATMENT</i>	-	16.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.000
ET5: <i>Adv Tech Dev in Clinical & Rehabilitative Medicine</i>	-	11.207	9.958	9.015	-	9.015	2.663	2.582	3.108	3.168	0.000	41.701
MM2: <i>MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)</i>	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000
MM3: <i>Warfighter Medical Protection & Performance</i>	-	20.194	20.218	16.908	-	16.908	17.323	18.697	20.030	20.430	0.000	133.800

Note

In project MM3 there are two title changes in FY19. The Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring) title changes to Physiological Health and the Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments title changes to Environmental Health & Protection.

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates advanced medical technologies including drugs, vaccines, medical diagnostic devices, 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 conducted in compliance with FDA regulations for human medical products, and EPA regulations for insect-control products that impact humans or the environment (e.g., repellents and insecticides). 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 stepwise: first to prove the product is safe in humans, second to demonstrate the desired effectiveness and optimal dosage

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>
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(amount to be administered) in a small group human study, and third to demonstrate effectiveness in large, diverse human populations. 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 safety and effectiveness 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 pivotal trials in diverse populations will be conducted for licensure. Activities in this PE may include completion of preclinical animal studies and small safety and effectiveness studies involving humans according to FDA and EPA requirements. Promising medical technologies that are not regulated by the FDA or EPA are modeled, prototyped, and tested in relevant environments.

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

Project 810 matures and demonstrates FDA-regulated medical countermeasures such as drugs, vaccines, and diagnostic systems to naturally occurring infectious diseases 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.

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.

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

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>
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methodologies), validating clinical signs and symptoms correlating to medical records, diagnosed diseases, and mortality rates. The key databases supporting this program are the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases allow for the examination of interactions of psychological stress and other deployment and occupational stressors that affect Warfighter health behaviors.

Project MM3 supports the Medical and Survivability technology areas with laboratory validation studies and field demonstrations of biomedical products designed to counteract myriad environmental and physiological stressors, as well as materiel hazards encountered in training and operational environments to protect, sustain, and enhance Soldier performance. The key efforts are to demonstrate and transition technologies, as well as validate tools associated with Soldier survivability, injury assessment and prediction, assessments for post-concussive syndrome, and enhancing performance during continuous operations. The three main thrust areas are (1) Physiological Health and Environmental Protection, (2) Injury Prevention and Reduction, and (3) Psychological Health and Resilience. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services.

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

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

Work in this PE is performed by Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; US Army Medical Research Institute of Infectious Diseases (USAMRIID) and the Armed Forces Institute of Regenerative Medicine (AFIRM), Ft Detrick, MD; US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; US 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; US Army Dental Trauma Research Detachment (USADTRD), Joint Base San Antonio, TX.

B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	68.365	67.780	63.996	-	63.996
Current President's Budget	106.040	67.780	62.496	-	62.496
Total Adjustments	37.675	0.000	-1.500	-	-1.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	39.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.895	-			
• Adjustments to Budget Years	0.594	-	-1.500	-	-1.500
• FFRDC	-0.024	-	-	-	-

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2017	FY 2018
Project: 814: NEUROFIBROMATOSIS		
Congressional Add: <i>Neurofibromatosis Research Program</i>	15.000	-
Congressional Add Subtotals for Project: 814	15.000	-
Project: 97T: NEUROTOXIN EXPOSURE TREATMENT		
Congressional Add: <i>Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program</i>	16.000	-
Congressional Add Subtotals for Project: 97T	16.000	-
Project: MM2: MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)		
Congressional Add: <i>Military Burn Trauma Research Program</i>	8.000	-
Congressional Add Subtotals for Project: MM2	8.000	-
Congressional Add Totals for all Projects	39.000	-

Change Summary Explanation

FY17 Congressional increases in projects 814 Neurofibromatosis \$15M, 97T Neurotoxin Exposure Treatment \$16M, and MM2 Medical Advance Technology Initiatives \$8M

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Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>				Project (Number/Name) 810 / <i>Ind Base Id Vacc&Drug</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
810: <i>Ind Base Id Vacc&Drug</i>	-	16.414	17.888	16.788	-	16.788	17.755	21.044	21.405	21.834	0.000	133.128

A. Mission Description and Budget Item Justification

This Project matures 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.

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

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

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>Title: Advanced Technology Research on drugs and vaccines against parasitic diseases</p> <p>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 (<i>Plasmodium falciparum</i>) and the less severe but relapsing form (<i>Plasmodium vivax</i>), 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 eliminate the need to take preventive anti-malarial drugs.</p> <p>FY 2018 Plans: Submit initial human testing data for FDA review and down-select lead Triazine compound for further human testing. Assess improved strategy for safe and more effective use of primiquine-like drugs for radical cure in humans. Continue to conduct trials in human volunteers using multiple technologies to evaluate efficacy of selected vaccine candidates in a controlled human malaria infection model.</p> <p>FY 2019 Plans: Will initiate safety and analytic studies to assess natural break-down of candidate drugs within the human body to improve drug safety and effectiveness for treatment and prevention of malaria for selected triazine lead compound. Will complete laboratory clinical trials to assess performance of lead <i>Plasmodium falciparum</i> malaria vaccine candidates. These activities enable down-selection of a lead vaccine for transition to advanced development. Will validate laboratory-based immune measures of protection and correlate with protective effectiveness among candidate vaccines undergoing clinical trials</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Normal or planned progression of the effort</p>	6.405	6.916	6.565
<p>Title: Bacterial Disease Threats</p> <p>Description: This effort selects promising candidate vaccines against each of the three main bacterial causes of diarrhea (<i>E. coli</i>, <i>Campylobacter</i>, and <i>Shigella</i>) 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.</p> <p>FY 2018 Plans: Conduct expanded (FDA) safety/initial efficacy study in humans for <i>Shigella</i> and ETEC vaccine candidates. Perform analyses of samples obtained from human safety studies and make decisions regarding advancement of vaccine candidates for further testing at field sites. Conduct initial (FDA) safety study in humans for a <i>Campylobacter</i> vaccine candidate. Perform analyses of samples</p>	3.772	4.291	3.955

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>obtained from safety study of the Campylobacter vaccine candidate and make a decision regarding advancement of this candidate in efficacy testing studies.</p> <p>FY 2019 Plans: Will continue to develop and advance multiple vaccine candidates for Shigella, ETEC and Campylobacter. Will prepare data packages for the FDA to test suitable vaccine candidates in humans for safety and effectiveness. Will test the vaccine candidates in human clinical trials for safety and effectiveness for Shigella, ETEC and Campylobacter.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Normal or planned progression of the effort</p>				
<p>Title: Viral Disease Threats</p> <p>Description: This effort progresses the most promising vaccine candidates against dengue fever (a severe debilitating disease caused by a virus and transmitted by a mosquito), and hantavirus (severe viral infection that causes internal bleeding and is contracted from close contact with rodents) and conducts FDA-required nonclinical safety and protection testing (laboratory-based) in animals, prepare FDA investigational new drug technical data packages, and conducts clinical testing of candidate vaccines in humans.</p> <p>FY 2018 Plans: 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. Continue to evaluate safety of controlled human dengue infection model with newly developed Dengue viruses. 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. Conduct human trials to evaluate the biological activity of the DNA-based vaccine to prevent Hemorrhagic Fever with Renal Syndrome (HFRS).</p> <p>FY 2019 Plans: Will continue to evaluate safety and initial effectiveness of commercial partner dengue vaccine candidates undergoing testing in South East Asia and Latin America. Will complete vaccine immunogenicity(ability to provoke an immune response) testing followed by dengue human infection model challenge and effectiveness testing of human subjects immunized with combination inactivated and weakened forms of virus vaccines. Will engage commercial partner to pursue development of purified inactivated dengue virus vaccine alone or in combination with live attenuated product. Will pursue an expanded Hemorrhagic Fever with Renal Syndrome (HFRS) DNA vaccine clinical trial in a country that has endemic HFRS cases. Will test for safety and effectiveness of the HFRS DNA vaccine.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		5.017	5.000	5.659

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 810 / <i>Ind Base Id Vacc&Drug</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Normal or planned progression of the effort				
Title: Diagnostics and Disease Transmission Control		1.220	1.681	0.609
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. Note: Diagnostics Systems funding will end at the beginning of FY19.				
FY 2018 Plans: Advance the evaluation of new generation spatial repellent(s) in the field for efficacy against insect and other arthropod vectors. 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.				
FY 2019 Plans: Will continue to improve data collection and characterization of arthropod vectors. Will evaluate new dipsticks (pathogen detection lateral flow diagnostic devices). Will continue to field test Ovitrap (mosquito detection/monitor device) and other vector control methods including repellants spatial devices.				
FY 2018 to FY 2019 Increase/Decrease Statement: A change in the priority of the effort. The civilian market is driving much of the innovation in this area of diagnostic research. As such, it is cost effective to let the market develop diagnostic platforms and the DoD develop the military relevant test menu of assays. This approach was successful with the BioFire FilmArray (Next Generation Diagnostic System). While a dedicated diagnostic capability will be eliminated within the Military Infectious Diseases Research Program, many of the existing task areas have the knowledge and proficiency to develop diagnostic assays.				
Accomplishments/Planned Programs Subtotals		16.414	17.888	16.788
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 814 / <i>NEUROFIBROMATOSIS</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
814: <i>NEUROFIBROMATOSIS</i>	-	15.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	15.000

Note

Congressional increase for Neurofibromatosis Research Program

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurofibromatosis research.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
<i>Congressional Add:</i> Neurofibromatosis Research Program	15.000	-
<i>FY 2017 Accomplishments:</i> N/A		
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

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 840 / <i>Combat Injury Mgmt</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
840: <i>Combat Injury Mgmt</i>	-	18.631	19.716	19.785	-	19.785	21.645	21.872	23.972	24.986	0.000	150.607

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. Emphasis is placed on provision of prolonged field care when evacuation to theater hospitals is delayed.

Research conducted in this project focuses on combat casualty care in the following four areas:

- (1) Damage Control Resuscitation
- (2) Combat Trauma Therapies
- (3) Traumatic Brain Injury
- (4) Combat Critical Care Engineering

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Damage Control Resuscitation	6.058	6.035	5.756
Description: This effort supports work required to validate safety and effectiveness of drugs and medical procedures to control or stop bleeding, maintain metabolism (the chemical processes that are required to maintain life) minimize harmful inflammation after major trauma preserving tissue function, and prevent or minimize secondary organ failure (including brain and spinal cord injury).			
FY 2018 Plans: Perform preclinical studies to evaluate stem cell therapies in an animal model of severe traumatic bleeding. 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. Perform animal studies to determine impact of prolonged hypotensive (low blood			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 840 / <i>Combat Injury Mgmt</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>pressure) resuscitation, due to delayed evacuation, on subsequent survival once patient receives definitive surgical care and full resuscitation. 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. 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. Evaluate methods to refrigerate whole blood that do not impair platelet function.</p> <p>FY 2019 Plans: Will begin clinical trial to demonstrate safety of cold-stored platelets in human subjects. Will evaluate stem cell safety and effectiveness in animal model of severe traumatic injury, bleeding, and inflammation. Will assess current bleeding control products under prolonged care scenarios (i.e., when medical evacuation is delayed or prolonged). Will perform preclinical studies to determine physiological effects of endovascular (refers to device that is directly introduced into a major blood vessel) bleeding control product use on subsequent fluid resuscitation effectiveness. Will evaluate mechanical interventions for bleeding not controlled by application of pressure to determine best products and practices. Will assess animal studies to determine effect of prolonged low blood pressure resuscitation on survival following definitive surgical repair and full resuscitation. Will evaluate combinations of blood products and drugs to determine which optimally mitigate the effects of inflammation and prolonged ischemia (inadequate or absent blood supply) produced in critical tissues by traumatic bleeding. Will continue evaluation of methods to refrigerate whole blood that do not impair platelet function.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: The Battlefield Platelets STO concluded in FY18 with a product transitioning to advanced development.</p>				
<p>Title: Combat Trauma Therapies</p> <p>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.</p> <p>FY 2018 Plans: Follow on work to evaluate therapies that reduce excessive scar tissue formation following traumatic muscle injury moves under Clinical and Rehabilitative Medicine. Perform studies to determine impact of prolonged tourniquet use on antibiotic concentrations at wound site. Perform retrospective analyses to identify clinical determinants of long-term disability in casualties with musculoskeletal injuries. Perform animal studies to determine optimal concentration of dilute hypochlorite for initial wash-out of dismounted complex battlefield injuries. 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.</p> <p>FY 2019 Plans:</p>		5.342	6.343	6.389

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 840 / <i>Combat Injury Mgmt</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Will assess path of healing in animal burn wounds and measure time to wound closure for various degrees of burn wounds. Will continue retrospective analyses to identify clinical determinants of long-term disability in casualties with musculoskeletal injuries. Will continue animal studies to determine optimal concentration of a commonly used antiseptic solution for initial wash-out of dismounted complex battlefield injuries. Will continue studies in animals to evaluate effectiveness of products to combat wound infection, inflammation and scarring of delayed wound healing.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase is due to inflation adjustment.</p>				
<p>Title: Traumatic Brain Injury (TBI)</p> <p>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.</p> <p>FY 2018 Plans: Complete studies to mitigate post-TBI hyperthermia (TBI-induced fever) and transition knowledge to clinical practice guidelines. 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. 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.</p> <p>FY 2019 Plans: Will validate novel biomarkers of TBI using human serum samples across the spectrum of TBI severity. Will refine drugs and drug treatment protocols to optimize outcome during the subacute (first two to three weeks following injury) and chronic (one to three months following injury) TBI recovery time frames.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: No-significant change.</p>		4.067	4.085	4.057
<p>Title: Combat Critical Care Engineering</p> <p>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. The aim is to improve care of severely injured or ill casualties during transport and in theater hospitals, and to develop and evaluate technologies to treat vital organ failure caused by traumatic injury.</p> <p>FY 2018 Plans:</p>		3.164	3.253	3.583

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 840 / <i>Combat Injury Mgmt</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Evaluate inhalation delivery of stem cells to treat lung injury in animal model. Continue to clinically evaluate means to prevent pressure ulcer development during evacuation. 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 clinical practice guidelines. 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.			
<i>FY 2019 Plans:</i> Will conduct safety/effectiveness study of miniaturized extracorporeal life support system in trauma burn patients with lung injury. Will conduct large animal studies of an automated type of endovascular balloon occlusion of the aorta (used for control of intra-abdominal bleeding) to determine its safety and ability to prevent organ failure. Will create evidence-based competency assessment program for combat casualty care skills for all provider levels. Will create centralized support system that includes best practice guidelines for evidence-based trauma management throughout continuum of care and supports telemedicine. Will evaluate performance of life-saving intervention prediction algorithm in intensive care environment. Will measure the performance of the Burn Resuscitation Decision Support System (a device that guides fluid resuscitation in patients with severe burns) technology in civilian burn centers. Will develop a model to predict wound closure rate and time to full closure in burn patients.			
<i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Project 840 funding for Combat Critical Care Engineering research area increased to accommodate maturing technologies.			
Accomplishments/Planned Programs Subtotals	18.631	19.716	19.785

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>				Project (Number/Name) 945 / <i>BREAST CANCER STAMP PROCEEDS</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
945: <i>BREAST CANCER STAMP PROCEEDS</i>	-	0.594	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.594

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 2017	FY 2018	FY 2019
Title: Breast Cancer Stamp Proceeds	0.594	-	-
Description: This is a Congressional Interest Item.			
Accomplishments/Planned Programs Subtotals	0.594	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) 97T / <i>NEUROTOXIN EXPOSURE TREATMENT</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>97T: NEUROTOXIN EXPOSURE TREATMENT</i>	-	16.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.000

Note
Congressional increase for Peer-Reviewed Neurotoxin Exposure Treatment Parkinson's Research Program

A. Mission Description and Budget Item Justification
Congressional Interest Item funding for Neurotoxin Exposure Treatment.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018
Congressional Add: Peer-Reviewed Neurotoxin Exposure Treatment Parkinsons Research Program	16.000	-
FY 2017 Accomplishments: N/A		
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

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>				Project (Number/Name) ET5 / <i>Adv Tech Dev in Clinical & Rehabilitative Medicine</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
ET5: <i>Adv Tech Dev in Clinical & Rehabilitative Medicine</i>	-	11.207	9.958	9.015	-	9.015	2.663	2.582	3.108	3.168	0.000	41.701

A. Mission Description and Budget Item Justification

This project supports basic research on experimental models that are developed to support in-depth trauma research studies. This project includes studies to understand the healing of burned or traumatically injured tissues including eye, bone, nerve, skin, muscle, organs and composite tissues. Such efforts will minimize lost duty time and provide military medical capabilities for post-evacuation restorative and rehabilitative care.

Research conducted in this project focuses on clinical and rehabilitative medicine.

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Clinical and Rehabilitative Medicine	11.207	9.958	9.015
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 2018 Plans: Advance early human clinical trials to ensure the safety and efficacy of an ocular bandage designed to rescue vision post-injury. Conduct pre-clinical investigation of engineered skin substitutes for regeneration of functional skin without scarring. Conduct pre-clinical trials of devices for repairing traumatic injury to craniofacial and extremity tissues. Evaluate candidate biological therapies and drugs for reduced need of immunosuppressive (inhibition of the immune response) therapies following hand and face transplants. Advance translation of candidate technologies and biologics that create a wound environment more conducive to bone healing.			
FY 2019 Plans: Will conduct advanced pre-clinical trials to ensure the safety and effectiveness of an ocular bandage designed to rescue vision post-injury. Will continue pre-clinical investigation of engineered skin substitutes for regeneration of functional skin without			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) ET5 / <i>Adv Tech Dev in Clinical & Rehabilitative Medicine</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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 down-select identified candidate technologies and biologics that create a wound environment more conducive to bone healing.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Decrement due to change in priority of Regenerative Medicine and Sensory Systems intramural efforts. New Task Area created for Battlefield Pain Management to accelerate research of several potential novel drugs for elimination of acute and battlefield pain.</p>				
Accomplishments/Planned Programs Subtotals		11.207	9.958	9.015
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>			Project (Number/Name) MM2 / <i>MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)</i>				
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
MM2: <i>MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)</i>	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

Note

Congressional increase for Peer-reviewed military burn research.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Advanced Technology Initiatives.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Military Burn Trauma Research Program	8.000	-
FY 2017 Accomplishments: N/A		
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

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>				Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
MM3: <i>Warfighter Medical Protection & Performance</i>	-	20.194	20.218	16.908	-	16.908	17.323	18.697	20.030	20.430	0.000	133.800

Note

FY19 the Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring) title changes to Physiological Health. In FY19 the Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments title changes to Environmental Health & Protection.

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:

The four main thrust areas are:

- (1) Physiological Health,
- (2) Environmental Protection,
- (3) Injury Prevention and Reduction
- (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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring)	5.629	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. Starting in FY2019 this effort moves to Physiological Health.			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2018 Plans:</i> Evaluate the impact of nutritionally optimized ration items on body composition and physiological status in Warfighters. 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. 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. Deliver a testable Cold Weather Ensemble Decision Aid (CWEDA), to compare different clothing ensembles for predicting cold weather endurance. 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. 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.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> In FY19, reduced funding for Physiological Health and Environmental Protection (Sleep Research/Environmental Monitoring) is due to: 1) movement of funding for Nutrition & Weight Balance, Nutritionally Optimized Food Products for an Expeditionary Force, Warfighter Physical Performance, Optimizing Mental Acuity STO, Cognitive Health & Performance to Physiological Health in order to reduce the number of R-Form Research Areas addressing Physiological Health; 2) movement of funding for Warfighter Physical Performance to Environmental Health and Protection in order to reduce the number of R-Form Research Areas addressing Environmental Health; 3) movement of funding for Blunt, Blast & Accelerative Injury to Injury Prevention & Reduction in order to reduce the number of R-Form Research Areas addressing Injury Prevention & Reduction.</p>			
<p><i>Title:</i> Physiological Health</p> <p><i>Description:</i> This effort supports and matures laboratory prototypes, nutritional formulations and interventions, and decision aids for the validation of physiological status and prediction of Soldier performance in extreme environments.</p> <p><i>FY 2019 Plans:</i> Will evaluate interventions to mitigate sleep loss and fatigue and improve individual and team performance in operational settings, including multi-domain battle scenarios. Will demonstrate effectiveness of transcranial electrical stimulation of the prefrontal cortex for enhancing learning through the consolidation of emotional memories. Will evaluate the utility and effectiveness of transcranial direct current electrical stimulation technologies as neurocognitive interventions for the enhancement of the recuperative sleep</p>	-	-	3.702

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
and the development of operationally relevant sleep strategies. Will validate dietary interventions for promoting satisfaction and healthy eating in dining facilities to ensure optimal health and performance.				
FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, funding for Physiological Health is increased due to 1) movement of funding for Nutrition & Weight Balance, Nutritionally Optimized Food Products for an Expeditionary Force, Optimizing Mental Acuity and Cognitive Health & performance to this task; 2) reduced funding for Nutrition & Weight balance due to realignment from this task to the Nutritionally Optimized Food Products for an Expeditionary Force STO; 3) increased funding for the Nutritionally Optimized Food Products for an Expeditionary Force STO due to realignment of funds from Nutrition & Weight Balance; 4) increased funding for Optimizing Mental Acuity due to normal progression and completion/closeout of the STO; 5 increased funding for Cognitive Health & Performance due to introduction and alignment of funds to a new subtask.				
Title: Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments.		3.900	2.953	-
Description: This effort supports and matures 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. Starting in FY19 this effort is combined into Environmental and Protection.				
FY 2018 Plans: Provide validated evidence-based practice recommendations for biomarkers of physiological adaptation and mathematical models for optimizing health and performance against combinations of environmental threats. 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. Develop a mobile application for identifying megacity chemical threats and adverse health effects and informing Command decisions, Integrate patented skin temperature feedback technology into current microclimate cooling system. Improve cooling efficiency by increasing the microclimate cooling surface area in direct contact with skin.				
FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, funding for Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments is reduced due to movement of funding for Heat, Cold & Terrestrial Altitude to Environmental Health & Protection in order to reduce the number of R-Form Research Areas addressing Environmental Health and Protection.				
Title: Environmental Health & Protection		-	-	5.804

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Description: This effort supports and matures non-invasive technologies, decision-aid tools, and models to enhance Soldier protection and sustainment across the operational spectrum. The aim is to provide the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimized physical and cognitive performance during cold-weather and hot-humid operations. This effort tests a computational algorithm for identifying latent hepatic, renal, and cardiac injury after toxic metal and/or toxic industrial chemical exposure during training and operations. This effort tests models to predict likelihood of neurologic and/or physical injury as a result of hazardous exposure(s) in the operational environment.</p> <p>FY 2019 Plans: Will provide evidence-based practice recommendations for protecting health and performance against combined environmental threats. Will develop enhanced next generation of predictive algorithms for incorporation into wearable sensor systems. Will transition the Cold Weather Ensemble Decision Aid (CWEDA) to PEO Soldier and US Army Alaska, for assessing and comparing different clothing ensembles for predicting cold weather endurance. Will validate prototype focused heating capability to improve manual dexterity for individuals in cold weather operations. Will transition prototypes such as the Heat Strain Decision Application (HSDApp) to JPEO-Chemical Biological Defense, PEO Soldier, and Army Public Health Center. Will evaluate modeling paradigms which identify population subgroups at increased risk of military operational exposure-related health responses. Will develop and enhance a next generation of health, readiness and performance predictive algorithms for incorporation into wearable sensors systems. Will validate assessment technologies/tools for physical and/or neurological health outcomes in operational environments.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, increased funding for Environmental Health and Protection is due to: 1) movement of funding for Heat, Cold & Terrestrial Altitude from Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments, Operational Exposure Dosimetry for Neurological and Physical Health (actually named Environmental Toxicant Exposure) from Health Research and Warfighter Physical Performance from Physiological Health and Environmental Protection (Sleep Research/Environmental Monitoring); 2) consistent funding for Heat, Cold & Terrestrial Altitude due to normal progression of the effort; 3) consistent funding for Environmental Toxicant Exposure due to normal progression of the effort; and 4) consistent funding for Warfighter Physical Performance due to normal progression of the effort.</p>				
Title: Injury Prevention and Reduction		4.718	5.299	4.227
<p>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, and land under a range of degraded visual environments and provide aeromedical</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>return to duty guidelines after neurosensory injury (deficits in the nervous system control of vision, hearing, taste, smell, and touch).</p> <p>FY 2018 Plans: Collect human middle ear reflex data to validate objective auditory injury risk models. Evaluate metrics that predict the type and severity of blast-induced eye and visual pathway injuries. Provide improved auditory protection standards and guidelines for speech discrimination, attenuation, and localization properties of active and passive hearing protection systems. 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. Provide improved aeromedical standards for human performance during degraded visual environments. Evaluate pilot metrics under selected visual and physiological stress conditions. Evaluate how components of older tasks contribute to musculoskeletal injury and incorporate these data into predictive musculoskeletal injury risk models for improved injury prevention guidance. Finalize and publish the Return to Duty (RTD) Toolkit and distribute it to clinical providers to enable RTD decisions. 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.</p> <p>FY 2019 Plans: Will use human head impact/blast and clinical diagnosis of mild traumatic brain injuries (mTBIs) within the training environment (e.g., airborne operations, combatives) to improve and validate mTBI prediction algorithms that can be used for the development of improved head protection systems. Will validate musculoskeletal injury risk models with data collected from training and theatre. Will also determine cervical spine injury risk (Head Supported Mass Criteria) leveraging methods used by personal protective equipment developers to measure impact of clothing and equipment such as the Army's Load Effects Assessment Program (LEAP). Will evaluate and extend current auditory injury risk models to include auditory nerve damage and begin to evaluate with advanced animal models. Will improve current guidance using results from computational models and animal studies for protective eyewear against blast threats that will inform the Authorized Protective Eyewear List (APEL). Validate medical requirements that will inform Army Aviation fitness for duty requirements</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, funding for Injury Prevention and Reduction decreased due to: 1) movement of funding for Blunt, Blast, & Accelerative Injury to this task; 2) eliminated funding for Sensory Performance, Injury & Protection in order to accelerate new priority programs within MRMC; 3) consistent funding for Musculoskeletal Injury due to normal progression of the effort; 4) reduced funding for Blunt, Blast & Accelerative Injury due to realignment of funds to a new sub-task within another CMI task; and 5) increased funding for Aircrew Health and Performance due to revised scope of the effort.</p>				
Title: Psychological Health and Resilience		4.956	3.667	3.175

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: 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. Validate at least one novel neurocognitive target of aggression and a corresponding intervention tool. Develop and test a gaming-based neurocognitive optimization application. 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).</p> <p>FY 2019 Plans: Will refine the Unit Behavioral Health Needs Assessment tool with metrics from combat operations, non-combat operations, and garrison. Will evaluate an evidence-based, team-level intervention that positively influences Soldier outcomes related to behavioral health, resilience, and unit readiness through the regulation of small-team dynamics (e.g., group effect). Will evaluate effectiveness of experimental compounds for PTSD symptom alleviation. Will continue characterizations of PTSD subtyping and collection of treatment associated blood specimens for development of precision medicine approaches to PTSD treatment. Will transition assessment tools to providers to augment return-to-duty decisions. Will transition to behavioral health providers a web-based model for dissemination of research findings addressing evidence-based PTSD treatments.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, slightly reduced funding for Psychological Health and Resilience is due to: 1) consistent funding for Behavioral Health, Wellness & Resilience due to normal progression of the effort; 2) reduced funding for Psychiatry & Clinical Psychology Disorders due to realignment of funds to new high priority programs within MRMC.</p>				
<p>Title: Health Research</p> <p>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</p>		0.991	1.085	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / <i>Medical Advanced Technology</i>	Project (Number/Name) MM3 / <i>Warfighter Medical Protection & Performance</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>a Warfighters exposure to environmental contamination and/or toxic substances, e.g. toxic industrial chemicals. Starting in FY19 this effort is combined into Environmental Health & Protection.</p> <p><i>FY 2018 Plans:</i> 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. 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. Evaluate longer-term neurological and/or physical health trajectories associated with operationally relevant exposures during military service.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> In FY19, reduced funding for Health Research due to movement of funding for Operational Exposure Dosimetry for Neurological and Physical Health to Environmental Health and wrapped up in the Environmental Toxicant Exposure CMI.</p>				
Accomplishments/Planned Programs Subtotals		20.194	20.218	16.908
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603003A / <i>Aviation Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	111.654	160.746	124.958	-	124.958	111.607	113.305	114.917	115.413	0.000	852.600
313: <i>Adv Rotarywing Veh Tech</i>	-	80.834	147.882	113.815	-	113.815	86.849	62.581	63.806	65.082	0.000	620.849
436: <i>Rotarywing MEP Integ</i>	-	8.063	6.767	7.424	-	7.424	20.964	46.855	47.162	46.303	0.000	183.538
447: <i>ACFT Demo Engines</i>	-	4.757	6.097	3.719	-	3.719	3.794	3.869	3.949	4.028	0.000	30.213
BAT: AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	-	18.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.000

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 and, structures. Project 436 matures, integrates and demonstrates air launched weapons systems, mission equipment packages to enable control of unmanned systems and advanced teaming capabilities. Project 447 matures and demonstrates affordable and efficient engines and drive trains.

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 for Research and Engineering S&T focus areas and the Army Modernization Strategy. Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603003A / <i>Aviation Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	94.280	160.746	127.723	-	127.723
Current President's Budget	111.654	160.746	124.958	-	124.958
Total Adjustments	17.374	0.000	-2.765	-	-2.765
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	18.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	3.000	-			
• SBIR/STTR Transfer	-3.581	-			
• Adjustments to Budget Years	-	-	-2.765	-	-2.765
• FFRDC	-0.045	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*

Congressional Add: *Future Vertical Lift*

Congressional Add: *Ballistic seating system*

Congressional Add Subtotals for Project: BA7

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	11.000	-
	7.000	-
Congressional Add Subtotals for Project: BA7	18.000	-
Congressional Add Totals for all Projects	18.000	-

Change Summary Explanation

FY17 Congressional increase in project BA7 Aviation Advanced Technology Initiatives for ballistic seating system and Future Vertical Lift (FVL)

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
313: Adv Rotarywing Veh Tech	-	80.834	147.882	113.815	-	113.815	86.849	62.581	63.806	65.082	0.000	620.849

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 and robust airframe structures. 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 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 2017	FY 2018	FY 2019
Title: Platform Design & Structures Systems	56.342	120.355	83.569
Description: Provide demonstration of Future Vertical Lift (FVL) platform configurations that address multi domain battle capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed, range, payload, and reduced operating costs, to inform and reduce future aviation materiel acquisitions. Flight demonstrate operational capabilities of technology demonstrators.			
FY 2018 Plans:			
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. 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). 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, data model, supporting documentation and tools. 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). 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			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
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 2017	FY 2018	FY 2019
<p>architecture. Completion of source selection activities for the Capstone Demonstration and agreement awards to multiple vendors. Begin Mission System Architecture Capstone Demonstration.</p> <p>FY 2019 Plans: Will mature and demonstrate integrated, fastenerless advanced structural assemblies that enable future vertical lift platforms with crashworthy, damage tolerant, lightweight and sustainable solutions. Will continue flight demonstrations of two Joint Multi-Role (JMR) Technology Demonstrator (TD) 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 demonstrate advanced flight control technologies. Will demonstrate on a ground test stand 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 finalize development a mission systems architecture from a representative architecture specification using JCA, model-based engineering tools, virtual integration methods and open systems architecture in a Mission Systems Architecture Capstone Demonstration.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: FY19 was decreased from FY18 due to completion of expanded scope JMR TD efforts related to the development of advanced flight controls, two speed gearbox and individual blade control technology.</p>				
<p>Title: Rotors & Vehicle Management Systems</p> <p>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.)</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will conduct trade studies to identify reliable technologies that enable highly efficient aircraft performance throughout the flight envelope.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decreased funding from FY2018 to FY2019 to focus on Future Vertical Lift. Funding redirected to other high priority areas for Future Vertical Lift.</p>		3.941	3.172	1.342
<p>Title: Rotorcraft Drive Systems</p>		0.974	2.262	1.077

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
<p>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 Future Vertical Lift (FVL) platforms.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will continue fabrication of advanced multi-speed drive train hardware and initiate development testing of demonstrator hardware under the Next Generation Rotorcraft Transmission program to enable greater aircraft speed/range in support of Future Vertical Lift.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decreased funding from FY2018 to FY2019 de-scoped efforts in support of CH-47, Chinook. Remaining effort focused on FVL. Funding redirected to other high priority areas for Future Vertical Lift.</p>			
<p>Title: Survivability for Degraded Visual Environment (DVE) Operations</p> <p>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.</p> <p>FY 2018 Plans: Continue to refine Integrated Cueing Environment (ICE) design and to integrate new technology, including spatial aural cues and experiment in the flight environment. Conduct limited flight test of real time enroute path guidance from sensor data using Obstacle Field Navigation (OFN) algorithms.</p> <p>FY 2019 Plans: Will conduct multiple research focused trials and demonstrations while seeking opportunities to spin off and transition research to programs that will provide capability to the warfighter. Will physically integrate sensor fusion engine onto test aircraft and conduct engineering flight test of integrated system. Will implement approaches for multi ship networking and operations in DVE.</p>	7.214	9.000	17.005

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
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 2017	FY 2018	FY 2019
<p>Will conduct capstone demonstration in government SIL that validates optimal cueing symbology, sensor driven guidance, flight control configuration, and optimum presentation of sensor data through augmented and virtual reality.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Funding increase from FY18 to FY 19 to support DVE demonstration.</p>				
<p>Title: Aircraft & Occupant Survivability Systems</p> <p>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.</p> <p>FY 2018 Plans: Continue maturation of individual technologies that comprise the Aircraft and Aircrew Protection solution. Establish a virtual prototype of the integrated Aircraft and Aircrew Protection solution and initiate incremental verification testing. Refine aircraft integration and system level demonstration strategies. Continue the demonstration of efficient, low drag rotor and hub designs and technologies to allow for high speed flight. Mature rotorcraft threat protection capabilities including self-protection and engagement technologies.</p> <p>FY 2019 Plans: Will develop aircraft survivability correlator algorithms that take into account aircraft signatures, vulnerable areas, maneuverability, terrain, threat understanding, and available countermeasures to provide an appropriate response for an increased level of threat aircraft protection. Will develop ownship and team based survivability behaviors and continue integration of rotorcraft threat protection technologies.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease investment in integration and demonstration of novel countermeasures.</p>		8.724	9.196	7.822
<p>Title: Next Generation Tactical UAS Technology Demonstration (NGTUAS)</p> <p>Description: Develop and demonstrate transformational air vehicle technologies that overcome key barriers to meet the Army's future Unmanned Aircraft System (UAS) performance, survivability, and reliability requirements and operational capabilities. Work in this area is being done in coordination with efforts at AMRDEC Program Element (PE) 0602211A, Platform Design & Structures Technologies.</p> <p>FY 2019 Plans:</p>		-	-	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
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 2017	FY 2018	FY 2019
<p>Will refine air vehicle technologies maturation, integration and system level test and demonstration strategies. Will validate new design and assessment methodologies relevant to UAS-scaled platforms through demonstration. Will develop an informed Model Performance Specifications (MPS) and provide quantifiable metrics and key attributes for the NGTUAS.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: New start in FY19 for Next Generation Tactical UAS Technology Demonstration (NGTUAS)</p>				
<p>Title: Maintainability & Sustainability Systems</p> <p>Description: Enables highly reliable, low maintenance platforms that can survive un-sustained in the multi-domain battle space for extended periods. Integrates and demonstrates technology solutions comprising aircraft health state awareness, data driven sustainment approaches, and operationally durable designs with minimal operating and sustainment costs.</p> <p>FY 2018 Plans: Initiate effort to develop an embedded and networked rotorcraft sustainment capability. 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. Identify and select hardware and software for integration into a sustainment rig and/or SIL test.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease in funding from FY2018 to FY2019: In FY19, funding redirected to other high priority areas for Future Vertical Lift.</p>		3.639	3.897	-
Accomplishments/Planned Programs Subtotals		80.834	147.882	113.815
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
436: Rotarywing MEP Integ	-	8.063	6.767	7.424	-	7.424	20.964	46.855	47.162	46.303	0.000	183.538

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 and integrated threat protection 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.

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Unmanned and Optionally Manned Systems	8.063	6.767	5.857
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 2018 Plans: 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. Demonstrate software integration within an open systems, modular architecture based system.			
FY 2019 Plans: Will continue the development, integration and demonstration of third party vendor software and advanced human machine interface technologies in simulations to enable increased manned and unmanned teaming capabilities and to inform crew station			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
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 2017	FY 2018	FY 2019
development programs for both legacy fleet aircraft upgrades and future aircraft procurements. Will continue to demonstrate software and hardware integration within an open systems, modular architecture based system.				
FY 2018 to FY 2019 Increase/Decrease Statement: Funding in FY19 will be decreased to other high priority areas for Future Vertical Lift.				
Title: Advanced Teaming		-	-	1.567
Description: Develop and demonstrate teaming behaviors and autonomous decision making for mixed platform formations in combined arms operations. Focus areas include: resilient autonomous algorithms; self-organizing unmanned formations; distributed command and control; and navigation.				
FY 2019 Plans: Develop and mature teaming algorithm development focused on resupply, reconnaissance and surveillance mission areas. Integrate and demonstrate sensor and processing technology to support teaming behavior for heterogeneous platform formations.				
FY 2018 to FY 2019 Increase/Decrease Statement: This is a new start effort in FY19.				
Accomplishments/Planned Programs Subtotals		8.063	6.767	7.424
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603003A / Aviation Advanced Technology	Project (Number/Name) 447 / ACFT Demo Engines
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
447: ACFT Demo Engines	-	4.757	6.097	3.719	-	3.719	3.794	3.869	3.949	4.028	0.000	30.213

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 and drive systems for vertical lift aircraft and Unmanned Aerial Systems (UAS) vehicles. This Project supports Army modernization by demonstrating mature technologies for lighter turbine engines and drives that provide increased power, increased fuel efficiency, improved sustainability and reduced maintenance. These advanced engine designs and drives will significantly improve the overall aircraft performance characteristics and reduce the logistical footprint of Army 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Alternative Concept Engine (ACE)	4.757	6.097	3.719
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 manned and unmanned platforms. The alternative concept engine technology demonstrations planned for this effort are applicable to current and future platforms. Work in this project is coordinated with efforts in PE 0602211A, Project 47A.			
FY 2018 Plans: Complete detailed design and initiate fabrication of innovative/adaptive engine component technologies such as variable speed power turbine. Perform component design integration efforts in preparation for full system demonstration.			
FY 2019 Plans: Will continue fabrication and initiate component test of innovative/adaptive engine component technologies such as variable speed power turbine. Will continue component design integration efforts and perform fabrication of hardware for full system demonstration to enable greater aircraft performance and engine durability in support of Future Vertical Lift.			
FY 2018 to FY 2019 Increase/Decrease Statement: In FY19, Funding redirected to other high priority areas for Future Vertical Lift.			
Accomplishments/Planned Programs Subtotals	4.757	6.097	3.719

C. Other Program Funding Summary (\$ in Millions)

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603003A / Aviation Advanced Technology	Project (Number/Name) 447 / ACFT Demo Engines

C. Other Program Funding Summary (\$ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
BA7: AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	-	18.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.000

Note
Congressional increases for Ballistic seating system (\$7M); Future Vertical Lift (\$11M)

A. Mission Description and Budget Item Justification
Congressional Interest Item funding for Aviation advanced technology development.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018
Congressional Add: Future Vertical Lift	11.000	-
FY 2017 Accomplishments: N/A		
Congressional Add: Ballistic seating system	7.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	18.000	-

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
N/A

E. Performance Metrics
N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	198.245	84.079	102.686	-	102.686	112.213	119.085	97.152	88.655	0.000	802.115
232: <i>Advanced Lethality & Survivability Demo</i>	-	44.320	54.977	70.410	-	70.410	76.071	81.479	59.065	49.820	0.000	436.142
43A: <i>ADV WEAPONRY TECH DEMO</i>	-	132.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	132.000
L96: <i>High Energy Laser Technology Demo</i>	-	17.179	24.096	26.253	-	26.253	30.169	30.035	30.736	31.350	0.000	189.818
L97: <i>Smoke And Obscurants Advanced Technology</i>	-	4.746	5.006	6.023	-	6.023	5.973	7.571	7.351	7.485	0.000	44.155

A. Mission Description and Budget Item Justification

This Program Element (PE) matures weapons and munitions components/subsystems and demonstrates lethal weapons systems with potential to increase force application and force protection capabilities across the spectrum of operations. Project 232 focuses on affordable delivery of scalable effects for kinetic 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 mobile demonstrators 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 and supports the Chief of Staff of the Army's (CSA's) future capability opportunities for leap-ahead technology for directed energy.

The work in this PE is performed by the Army Research, Development and Engineering Command (RDECOM) and the United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	68.714	84.079	85.808	-	85.808
Current President's Budget	198.245	84.079	102.686	-	102.686
Total Adjustments	129.531	0.000	16.878	-	16.878
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	132.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.438	-			
• Adjustments to Budget Years	-	-	16.878	-	16.878
• FFRDC	-0.031	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 43A: ADV WEAPONRY TECH DEMO

- Congressional Add: *Program Increase*
- Congressional Add: *Weapons mounts*
- Congressional Add: *Accelerate extended range cannon artillery*
- Congressional Add: *Laser defense system for small UAS*
- Congressional Add: *Weapon effectiveness in urban engagement*
- Congressional Add: *Armament system integration*
- Congressional Add: *High energy laser research*

Congressional Add Subtotals for Project: 43A

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	42.000	-
	2.500	-
	21.000	-
	15.000	-
	8.500	-
	5.000	-
	38.000	-
Congressional Add Subtotals for Project: 43A	132.000	-
Congressional Add Totals for all Projects	132.000	-

Change Summary Explanation

FY17 Congressional increase in project 43A Adv Weaponry Tech Demo for small Unmanned Aerial System (UAS), high energy laser research (HEL), and survive and project indirect fires. FY19 funding increased in this PE to address higher priority Army Modernization efforts in the area of Long Range Precision Fires.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
232: Advanced Lethality & Survivability Demo	-	44.320	54.977	70.410	-	70.410	76.071	81.479	59.065	49.820	0.000	436.142

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for affordable precision munitions including advanced energetic materials and 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Ground Based Networked Munitions Technologies</p> <p>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.</p>	1.242	-	-
<p>Title: Cluster Munitions Replacement Acceleration</p> <p>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.</p> <p>FY 2018 Plans: 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 undergo extensive laboratory testing to ensure arming in proper environments and ensure fuzing reliability growth.</p> <p>FY 2019 Plans: Will continue to conduct ballistic testing with the objective of a TRL6 demonstration at the end of FY19 to validate performance of critical components such as fuzing and warheads; will optimize tests to capture as much pertinent data as possible to inform requirements generation; will mature and demonstrate the performance of integrated components through ballistic testing to show improvements over legacy systems and serve as a down-select to a tactical design; will generate documentation capturing the</p>	8.434	8.000	8.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
cluster munition effort relevant data to facilitate transition to PEO/PM in support of the Cannon-Delivered Area Effects Munitions (C-DAEM) Program of Record.				
<p>Title: Medium Caliber Weapon Systems</p> <p>Description: This effort matures and demonstrates advanced medium caliber ammunition, weapon, fire control, and Ammunition Handling Systems (AHS) 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.</p> <p>FY 2018 Plans: Validate weapon system integration with AHS and 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 provides 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.</p> <p>FY 2019 Plans: Will mature fire control software to support 50mm weapon system integration; will integrate complete weapon system into a test bed turret to mature and demonstrate test bed turret control systems and fire control ballistic solutions for optimized lethal performance; will validate simulated system analysis data against various target sets and provide feedback into fire control solutions for integrated system optimization; will complete an integrated (TRL 6) 50mm demonstration to validate the integrated system accuracy and lethal performance.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to component technologies mature and ready for a fixed stand integrated demonstration in FY19.</p>		15.291	18.700	10.015
<p>Title: Scale-up of Energetic Materials</p> <p>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.</p> <p>FY 2018 Plans:</p>		-	1.400	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will continue to qualify energetic materials for complete material characterization; will demonstrate high-energy, reduced sensitivity melt-pour formulations for enhanced fragmentation representative munitions.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase due to completion of energetic materials and load projectiles characterization with new formulations to demonstrate enhanced lethal effects.</p>				
<p>Title: Active Protection Armament Technologies</p> <p>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.</p> <p>FY 2018 Plans: 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 include: threat detection, tracking, signal processing (Fire Control/Modular APS Controller (MAC)) and threat defeat of rocket propelled grenades (RPGs) and recoilless rifles. Optimize interface specifications to support layered demonstrator of MAPS compliant hard kill component.</p> <p>FY 2019 Plans: Will conduct demonstrations of mature Modular APS Framework (MAF)-compliant HKCM subsystems to validate modularity and performance optimization; provide mature technologies for integration in a MAF-compliant HKCM subsystem for a layered demonstration of combined Soft Kill and Hard Kill component technologies.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to Hard Kill Counter Measure (HKCM) maturation and availability for demonstration.</p>		5.973	7.250	4.500
<p>Title: Long Range Gun Technology</p> <p>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.</p>		1.611	1.700	4.778

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p><i>FY 2018 Plans:</i> 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.</p> <p><i>FY 2019 Plans:</i> Will optimize the design of secondary weapon subsystems such as scavenge systems, elevation, equilibration, automated breech operation, and thermal warning technologies; will demonstrate compact automatic ammunition handling and loading systems with armaments using emerging charge and projectile technologies for improved range and rate of fire performance.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Increase due to finalization of armament system components as well as automatic ammo loading technologies in time for a demonstration</p>				
<p><i>Title:</i> Affordable Precision Technologies</p> <p><i>Description:</i> 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.</p> <p><i>FY 2018 Plans:</i> Demonstrate the integrated image based terminal guidance system on an indirect fire platform. The system demonstration shows the end to end functionality of the Guidance, Navigation, and Control (GNC) system?s ability to maintain <10m precision capability in a GPS denied environment. After this demonstration series, a Technical Readiness Assessment (TRA) is conducted to verify system at TRL-6.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> N/A; effort completed in FY18.</p>		1.911	3.000	-
<p><i>Title:</i> Counter-Unmanned Aviation System (C-UAS) Technology</p> <p><i>Description:</i> This effort matures and demonstrates C-UAS technologies designed to encompass the entire kill chain including detection, tracking, classification, and kinetic defeat of UAS for point defense and mobile applications.</p> <p><i>FY 2018 Plans:</i> 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</p>		2.581	1.700	3.740

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>and validate the fire control radar and software for the UAS kill chain; update modeling and simulation tools based on collected data.</p> <p>FY 2019 Plans: Will demonstrate integrated small (0.50) caliber counter UAS technologies at a live fire event; will demonstrate the ability to track outgoing rounds and incorporate data into fire control solution; will mature and demonstrate guided medium caliber armament system initially created through DARPA effort to search, identify, track and intercept maneuvering threats; will improve fire control and guidance algorithms for C-UAS/Air Defense scenarios; will optimize kinetic armament system components design for integration on a ground vehicle platform.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase due to fund efforts to validate radar technology capabilities and optimize integration of C-UAS system into a ground platform.</p>				
<p>Title: Accelerated Extended Range Munition Suite</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will mature and evaluate long range unitary artillery projectile components in the areas of precision, counter-measure, and payload technologies; will conduct system modeling and simulation to assess improved projectile performance by these technologies when fired from Extended Range Cannon Artillery (ERCA) cannon tube; will develop and test integration concepts and algorithms and refine guidance and navigation system design concepts at extended ranges in GPS-denied environments; will mature component development for cargo and effects munition compatible with legacy and ERCA in the following areas: 1) dispensing techniques and sensor for area effects to service precisely located targets ; 2) optimal formulations and characteristics for smoke and illumination payloads that maximize effectiveness ; and 3) survivability of cannon-launched terrain shaping munition for maximum area denial effects; will conduct critical design review of component technologies; will perform test and evaluation of key enabling component technologies; refine concepts for system integration; and will mature modeling and simulation concepts for subsequent validation.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		2.676	3.134	22.872

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Increase to allow higher priority Army acceleration efforts in the area of Long Range Precision Fires.				
<p>Title: Fuze and Power Technology for Munitions</p> <p>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.</p> <p>FY 2018 Plans: 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 continue to support the Joint Munitions Program TCG-5 and TCG-10 and the Joint Fuze Technology Program (JFTP).</p> <p>FY 2019 Plans: Will conduct live fire (Mann Barrel) demonstration of several 30x173mm or Light Weight 50mm airburst rounds that demonstrate an increase in range accuracy when rounds are corrected; will conduct live fire demonstration of a 40mm round using a pre-timed airburst function and low cost Electronic Safe and Arming (ESAD); will conduct demo of the Precision Guided Kit in a 155mm projectile using the Next Gen Large Cal Setter; and will conduct demo of the extended run time thermal battery.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to integrated demo of TRL 6 enabling technologies for airburst, fuze setter, and thermal battery.</p>		1.720	2.860	2.434
<p>Title: Advanced Small Arms Ballistic System</p> <p>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.</p>		1.830	-	-
<p>Title: Enhanced Tactical Multi-Purpose (ETMP) Hand Grenade</p> <p>Description: This effort develops a multi-purpose selectable lethal hand grenade that produces either fragmentation or blast overpressure effects.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		1.051	1.000	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
N/A; effort completed in FY18.				
<p>Title: Extended Range Armament and Fire Control Integration</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will optimize enhanced light weight structures for cannon and mount components, will integrated controls and ammunition handling system; will exploit projectile tracking and guidance technologies to provide accuracy at extended ranges in global positioning system (GPS)-denied environments; will continue to mature and demonstrate advanced and common fire control hardware and software to increase accuracy and reduce logistic burden.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase due to maturation of armament system technologies and fire control hardware and software.</p>		-	3.096	3.559
<p>Title: Aviation Armament System Technologies</p> <p>Description: This effort matures and demonstrates armament solutions adaptable to current aviation and future vertical lift applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will mature and demonstrate a Technology Readiness Level (TRL) 6 airburst munition with a selectable proximity airburst - point detonation fuze for the Apache AH-64E; will optimize critical ammunition technologies in areas of power generation, proximity sensor, and smart multi-mode fuzing to support the Apache AH-64E.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		-	1.237	2.512

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Increase due to efforts on the airburst ammunition and the proximity fuze.				
<p>Title: Leader-Soldier Effects Tool Suite</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort was realigned to higher priority Army Modernization efforts.</p>		-	0.700	-
<p>Title: Advanced Small Arms Fire Control</p> <p>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.</p> <p>FY 2018 Plans: Mature and demonstrate optimized architecture for the precision-optical wind system; 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: N/A; effort completed in FY18.</p>		-	1.200	-
<p>Title: Extended Line of Site Munition (ELOS)</p> <p>Description: This effort demonstrates a 120mm Tank fired ELOS Munition that counters the growing Anti-Tank Guided Missile (ATGM) threat at extended line of sight ranges beyond current capability.</p> <p>FY 2019 Plans: Will optimize an ELOS Munition Air Frame (projectile) design to include fin stabilization element, Seeker Unit, Guidance Electronics Unit (GEU), Canard Actuation System (CAS), Warhead, GNC (Guidance, Navigation, and Control) Software, Target</p>		-	-	6.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 232 / <i>Advanced Lethality & Survivability Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
Acquisition and Tracking Software, and Propulsion system; will integrate these components to validate their performance through a preprogram maneuver cannon fired experiment. FY 2018 to FY 2019 Increase/Decrease Statement: N/A; effort begins in FY19.			
Accomplishments/Planned Programs Subtotals	44.320	54.977	70.410

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
43A: ADV WEAPONRY TECH DEMO	-	132.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	132.000

Note

Congressional increases for Program increase (\$42M); Weapons mounts (\$2.5M); Accelerate extended range cannon artillery (\$21M); Laser defense system for small UAS (\$15M); Weapon effectiveness in urban engagement (\$8.5M); Armament systems integration (\$5M); High energy laser research (\$38M)

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Advanced Weaponry Technology development.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase <i>FY 2017 Accomplishments:</i> N/A	42.000	-
Congressional Add: Weapons mounts <i>FY 2017 Accomplishments:</i> N/A	2.500	-
Congressional Add: Accelerate extended range cannon artillery <i>FY 2017 Accomplishments:</i> N/A	21.000	-
Congressional Add: Laser defense system for small UAS <i>FY 2017 Accomplishments:</i> N/A	15.000	-
Congressional Add: Weapon effectiveness in urban engagement <i>FY 2017 Accomplishments:</i> N/A	8.500	-
Congressional Add: Armament system integration <i>FY 2017 Accomplishments:</i> N/A	5.000	-
Congressional Add: High energy laser research <i>FY 2017 Accomplishments:</i> N/A	38.000	-
Congressional Adds Subtotals	132.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) 43A / <i>ADV WEAPONRY TECH DEMO</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
Remarks		
D. Acquisition Strategy N/A		
E. Performance Metrics N/A		

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>				Project (Number/Name) L96 / <i>High Energy Laser Technology Demo</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
L96: <i>High Energy Laser Technology Demo</i>	-	17.179	24.096	26.253	-	26.253	30.169	30.035	30.736	31.350	0.000	189.818

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. SSL technology has demonstrated 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 and supports the Chief of Staff of the Army's (CSA's) future capability opportunities for leap-ahead technology for directed energy.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Laser System Ruggedization	4.216	12.961	19.138
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 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 High Energy Laser (HEL) weapon system. This IDR matures the design of the HEL system as part of the HEL Tactical Vehicle Demonstrator effort.			
FY 2019 Plans: Will complete Critical Design Review (CDR) for the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD). This review will complete the design of the system and includes details of the laser subsystems interfaces with the platform, a Family of Medium Tactical Vehicles (FMTV). Will begin ruggedizing and assembling thermal management, electrical power, and battle management			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) L96 / <i>High Energy Laser Technology Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
subsystems for the HEL TVD based on designs of the laser and beam control system designs developed under PE 0602307A, Project 042. FY 2018 to FY 2019 Increase/Decrease Statement: Increase is due to additional ruggedization effort on HEL TVD laser developed under 62307/042 - High Efficiency Laser Development.				
Title: High Energy Laser Systems Integration and Mobile Demonstrations Description: This effort integrates a 50 kW-class laser from Project 042 into the existing mobile laser demonstrator platform that includes the ruggedized Beam Control System (BCS) built under the High Energy Laser (HEL) 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 2018 Plans: Complete planning for the 50 kW-class High Energy Laser Mobile Test Truck (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. FY 2019 Plans: Will complete analysis of the FY18 HELMTT 50 kW-class system risk reduction demonstration. Will consolidate lessons learned from HELMTT demonstration to apply to High Energy Laser Tactical Vehicle Demonstrator (HEL TVD). Will begin preliminary planning for HEL TVD demonstration and define target requirements for FY22 demonstration. Will initiate system demonstration performance prediction analysis based on HEL TVD predicted performance parameters. FY 2018 to FY 2019 Increase/Decrease Statement: Decrease is due to the High Energy Laser Mobile Test Truck FY18 demonstration is complete at end of FY18. This demonstration provides a knowledge point for the HEL TVD development. The HEL TVD FY22 demonstration effort is not initiated until FY21.		12.963	11.135	7.115
Accomplishments/Planned Programs Subtotals		17.179	24.096	26.253
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) L96 / <i>High Energy Laser Technology Demo</i>

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) L97 / <i>Smoke And Obscurants Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>L97: Smoke And Obscurants Advanced Technology</i>	-	4.746	5.006	6.023	-	6.023	5.973	7.571	7.351	7.485	0.000	44.155

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Obscurant Enabling Technologies</p> <p>Description: This effort demonstrates the dissemination of new and advanced obscurants. This effort will support Modular Active Protection System (MAPS) in 0603005/221.</p> <p>FY 2018 Plans: Redesign and improve vehicle protection grenade cloud characteristics. Initiate particulate materials dissemination studies for the Screening Obscuration Module generator system. Explore obscurants? ability to defeat anti-tank guided missiles.</p> <p>FY 2019 Plans: Will assess existing and emerging obscurants and their dissemination in vehicle protection grenades. Will initiate design efforts to integrate with MAPS system.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Significant demonstrations will occur during this FY, as a result a significantly larger amount of funding is needed.</p>	0.788	0.866	1.873
<p>Title: Forensic Analysis of Explosives</p>	2.033	2.134	2.152

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / <i>Weapons and Munitions Advanced Technology</i>	Project (Number/Name) L97 / <i>Smoke And Obscurants Advanced Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Description: This effort demonstrates improved point and stand-off detection of explosives and homemade explosive (HME) precursors.</p> <p>FY 2018 Plans: Refine prototype Chemical Fingerprint Imaging System (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). Evaluate spatially offset Raman prototype for the forensic analysis of explosive materials in opaque containers.</p> <p>FY 2019 Plans: Will revise and develop 2nd Generation Chemical Fingerprint Imaging System (CFIS) prototype showing optimized detection performance including improved detection of trace explosive residues and other molecules on curved surfaces and detection algorithm for discrimination of target materials on complex backgrounds.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Inflation</p>				
<p>Title: Detection Mechanisms for Contaminants</p> <p>Description: This effort demonstrates improved point and standoff detection of a wide range of hazardous materials.</p> <p>FY 2018 Plans: Improve standoff detection capabilities for homemade and military explosives by developing advanced Raman detection algorithm emphasizing detection of trace explosives on surfaces. Conduct analysis of alternative solutions for solid state laser sources and spectrometer designs to enhance detection sensitivity. Integrate hardware and software improvements into existing commercial system for subsequent testing.</p> <p>FY 2019 Plans: Will investigate UV laser alternatives and spectrometer for trace explosives standoff detection system. Will conduct technology assessment of trace explosives sensors through a field trial to evaluate sensor sensitivity and technical performance analysis.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Demonstration of existing prototypes to evaluate sensor sensitivity will require a slightly reduced amount of S&T Funds.</p>		1.925	2.006	1.998
Accomplishments/Planned Programs Subtotals		4.746	5.006	6.023
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / Weapons and Munitions Advanced Technology	Project (Number/Name) L97 / Smoke And Obscurants Advanced Technology

C. Other Program Funding Summary (\$ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	163.501	125.537	119.739	-	119.739	118.783	119.365	122.973	127.885	0.000	897.783
221: <i>Combat Veh Survivablty</i>	-	60.877	66.436	60.084	-	60.084	57.001	56.439	59.065	60.247	0.000	420.149
441: <i>Combat Vehicle Mobilty</i>	-	37.588	33.447	26.508	-	26.508	27.352	29.316	30.090	33.107	0.000	217.408
497: <i>Combat Vehicle Electro</i>	-	6.845	7.162	7.215	-	7.215	7.359	7.506	7.662	7.815	0.000	51.564
515: <i>Robotic Ground Systems</i>	-	12.191	18.492	25.932	-	25.932	27.071	26.104	26.156	26.716	0.000	162.662
533: <i>Ground Vehicle Demonstrations</i>	-	46.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.000

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 Army Research Development and Engineering Command (RDECOM)

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	122.132	125.537	121.013	-	121.013
Current President's Budget	163.501	125.537	119.739	-	119.739
Total Adjustments	41.369	0.000	-1.274	-	-1.274
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	46.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.573	-			
• Adjustments to Budget Years	-	-	-1.274	-	-1.274
• FFRDC	-0.058	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 533: *Ground Vehicle Demonstrations*

Congressional Add: *Program Increase*

Congressional Add: *Advanced Water Harvesting Technology*

Congressional Add: *Combat Vehicle Weight Reduction Initiative*

Congressional Add Subtotals for Project: 533

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	30.000	-
	6.000	-
	10.000	-
Congressional Add Subtotals for Project: 533	46.000	-
Congressional Add Totals for all Projects	46.000	-

Change Summary Explanation

FY17 Congressional increase in project 533 Ground Vehicle Demonstrations

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018			
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>					Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost	
221: <i>Combat Veh Survivablty</i>	-	60.877	66.436	60.084	-	60.084	57.001	56.439	59.065	60.247	0.000	420.149	

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Vision Protection:	4.800	5.000	-
Description: This effort matures and integrates devices to protect occupant's eyes, vehicle cameras, and electro-optic fire control systems against anti-sensor laser devices as well as reduces the sensor's optical signature. Anti-sensor laser devices can deny vision either temporarily by flooding the sensor with too much light (jamming) or permanently by damaging the sensor. These jamming or damaging effects can slow our battle tempo, disrupt fire control solutions, or prevent vehicles from completing their mission. This effort focuses on demonstrating the effectiveness of optical systems that protect sensors and Warfighter vision from pulsed, continuous wave and future laser threats to maintain fire control capability and situational awareness. Coordinated work is also being performed in Program Elements (PEs) 0602120A, 0602705A, 0602712A, and 0602786A.			
FY 2018 Plans: Complete vulnerability evaluation of current systems against ultra-short pulse laser threats; integrate fabricated components of the ultra-short pulse laser protection concepts onto current systems for performance demonstrations in a relevant environment; improve future protection concepts by reducing optical cross-section, minimizing jamming and dazzling, and increasing damage thresholds.			
FY 2018 to FY 2019 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
The reduction in funding results in reduced scope of effort as a result this effort coming to an end				
<p>Title: Advanced Armor Technologies:</p> <p>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; refine 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.</p> <p>FY 2018 Plans: Mature subsystem integration study for passive (B-kit) and reactive armor (C-kit); improve integrated subsystem performance while decreasing weight and maintaining cost; demonstrate capabilities of various adaptive armor solutions in relevant environment; down-select between various adaptive armor solution options.</p> <p>FY 2019 Plans: Will validate integrated subsystem performance for passive (B-kit) and reactive armor (C-kit) against weight and cost objectives; will complete ballistic performance testing of the B-kit and C-kit armor subsystems; will mature adaptive armor solution and optimize for integration with Modular Active Protection System (MAPS) surrogate subsystems into subsystem demonstrator to maximize performance; will verify refined subsystem design through modeling and simulation. Will conduct a demonstration of adaptive armor solutions to verify ballistic performance.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increased Demonstration for Modular Active Protection System (MAPS) surrogate subsystems into subsystem demonstrator</p>		6.412	12.938	15.364
<p>Title: Occupant Centric Protection (OCP) Technologies:</p> <p>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.</p> <p>FY 2018 Plans: 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; begin fabrication of hardware</p>		8.261	4.235	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
required for subsystem integration of Survive Demonstrator; complete next generation WIAMan device testing based on the previously developed test certification procedures; update WIAMan test capability requirements documentation and materiel solution design specifications based on WIAMan device testing.				
FY 2018 to FY 2019 Increase/Decrease Statement: Completed OCP and moved to higher priority effort for Combat Vehicle Prototyping				
Title: Blast Mitigation:		9.346	10.565	7.574
Description: This effort fabricates and matures advanced survivability and protection components, tools, and subsystems for enhanced protection against vehicle mines, improvised explosive devices (IEDs) and other underbody blast threats, and vehicle collision and rollover events that result from blast events. This effort also integrates and improves occupant protection technologies such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious performance evaluation through modeling & simulation (M&S), experimentation, and instrumented test of blast-mitigating technologies in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, and sensors for active blast mitigating technologies. This effort is done in coordination with efforts in PE 0602601A.				
FY 2018 Plans: Mature integration of subsystem technologies into subsystem demonstrator based on blast test results; integrate armor and Modular Active Protection System (MAPS) surrogate subsystems into subsystem demonstrator to maximize performance; verify refined subsystem design through modeling and simulation prior to subsystem fabrication improvements.				
FY 2019 Plans: Will conduct component design improvements for seats, restraints, flooring, structures and active blast technologies based on component level test results. Will assess blast technology form, fit and function in an integrated blast mitigation system prior to system level integration. Will fabricate seats, restraints, flooring, structures and active blast components to be integrated into a system demonstrator for vehicle section durability and blast testing.				
FY 2018 to FY 2019 Increase/Decrease Statement: Reduced demonstration time as a result of prior years investment				
Title: Vehicle Fire Protection:		2.789	2.838	2.628
Description: This effort matures, integrates, and demonstrates technologies to minimize vehicle and crew vulnerabilities to fires in current and future military ground vehicles. Supporting technologies include modeling & simulation (M&S), sensor systems, software, chemical agents, fire-resistant materials, and hardware components. This effort is done in coordination with efforts in PE 0602601A.				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
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FY 2018 Plans:
 Improve fire protection technologies performance based on results from modeling and simulation and laboratory testing; evaluate no/low global warming potential (GWP) agents through full scale testing. Evaluate vehicle concepts that support the next generation of combat vehicles for fire protection technology integration feasibility and effectiveness.

FY 2019 Plans:
 Will continue to evaluate no/low global warming potential (GWP) agents through full scale testing. Will mature vehicle fire protection concepts for the next generation of combat vehicles to improve integration feasibility and effectiveness. Will develop concepts and technologies to conduct fuel containment and fire prevention.

FY 2018 to FY 2019 Increase/Decrease Statement:
 Maturation of technology driving reduced demonstration

<p>Title: Hit Avoidance Technologies:</p> <p>Description: This effort matures, integrates, and demonstrates hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) Active Protection System (APS) components and integrated systems to verify the APS Common Architecture 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</p> <p>FY 2018 Plans: Complete the design and build steps of the soft-kill and hard-kill modular APS controller (MAC); 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; mature MAPS subsystem integration onto SURVIVE demonstrator in preparation for eventual capability testing.</p> <p>FY 2019 Plans: Will complete Modular APS Controller (MAC) software updates based on improvements required from previous demonstrations and testing. Will integrate updated software into the MAC. Will complete a virtual demonstration of hard-kill systems integrated on current vehicle platforms. Will complete the integration of the MAC to demonstrate and validate a soft-kill and hard-kill APS configuration on a demonstrator platform against various threats in various environmental conditions; will complete fabrication and integration of soft-kill and hard-kill system with the MAC on a platform demonstrator. Will complete demonstration and testing</p>	26.212	29.079	30.653
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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
of a layered soft-kill and hard-kill active protection system integrated on a platform demonstrator to validate MAC modularity and system performance. FY 2018 to FY 2019 Increase/Decrease Statement: Increase in funding is a result in need to procure items needed for validation in MAC system performance				
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 2018 Plans: Mature and demonstrate lightweighting capabilities through the continued use of virtual modeling and simulation and other lightweighting tools; optimize demonstrator upper hull and lower hull for reduced weight, improved transportability, increased fuel economy, and increased reliability; validate lightweighting capability with demonstrator performance against relevant environment threats. FY 2019 Plans: Will assess the modeling and simulation data to provide metrics validating the value of Light Weighting to improve transportability, increase fuel economy and increase SWaP-C. Will continue to evaluate advanced materials and their ability to optimize weight while maintaining or improving performance. Will conduct Modeling & Simulation to evaluate the impact of lightweight materials on vehicle subsystem loading. FY 2018 to FY 2019 Increase/Decrease Statement: Demonstration of new materials as the Army continues to look at weight savings in combat vehicles		3.057	1.781	3.865
Accomplishments/Planned Programs Subtotals		60.877	66.436	60.084
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 221 / <i>Combat Veh Survivablty</i>

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>				Project (Number/Name) 441 / <i>Combat Vehicle Mobility</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
441: <i>Combat Vehicle Mobility</i>	-	37.588	33.447	26.508	-	26.508	27.352	29.316	30.090	33.107	0.000	217.408

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Onboard Vehicle Electric Power Component Development:	4.042	4.162	2.838
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 integrated electric machines to assist internal combustion engines for propulsion) electric propulsion and high power electric generation. Coordinated work is also being conducted under Program Element (PE) 0602601A.			
FY 2018 Plans: Exploit SIL system optimization, performance, and reliability resulting in a matured, high-voltage integrated OBVP system. Begin integration of advanced OBVP system on combat vehicle advanced propulsion system. Validate strategy for intelligent engine start/stop for the minimization of idle fuel usage.			
FY 2019 Plans: Will continue to exploit SIL system optimization, performance, and reliability pushing components to higher powertrain operating temperatures and finalizing OBVP system communication/ network architecture. Will integrate and optimize advanced OBVP			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 441 / <i>Combat Vehicle Mobilty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
system with an advanced powertrain to include thermal management and define interface with vehicle power management controls. Will optimize control algorithms for intelligent engine start/stop for the minimization of idle fuel usage. FY 2018 to FY 2019 Increase/Decrease Statement: No hardware purchases needed for demonstration				
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 2018 Plans: 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. Fabricate integrated system for future testing. FY 2019 Plans: Will continue to mature and demonstrate an integrated advanced track and suspension solution for a medium combat vehicle. Will optimize the advanced track and suspension solution to provide increased mobility at a reduced weight. Will demonstrate and improve durability and exploit new design to reduce maintenance tasks as compared to currently fielded track solutions. Will fabricate components to demonstrate an integrated system for design optimization of an advanced medium combat vehicle running gear system. FY 2018 to FY 2019 Increase/Decrease Statement: Reduction in Hardware purchases for demonstration		3.277	3.622	2.140
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		11.570	12.500	8.847

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 441 / <i>Combat Vehicle Mobilty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: Complete design of advanced propulsion components such as advanced engine, advanced transmission, and advanced thermal management system. Mature and optimize next generation combat vehicle with advanced technologies and technology concepts to allow for flexible, scalable and modular technologies. 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.</p> <p>FY 2019 Plans: Will fabricate advanced propulsion components such as advanced engine, advanced transmission, and advanced thermal management system. Will continue to optimize next generation combat vehicle with advanced technologies and lessons learned to allow for flexible, scalable and modular technologies. Will integrate and optimize components from powertrain to demonstrate advanced technologies, capabilities, and improved performance. Will validate mobility and occupant protection analyses, trade studies, and concepts to inform the advanced combat vehicle survivability demonstrator. Will continue to evaluate and optimize concept platform configurations to reduce gaps in operational capabilities.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Reduction in Hardware purchases for demonstrations</p>				
<p>Title: Energy Storage Systems Development:</p> <p>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.</p> <p>FY 2018 Plans:</p>		2.950	3.114	3.137

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 441 / <i>Combat Vehicle Mobility</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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. Begin demonstrating safe logistical transportation of Lithium-ion battery packs with the Navy.</p> <p>FY 2019 Plans: Will continue to optimize advanced form factor (6T) Lithium-ion battery pack system level performance and durability to decrease recharge time, weight, and volume. Will improve the integrated battery management system and demonstrate optimized combat vehicle power management synchronization and safety. Will continue to demonstrate safe logistical transportation of Lithium-ion battery packs with the Navy, improve the Li-ion specification, and inform combat vehicle standardized interfaces to reduce logistics costs.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Inflation</p>				
<p>Title: Pulse Power:</p> <p>Description: This effort matures and demonstrates high energy, compact pulse power components, subsystems, and systems that enable significantly improved survivability and lethality applications components to include Direct Current (DC) to DC chargers, high energy batteries, pulse chargers, high density capacitors, solid state-switches, control systems, and electromagnetic armor panels. Coordinated work is also being conducted under PEs 0602601A, 0602618A, and 0602705A.</p>		3.632	-	-
<p>Title: Non-Primary Power Systems:</p> <p>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, reduces logistic burdens, and also 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.</p>		4.632	-	-
<p>Title: Propulsion and Thermal Technologies:</p> <p>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 and range), enhanced mobility (survivability), and reduced cooling system burden (size and 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</p>		4.300	5.000	4.793

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 441 / <i>Combat Vehicle Mobility</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: Complete design and software development of high power density, low heat rejection, fuel efficient opposed piston engine concept, and validate subsystem performance and calibration. Optimize the control strategy for the combat vehicle transmission. Mature and optimize gear set design for integration into combat vehicle transmission. Mature combat vehicle transmission for integration into advanced combat propulsion system.</p> <p>FY 2019 Plans: Will complete interface and software maturation of opposed piston engine, advanced thermal management, advanced combat transmission for integration into advanced combat propulsion system. Will optimize the control strategy for each component and develop supervisory controls for integration of the advanced propulsion system. Will complete design of components needed to integrate the advanced combat propulsion system into hull for demonstration. Will demonstrate and validate advanced propulsion system controls calibration and efficient operation to meet combat vehicle electrical power and mobility requirements.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Validation of previous demonstration requiring less funding</p>				
<p>Title: Force Projection:</p> <p>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.</p> <p>FY 2018 Plans: Continue to demonstrate energy efficient waste water treatment and recycling technologies to support sustainability logistics basing. 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. Validate that the 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.</p> <p>FY 2019 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 the fuel efficient gear oils</p>		3.185	5.049	2.206

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 441 / <i>Combat Vehicle Mobilty</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
maintain and improve vehicle axle durability and provide extended performance time over current gear oil, as well as limited slip performance. FY 2018 to FY 2019 Increase/Decrease Statement: Less demonstration time needed in the waste water treatment portion of this effort				
Title: Crew Augmentation Description: This effort focuses on optimizing crew station technologies while reducing crew sizes that will provide the same overall performance by exploiting human-interaction technologies, automations, machine intelligence and customization to permit soldiers to achieve performance beyond today?s constrained ground vehicle environment. FY 2019 Plans: Will mature software and demonstrate simulations to provide workload, span of control and mission performance data to show improved soldier performance through customization, machine augmented, information sorting, and weapon engagement software and algorithms. Will continue demonstrating that crew size reduction can provide the same overall performance by validating technical assessments that will provide a strong knowledgebase to support future crew stations efforts. FY 2018 to FY 2019 Increase/Decrease Statement: New Start as result in prioritization of NGCV		-	-	2.547
Accomplishments/Planned Programs Subtotals		37.588	33.447	26.508
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>				Project (Number/Name) 497 / <i>Combat Vehicle Electro</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
497: <i>Combat Vehicle Electro</i>	-	6.845	7.162	7.215	-	7.215	7.359	7.506	7.662	7.815	0.000	51.564

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Vehicle Electronics Integration Technologies:	3.432	2.907	3.025
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 size, weight and power (SWaP) concerns for vehicle electronics. This effort is coordinated with efforts in Program Element (PE) 0602601A.			
FY 2018 Plans: 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.			
FY 2019 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 497 / <i>Combat Vehicle Electro</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Will validate the matured technology demonstration designs and technologies from the VEA Research SIL in a current combat vehicle platform to validate enhanced performance specifications for open power, data, network interface requirements, standards and architectural design patterns. Will validate integrated Silicon Carbide (SiC) power system functionality.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Slight increase in funding needed for validations and components in the Vehicle Electronics Architectures SIL</p> <p>Title: Vehicle Electronics Architecture and Standards:</p> <p>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.</p> <p>FY 2018 Plans: Optimize the open data and power architecture capabilities as the VEA Mobile Demonstrator (VMD) component technologies are being integrated. Continue to mature and demonstrate integration of MAPS standard interface definitions which provides guidance to other vehicle electronic subsystems development.</p> <p>FY 2019 Plans: Will validate the open data and power architecture capabilities as the VMD is prepared for demonstration. Will validate the MAPS standard interface definitions to mature compliant systems that support the efficient integration of electronics components into vehicle systems through the use of open standards.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Slight funding increase needed for MAPS integration into vehicle systems</p>		2.071	2.843	3.015
<p>Title: Autonomous Vehicle Architecture:</p> <p>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.</p>		1.342	1.412	1.175

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 497 / <i>Combat Vehicle Electro</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2018 Plans:</i> Develop a common system architecture for autonomous vehicles through the exploitation of multiple different pre-existing autonomous vehicle systems architectures. Develop algorithm software modules, vehicle architecture, a common interface, and hardware & software integration within the end-to-end autonomous vehicle architecture.</p> <p><i>FY 2019 Plans:</i> Will continue to mature and validate the common system architecture for autonomous vehicles by demonstrating autonomous vehicle architecture, algorithm software modules, a common interface and hardware and software integration across the full spectrum of operational and tactical supply movement operations.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Demonstration of existing prototype -- Reduced hardware purchase</p>			
Accomplishments/Planned Programs Subtotals	6.845	7.162	7.215

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>				Project (Number/Name) 515 / <i>Robotic Ground Systems</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
515: <i>Robotic Ground Systems</i>	-	12.191	18.492	25.932	-	25.932	27.071	26.104	26.156	26.716	0.000	162.662

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 in Robotics/Autonomy.. Ground Portfolio investments are greatly improving logistics throughput and surge capability supporting maneuver forces (Leader-Follower technology) and allow experimentation with manned and unmanned teams to develop the advantages that inform/protect the maneuver force (Robotic Wingman JCTD)

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Unmanned Ground Systems Technology:	12.191	12.054	9.443
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 2018 Plans: Continue to mature and develop the modeling and simulation tools to support the design, development, testing, and evaluation of autonomous vehicles. 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. 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. Conduct operational experiments with			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 515 / <i>Robotic Ground Systems</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>unmanned Reconnaissance Surveillance and Target Acquisition (RSTA) missions leveraging autonomous ground platforms teamed with tethered unmanned aerial vehicles (UAVs).</p> <p>FY 2019 Plans: Will mature and develop an improved and optimized distribution system that integrates new and emerging technologies across the full spectrum of operational and tactical supply movement operations. Will continue to optimize common interfaces and open architecture. Will mature hardware-in-the-loop simulators to optimize cargo & vehicle configurations and implementations of autonomous ground resupply on realistic routes. Will continue to improve test & evaluation procedures for robotic systems utilizing modeling and simulation tools that will increase vehicle and pedestrian safety along with robotic control and command.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Previous year was procurement of test and validation equipment, thus the reduced need for identical funding in FY 19</p>				
<p>Title: Autonomous Ground Vehicle Architecture Integration and Demonstration</p> <p>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.</p> <p>FY 2018 Plans: 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. Mature and demonstrate advanced vehicle behaviors for defensive maneuvers and tactical convoy formations built upon the open architecture. Mature and integrate off-road path planning software to enable robotic vehicles to perceive, classify and navigate complex, difficult terrains. Improve advanced vehicle behaviors for sustainment convoy operations to improve leader follower functionality, improved obstacle detection and avoidance, and increased platform speed.</p> <p>FY 2019 Plans: Will mature and develop an improved and optimized distribution system that integrates new and emerging technologies across the full spectrum of operational and tactical supply movement operations. Will continue to optimize common interfaces and architecture for all future autonomous ground vehicle development. Will mature and define open architecture design, data buses and messages. Will exploit automation software and algorithms to increase platform autonomy in increasing complex</p>		-	6.438	16.489

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 515 / <i>Robotic Ground Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
environments and mission applications. Will mature & demonstrate scalable autonomy in a single material solution agnostic of platform. <i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Significant increase in priority in Unmanned Systems Software and autonomy with a strong desire to delivery more capability sooner than was planned in prior years.			
Accomplishments/Planned Programs Subtotals	12.191	18.492	25.932

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / <i>Combat Vehicle and Automotive Advanced Technology</i>	Project (Number/Name) 533 / <i>Ground Vehicle Demonstrations</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>533: Ground Vehicle Demonstrations</i>	-	46.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.000

Note

Congressional increases for Combat vehicle weight reduction initiative (\$10M); Advanced water harvesting technology (\$6M); Program increase (\$30M)

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	30.000	-
FY 2017 Accomplishments: N/A		
Congressional Add: Advanced Water Harvesting Technology	6.000	-
FY 2017 Accomplishments: N/A		
Congressional Add: Combat Vehicle Weight Reduction Initiative	10.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	46.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603006A / <i>Space Application Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	3.787	12.231	13.000	-	13.000	13.986	16.675	17.158	17.501	0.000	94.338
592: <i>Space Application Tech</i>	-	3.787	12.231	13.000	-	13.000	13.986	16.675	17.158	17.501	0.000	94.338

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/timing, 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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	3.904	12.231	13.000	-	13.000
Current President's Budget	3.787	12.231	13.000	-	13.000
Total Adjustments	-0.117	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.116	-			
• FFRDC	-0.001	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603006A / <i>Space Application Advanced Technology</i>				Project (Number/Name) 592 / <i>Space Application Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
592: <i>Space Application Tech</i>	-	3.787	12.231	13.000	-	13.000	13.986	16.675	17.158	17.501	0.000	94.338

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.

This program is designated as a DoD Space Program.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Payload Technology Development	3.787	12.231	13.000
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 2018 Plans: Develop a plan to demonstrate small satellite technologies to support multi-band beyond-line-of-sight (BLOS) and on-the-move communications 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.			
FY 2019 Plans: In FY 2019, work in this effort is realigned to support the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army. The effort's priority will be to mature and demonstrate technologies to address Army gaps in tracking and locating capabilities for ground objects of interest; will advance space-based data exploitation technologies and components, space-based signal detection/processing/dissemination			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603006A / <i>Space Application Advanced Technology</i>	Project (Number/Name) 592 / <i>Space Application Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
technologies, and software algorithms; and will demonstrate and exploit incremental advances made in tag, track, and location technologies and capabilities.				
<i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Due to shifts in priorities, investments were increased to advance tag, track and location technologies				
Accomplishments/Planned Programs Subtotals		3.787	12.231	13.000
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603007A / <i>Manpower, Personnel and Training Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	12.110	6.466	8.044	-	8.044	12.632	12.798	16.834	17.254	0.000	86.138
<i>792: Personnel Performance & Training</i>	-	12.110	6.466	8.044	-	8.044	12.632	12.798	16.834	17.254	0.000	86.138

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and validates applied behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., unit cohesion). 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 Talent Management methods to optimize individual and team performance to ensure the Army can meet mission requirements in uncertain and complex environments. This PE evaluates new selection measures, assignment methods, and performance metrics for individuals and units, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Work 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 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 U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603007A / <i>Manpower, Personnel and Training Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	14.417	6.466	8.088	-	8.088
Current President's Budget	12.110	6.466	8.044	-	8.044
Total Adjustments	-2.307	0.000	-0.044	-	-0.044
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.400	-			
• Adjustments to Budget Years	-1.902	-	-0.044	-	-0.044
• FFRDC	-0.005	-	-	-	-

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).

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603007A / <i>Manpower, Personnel and Training Advanced Technology</i>	Project (Number/Name) 792 / <i>Personnel Performance & Training</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>792: Personnel Performance & Training</i>	-	12.110	6.466	8.044	-	8.044	12.632	12.798	16.834	17.254	0.000	86.138

A. Mission Description and Budget Item Justification

This Project matures and validates applied behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., unit cohesion). 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 Talent Management methods to optimize individual and team performance to ensure the Army can meet mission requirements in uncertain and complex environments. This Project evaluates new selection measures, assignment methods, and performance metrics for individuals and units, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Work 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 Program Element (PE) 0602785A (Manpower/Personnel/Training Technology).

The cited work is consistent with the Science and Technology priorities of the Army Chief of Staff, the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas, and the Army Human Capital Strategy.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Talent Management	9.008	4.395	7.659
Description: Previously titled "Personnel Assessment," this effort refines and assesses innovative talent management approaches to provide the Army the flexibility to adapt to changes in force structure and recruiting environments. This effort validates Soldier selection measures, techniques, and tools to more fully assess Soldier potential and better predict behavior, attrition, and performance. This effort also matures and validates methods to develop and model Soldier talents/competencies longitudinally across a career.			
FY 2018 Plans: Validate competency model (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).			
FY 2019 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603007A / <i>Manpower, Personnel and Training Advanced Technology</i>	Project (Number/Name) 792 / <i>Personnel Performance & Training</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Will demonstrate differential prediction of cognitive and non-cognitive abilities among Military Occupational Specialty clusters for incorporation into the assignment process to support forecasting of future talent management and human performance needs in near-peer operational environments; provide research to assess the validity of integrated personnel assessments augmented with archival human capital data; provide research to empirically validate instructional approaches to prepare instructors/trainers to train complex skills required for emerging high-tempo operational environments that necessitate decisive and timely decision making (e.g., dense urban and distributed units).</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increased funding will accelerate talent management assessments efforts.</p>				
<p>Title: Unit Performance and Cohesion</p> <p>Description: Previously titled "Personnel Readiness, Performance, and Conduct," this effort will mature and refine measures and methods to ensure cohesive, high performing teams for future operational environments. This effort will mature and assess methods to optimize team composition to enhance unit performance, methods to rapidly build and sustain team cohesion, and metrics and assessments of unit performance, command climate, unit resilience, and cohesion.</p> <p>FY 2018 Plans: Validate integrated holistic assessment that leverages existing personnel data (i.e., integrated measures collected across the Soldier Lifecycle that feeds holistic assessments and predictive models of behaviors, performance, and outcomes); demonstrate the effectiveness of strategies to optimize individual training performance (e.g., deliver prototype training tool to enhance PATRIOT air defense launch control crewmembers' fire control decision-making).</p> <p>FY 2019 Plans: Will refine measures of collective performance in combat training exercises.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease in funding to support the acceleration of Talent Management assessment efforts.</p>		3.102	2.071	0.385
Accomplishments/Planned Programs Subtotals		12.110	6.466	8.044
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603009A / <i>Tractor Hike</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	21.374	40.552	22.631	-	22.631	23.041	21.459	21.898	22.336	0.000	173.291
B18: <i>DB18</i>	-	21.374	16.642	8.704	-	8.704	8.879	9.055	9.240	9.425	0.000	83.319
FH1: <i>TRACTOR HIKE</i>	-	0.000	23.910	13.927	-	13.927	14.162	12.404	12.658	12.911	0.000	89.972

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)

	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Previous President's Budget	21.374	28.552	20.631	-	20.631
Current President's Budget	21.374	40.552	22.631	-	22.631
Total Adjustments	0.000	12.000	2.000	-	2.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	12.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	2.000	-	2.000

Change Summary Explanation

FY18 Congressional Add for Missile Defeat and Defense Enhancements \$12M.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / <i>Tractor Hike</i>				Project (Number/Name) B18 / <i>DB18</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
B18: <i>DB18</i>	-	21.374	16.642	8.704	-	8.704	8.879	9.055	9.240	9.425	0.000	83.319

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).

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / <i>Tractor Hike</i>				Project (Number/Name) FH1 / <i>TRACTOR HIKE</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
FH1: <i>TRACTOR HIKE</i>	-	0.000	23.910	13.927	-	13.927	14.162	12.404	12.658	12.911	0.000	89.972

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).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	18.238	16.434	25.682	-	25.682	26.471	21.978	21.148	22.422	0.000	152.373
S28: <i>Immersive Learning Environments</i>	-	3.129	0.483	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.612
S29: <i>Modeling & Simulation - Adv Tech Dev</i>	-	5.934	6.273	17.143	-	17.143	17.802	13.166	12.167	10.901	0.000	83.386
S31: <i>Modeling And Simulation Infrastructure Technology</i>	-	9.175	9.678	8.539	-	8.539	8.669	8.812	8.981	11.521	0.000	65.375

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, Development, and Engineering Command (RDECOM).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	18.969	16.434	20.672	-	20.672
Current President's Budget	18.238	16.434	25.682	-	25.682
Total Adjustments	-0.731	0.000	5.010	-	5.010
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.721	-			
• Adjustments to Budget Years	-0.010	-	5.010	-	5.010

Change Summary Explanation

Changes in FY19 funding in order to support the acceleration of Synthetic Training Environment efforts in order to meet senior leader priorities for Soldier Lethality.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>	Project (Number/Name) S28 / <i>Immersive Learning Environments</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>S28: Immersive Learning Environments</i>	-	3.129	0.483	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.612

Note

This project completed in FY18.

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 portfolio.

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

Research in this project will be completed in FY18.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Immersive Techniques for Training Applications	FY 2017	FY 2018	FY 2019
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. Research in this effort will be completed in FY18.	3.129	0.483	-
This effort completes in FY18.			
FY 2018 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>	Project (Number/Name) S28 / <i>Immersive Learning Environments</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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 courseware developed and transition the developed 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.</p>			
Accomplishments/Planned Programs Subtotals	3.129	0.483	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>				Project (Number/Name) S29 / <i>Modeling & Simulation - Adv Tech Dev</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>S29: Modeling & Simulation - Adv Tech Dev</i>	-	5.934	6.273	17.143	-	17.143	17.802	13.166	12.167	10.901	0.000	83.386

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 portfolio.

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Embedded Techniques	4.634	-	-
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.			
Title: Training Effectiveness	1.300	1.300	1.300
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 2018 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>	Project (Number/Name) S29 / <i>Modeling & Simulation - Adv Tech Dev</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>Mature and demonstrate performance measurement technologies that facilitate optimization of training efficiency and effectiveness. Improve predictive models for training outcomes in live and simulated training environments for both individual and team tasks. Demonstrate methods for effectively blending training across classroom, computer-based, simulation-based, and live environments.</p> <p>FY 2019 Plans: Will mature and demonstrate automated training performance assessment algorithms for individuals in virtual training environments; provide a baseline of measures and methods for use in assessing effectiveness of collective training for a subset of technologies used in various training environments (mixed reality and live); identify impacts and tradeoffs associated with effectiveness of collective training using current (training) simulation architectures and the expected effectiveness of collective training associated with using future training technologies (mixed reality and live).</p>			
<p>Title: Mixed and Augmented Reality</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will mature and begin internal demonstrations of Augmented Reality subcomponents such as advanced optics for the helmet mounted display, occlusion, and increased computational of the man-wearable computer to reduce size, weight, power, and cooling while also reducing logistics to enable a future augmented reality training environment that can represent the complexities of the future operational environment within which soldiers must operate.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Reduction in Augmented Reality demonstrations in order to support the acceleration of Synthetic Training Environment efforts.</p>	-	4.973	4.799
<p>Title: Mixed and Augmented Reality for Complex Environments</p> <p>Description: This effort matures and demonstrates the models and simulations that enable immersive training in future complex operational environments involving megacity terrain and unmanned autonomous systems. These technologies support the Army capability needs for the soldier to have better asymmetric vision and decide faster for dismounted soldiers in a complex urban environment.</p>	-	-	1.144

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>	Project (Number/Name) S29 / <i>Modeling & Simulation - Adv Tech Dev</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2019 Plans:</i> Will mature modeling and simulations for megacities environments that will be used for urban interactive immersive training capability, components will include the simulated terrain environment representing complex and dense urban environments as well as manned/unmanned teaming models; mature the components of the dismounted soldier augmented reality visual system and occlusion algorithms for manned/unmanned teaming training operations.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Investment supports senior leader priorities for Soldier Lethality and Synthetic Training Environment.</p>			
<p><i>Title:</i> Synthetic Training Environment Acceleration</p> <p><i>Description:</i> This effort matures and demonstrates technologies to enable a Synthetic Training Environment which is a single, interconnected training system in which units from squad through ASCC can train in the most appropriate domain - live, virtual, constructive, and gaming, or in all four simultaneously.</p> <p><i>FY 2019 Plans:</i> Will mature and demonstrate training simulation software technologies, which enable the representation of a relevant Multi Domain Battle (MDB) within a global terrain, in direct support of the Army's synthetic training environment; optimize the use of distributed computing and cloud infrastructures to demonstrate dynamic content updates (e.g. terrain) and point-of-need training, including the maturation of human-machine interfaces; exploit the maturations in fidelity of the global terrain, the increase in simulated entities and increase concurrent role-players for demonstration in a relevant collective training exercise.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Effort to support the acceleration of Synthetic Training Environment research in support of Soldier Lethality senior leader priorities.</p>	-	-	9.900
Accomplishments/Planned Programs Subtotals	5.934	6.273	17.143

<p>C. Other Program Funding Summary (\$ in Millions) N/A</p> <p>Remarks</p>
<p>D. Acquisition Strategy N/A</p>
<p>E. Performance Metrics N/A</p>

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>			Project (Number/Name) S31 / <i>Modeling And Simulation Infrastructure Technology</i>				
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
S31: <i>Modeling And Simulation Infrastructure Technology</i>	-	9.175	9.678	8.539	-	8.539	8.669	8.812	8.981	11.521	0.000	65.375

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 portfolio.

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Simulation Tools and Models	7.175	7.678	6.539
Description: This effort matures and demonstrates modeling & simulation (M&S) technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and System of Systems (SoS) architecture, technology tradeoffs, etc. This research transitions to the U.S Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).			
FY 2018 Plans: Mature simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities (Training, Experimentation and Acquisition targeted); optimize authoring tools that support a variety of user types ranging from simulation expert to exercise developer in support of advancing simulation execution; refine composable modeling methods that are required to represent a synthetic force at various levels in real time; and mature repeatable measurement methodologies for human behavior modeling to enhance training intervention or simulation technologies.			
FY 2019 Plans: Will demonstrate simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities in a relevant context; optimize composable modeling methods focused on broad model reuse; improve repeatable measurement			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / <i>Next Generation Training & Simulation Systems</i>	Project (Number/Name) S31 / <i>Modeling And Simulation Infrastructure Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
methodologies for human behavior modeling; refine visualization and interaction technologies that improve human-computer interaction for training simulation; mature cyber data exchange models to enhance synthetic and live integrated training.				
FY 2018 to FY 2019 Increase/Decrease Statement: Investments in the development of human behavior modeling tools is being reduced.				
Title: Early Human Systems Integration Demonstrations		2.000	2.000	2.000
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 2018 Plans: Develop tools and methods for early HSI based on gaps determined in Fiscal Year (FY) 17; mature concepts and metrics to establish return on investment (ROI) for early HSI in acquisition; link analytic approaches that bridge disciplines and analysis communities.				
FY 2019 Plans: Will develop enhanced Soldier performance metrics and training development tools; identify technologies to improve early system design using Soldier-centered design tools and systems engineering architecture.				
Accomplishments/Planned Programs Subtotals		9.175	9.678	8.539
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603020A / <i>TRACTOR ROSE</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	11.910	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.910
DB1: <i>DDB1</i>	-	11.910	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.910

Note

Program ended in FY17

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)

	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Previous President's Budget	11.910	0.000	0.000	-	0.000
Current President's Budget	11.910	0.000	0.000	-	0.000
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	33.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	75.524
DF5: <i>Agile Integration & Demonstration</i>	-	25.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	67.524
DW4: <i>Energy Technologies (Congressional Adds (CAs))</i>	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

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 activities to stress and assess emerging technologies earlier in the systems development life-cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this PE is complementary to and is fully coordinated with PE 0602618A/Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and 0603005A (Combat Vehicle and Automotive 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).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	27.686	26.903	21.268	-	21.268
Current President's Budget	33.553	26.903	3.762	-	3.762
Total Adjustments	5.867	0.000	-17.506	-	-17.506
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	8.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.068	-			
• SBIR/STTR Transfer	-1.052	-			
• Adjustments to Budget Years	-	-	-17.506	-	-17.506
• FFRDC	-0.013	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: DW4: *Energy Technologies (Congressional Adds (CAs))*

Congressional Add: *Force Protection Radar Development*

Congressional Add Subtotals for Project: DW4

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	8.000	-
	8.000	-
	8.000	-

Change Summary Explanation

FY17 Congressional increase in project DW4 Energy Technologies. FY19 decreases to project DF5 reflect changes to support Army Modernization Priorities resulting in conclusion of Red Teaming efforts in FY18 and reductions to the Ground Vehicle Power and Energy effort.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>				Project (Number/Name) DF5 / <i>Agile Integration & Demonstration</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
DF5: <i>Agile Integration & Demonstration</i>	-	25.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	67.524

Note

In FY19, the investment under Project DF5 is realigned in support of the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army.

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 field demonstrations and red teaming activities to stress and assess emerging technologies earlier in the systems development life-cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this Project is complementary to and is fully coordinated with Program Element (PE) 0602618A/Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and PE 0603005A (Combat Vehicle and Automotive 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Ground Platform Subsystem Demonstrations	4.508	4.000	1.073
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 protection 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 2018 Plans: Mature the VEA Mobile Demonstrator (VMD) technology by optimizing subsystem performance during hardware integration onto vehicle platform, and begin demonstrations of VMD capabilities to validate system performance against future power and data			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>	Project (Number/Name) DF5 / <i>Agile Integration & Demonstration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>requirements. Mature and validate powertrain controls architecture and algorithm to improve powertrain efficiencies and minimize parasitic losses through component modeling and simulation. 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.</p> <p>FY 2019 Plans: Will complete optimization of VEA Mobile Demonstrator (VMD) performance during hardware integration onto vehicle platform, and will validate system performance against future power and data requirements. Will complete validation of powertrain controls architecture and algorithms, improving powertrain efficiencies and minimizing parasitic losses. Will complete validation of integrated starter generator, advanced thermal management system, and advanced modular lithium ion battery technologies to improve subsystem fuel efficiency and increase electrical power generation.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Funding realigned to higher Army Priorities.</p>				
<p>Title: Ground Vehicle Power and Energy</p> <p>Description: This effort matures and demonstrates advanced technologies that enable military ground vehicles to become significantly more energy efficient. It collaborates with the DOE to demonstrate technologies in: advanced combustion engines and transmissions; lightweight structures and materials; energy recovery and thermal management; alternative fuels and lubricants; hybrid propulsion systems; batteries and energy storage; and analytical tools (e.g., modeling and simulation). This effort is coordinated with PE 0602601A.</p> <p>FY 2018 Plans: Continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. 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. Improve tire modeling and simulation capabilities based on dynamic property data from advanced tire testing. Improve corrosion prevention capabilities through results from investigation of corrosion mechanisms and effects on dissimilar material joints which identified materials and processes to inhibit corrosion.</p> <p>FY 2019 Plans: Will continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Will develop methodology and software for optimal sizing of fuel cells and battery packs for military vehicles. Will develop advanced electrolytes to increase Lithium Metal Battery energy density, performance and life. Will develop and test Thermal Barrier Coatings to reduce heat loss/improve fuel economy of combustion engines. Will develop and evaluate next-generation, light-weight materials, manufacturing and related processes. Will support the AVPTA project portfolio via "Extended Enterprise"</p>		4.747	5.340	2.689

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>	Project (Number/Name) DF5 / <i>Agile Integration & Demonstration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
efforts such as Improving the Fuel Efficiency of the Current Ground Tactical Fleet; JP-8 Fuel Cell Power; and other activities that will enhance Operational Energy efficiency and reduce energy consumption.				
FY 2018 to FY 2019 Increase/Decrease Statement: Funding realigned to higher Army Priorities.				
Title: Red Teaming Field Demonstration		8.041	7.282	-
Description: This effort conducts field demonstrations to stress emerging technologies in realistic environments and scenarios, using warfighters and adaptive adversaries. Field demonstration activities seek to place emerging technologies in the hands of Warfighters early in the development cycle to leverage their feedback and to uncover potential vulnerabilities in future systems, allowing identification of design fixes and improvements while mitigations are less expensive. Red Teaming Field Demonstration activities are coordinated with PE 0602618.				
FY 2018 Plans: Conduct a series of 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. Technical areas of interest include interoperability, internet of things, autonomous systems, and electronic warfare. Demonstrations are structured to stress the technologies/systems and uncover vulnerabilities through their employment in complex mission scenarios with friendly and opposing forces, including emulated threat probes for electronic warfare vulnerabilities. Provide feedback to developers through structured assessments to facilitate reduction or mitigation of vulnerabilities.				
FY 2018 to FY 2019 Increase/Decrease Statement: Effort concludes in FY18 due to a change in the priority of the effort.				
Title: Red Teaming Systems Intensive Analysis		4.910	4.369	-
Description: This effort conducts in-depth analysis (from concepts to employment to interoperability) of selected high priority emerging technology sub-systems and systems with planned transitions to future programs of record. The intent is assess technologies using virtual and laboratory experiments across a broad range of potential threat vectors, environments, and use cases to identify and mitigate any identified vulnerabilities as early as possible.. These venues allow for detailed analysis in areas that would be too dangerous or too expensive to assess during a live, field demonstration.				
FY 2018 Plans: 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.				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>	Project (Number/Name) DF5 / <i>Agile Integration & Demonstration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
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.				
FY 2018 to FY 2019 Increase/Decrease Statement: Effort concludes in FY18 due to a change in the priority of the effort.				
Title: Red Teaming Vulnerability Exercises		3.347	2.912	-
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. Outputs of these exercises influence technologies and scenarios chosen for Systems Analysis and Field Demonstrations.				
FY 2018 Plans: 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 cover broader time and space conditions than are possible in live field experiments. 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 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.				
FY 2018 to FY 2019 Increase/Decrease Statement: Effort concludes in FY18 due to a change in the priority of the effort.				
Title: Unmanned Teaming Technology Assessment		-	3.000	-
Description: This effort provides an assessment of technology components and enablers required to establish a manned-unmanned teaming capability for enhanced combat power in complex and contested environments. The assessment will consider Soldiers, unmanned ground vehicles, unmanned air vehicles, command and control, communications, and lethality technologies.				
FY 2018 Plans: Identify components, technologies and enablers required to establish a manned unmanned teaming capability to provide enhanced combat power in complex and contested environments. Determine component priority by assessing unmanned				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>	Project (Number/Name) DF5 / <i>Agile Integration & Demonstration</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
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.			
<i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Effort concludes in FY18; planned progression of effort.			
Accomplishments/Planned Programs Subtotals	25.553	26.903	3.762

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / <i>Combating Terrorism - Technology Development</i>	Project (Number/Name) DW4 / <i>Energy Technologies (Congressional Adds (CAs))</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>DW4: Energy Technologies (Congressional Adds (CAs))</i>	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

A. Mission Description and Budget Item Justification

This project contains Congressional add funding.

B. Accomplishments/Planned Programs (\$ in Millions)

<u>B. Accomplishments/Planned Programs (\$ in Millions)</u>	FY 2017	FY 2018
<i>Congressional Add:</i> Force Protection Radar Development	8.000	-
<i>FY 2017 Accomplishments:</i> N/A		
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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603130A / <i>TRACTOR NAIL</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	2.340	4.880	4.896	-	4.896	4.943	4.992	5.044	5.145	0.000	32.240
DS8: <i>Tractor Nail</i>	-	2.340	4.880	4.896	-	4.896	4.943	4.992	5.044	5.145	0.000	32.240

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)

<u>B. Program Change Summary (\$ in Millions)</u>	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Previous President's Budget	2.340	4.880	4.896	-	4.896
Current President's Budget	2.340	4.880	4.896	-	4.896
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Change Summary Explanation

Fiscal Year 2018 Classified Program funds increase.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603131A / <i>TRACTOR EGGS</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	2.470	4.326	6.041	-	6.041	8.591	10.144	10.206	10.410	0.000	52.188
DS9: <i>Tractor Eggs</i>	-	2.470	4.326	6.041	-	6.041	8.591	10.144	10.206	10.410	0.000	52.188

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)

	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Previous President's Budget	2.470	4.326	6.041	-	6.041
Current President's Budget	2.470	4.326	6.041	-	6.041
Total Adjustments	0.000	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	40.819	31.296	31.491	-	31.491	35.317	37.360	38.469	39.262	0.000	254.014
CY3: <i>Cyberspace Technology Development</i>	-	0.000	0.000	6.483	-	6.483	6.531	6.511	6.607	6.739	0.000	32.871
K12: <i>EW Demonstrations (CA)</i>	-	14.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.000
K15: <i>Advanced Comm Ecm Demo</i>	-	7.791	9.288	2.439	-	2.439	4.700	6.339	6.549	6.681	0.000	43.787
K16: <i>Non-Commo Ecm Tech Dem</i>	-	19.028	22.008	22.569	-	22.569	24.086	24.510	25.313	25.842	0.000	163.356

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 CY3 matures and demonstrates architecture, sensor and software techniques to provide operationally relevant capabilities for cyber support at Corps level and below and enables cyber situational awareness, command and control, mission rehearsal, observable reporting, and framework to incrementally advance cyber tool development. 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 Research, Development, and Engineering Command (RDECOM), Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	27.893	31.296	34.241	-	34.241
Current President's Budget	40.819	31.296	31.491	-	31.491
Total Adjustments	12.926	0.000	-2.750	-	-2.750
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	14.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.060	-			
• Adjustments to Budget Years	-	-	-2.750	-	-2.750
• FFRDC	-0.014	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: K12: *EW Demonstrations (CA)*

Congressional Add: *Program Increase*

	FY 2017	FY 2018
Congressional Add Subtotals for Project: K12	14.000	-
Congressional Add Totals for all Projects	14.000	-

Change Summary Explanation

In Fiscal Year 2018 funding increased to support needed aircraft survivability and Multifunction Electronic Warfare efforts.
FY17 Congressional increase \$14M

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>				Project (Number/Name) CY3 / <i>Cyberspace Technology Development</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>CY3: Cyberspace Technology Development</i>	-	0.000	0.000	6.483	-	6.483	6.531	6.511	6.607	6.739	0.000	32.871

Note

This Project was funded previously to FY19 as part of Project K15. Funding was realigned in accordance with Volume 2B, Chapter 18, of the DoD Financial Management Regulation (FMR), requiring all "cyberspace activities" funding move into pure budget Projects.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates architecture, sensor and software techniques to provide operationally relevant capabilities for cyber support at Corps and Below. This Project enables cyber situational awareness, command and control, mission rehearsal, observable reporting, and framework to incrementally advance cyber tool development to realize the desired intent against any threat, to perform Cyber/EW/SIGINT operations and to assist in answering the commanders understanding of the battlespace in a hostile electromagnetic and cyber 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.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Offensive Operations	FY 2017	FY 2018	FY 2019
Description: This effort matures and demonstrates integrated electronic attack (EA) and cyberspace electromagnetic activities (CEMA) 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/Projects K15 and K16 and PE 0602270A/Projects CYB and 906 complement this effort. In FY 2019 this effort was moved from Project K15 per an Office of the Secretary of Defense directive to identify cyber investments in cyber unique Projects.	-	-	6.483
FY 2019 Plans: Will mature CEMA mission management software to augment the Commander's ability to build courses of action that achieve desired intent by allowing the Commander to choose the right cyber toolset for the mission based on availability of tools and computing resources on Blue Force platforms; will optimize methods to employ tactical cyber/EW/SIGINT platforms as sensors to ascertain sufficient situational understanding of the mission space; will demonstrate mature cyber and EW techniques against validated threats in support of and for transition to Programs of Record; will use Modeling and Simulation to demonstrate how			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) CY3 / <i>Cyberspace Technology Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
machine learning can be used to overcome technology hurdles, operational complexities, and enable timely Blue Force response; and use software and subsystem improvements to mature a simulated laboratory-based offensive cyber infrastructure for advanced EW/cyber development, tactical rehearsal, and training capabilities.			
<i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> In FY19 this Project was created per an Office of the Secretary of Defense directive to identify cyber investments in cyber unique Projects.			
Accomplishments/Planned Programs Subtotals	-	-	6.483

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K12 / <i>EW Demonstrations (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>K12: EW Demonstrations (CA)</i>	-	14.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.000

Note

Congressional Program Increase

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Electronic Warfare Demonstrations.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	14.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	14.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K15 / <i>Advanced Comm Ecm Demo</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
K15: <i>Advanced Comm Ecm Demo</i>	-	7.791	9.288	2.439	-	2.439	4.700	6.339	6.549	6.681	0.000	43.787

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, signals of interest (SOI) and computer networks/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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Offensive Operations</p> <p>Description: This effort matures and demonstrates integrated electronic attack (EA) and cyberspace electromagnetic activities (CEMA) 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/Projects CY3 and K16 and PE 0602270A/Projects CYB and 906 complement this effort. In FY 2019 this effort was moved to Project CY3 in accordance with Volume 2B, Chapter 18, of the DoD Financial Management Regulation (FMR), requiring all "cyberspace activities" funding move into pure budget Projects.</p> <p>FY 2018 Plans: 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 CEMA situational awareness (SA) and understanding (SU); mature and conduct modeling and simulation (M&S) within the laboratory to replicate next generation CEMA architecture and mature analytic tools to inform/develop the commander's SU; and</p>	5.523	6.177	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K15 / <i>Advanced Comm Ecm Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>replicate the current offensive cyber operation (OCO) operational state within a simulated laboratory environment to facilitate an EW/cyber tactical rehearsal and training capability.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: In FY19 this effort was moved to Project CY2 per an Office of the Secretary of Defense directive to identify cyber investments in cyber unique Projects.</p>				
<p>Title: Stand-off Non-Cooperative Multi-Intelligence (Multi-INT) Technologies</p> <p>Description: This effort matures and demonstrates hardware and software to conduct standoff electronic warfare (EW) intelligence, surveillance reconnaissance, planning and effects in a three dimensional urban battlespace. Work being accomplished under Program Element (PE) 0603270A/Project K16 and PE 0602270/Project 906 complement this effort.</p> <p>FY 2018 Plans: Mature and develop techniques focused on executing electronic surveillance (ES) (sense/detect/identify/geolocate) and electronic attack (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 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.</p> <p>FY 2019 Plans: Will mature modeling & simulation (M&S) capabilities to analyze advanced threat scenarios to optimize future Blue Force multi-function EW sensor employment; will conduct a laboratory demonstration of EW operations coordinated with other Warfighting functions (Fires, Maneuver, etc.) within the context of the EWPMT POR; demonstrate the implementation of ES and EA C2 functions in a laboratory environment to support future Terrestrial Layer Intelligence. Will support requirements development using EWPMT and/or surrogate sensors/systems; and will mature and demonstrate software algorithms that optimize the planning of coordinated disparate airborne EW (i.e. the Air large increment of the Multifunction EW POR) and Intel assets (i.e. Enhanced Medium Altitude Reconnaissance and Surveillance System and Tactical SIGINT Payload PORs) with ground-based multi-function assets (i.e. dismounted/mounted Intel/EW systems) to illustrate the value of a combined Intel and CEMA common operating picture for enhanced situational understanding.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		2.268	3.111	2.439

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K15 / <i>Advanced Comm Ecm Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
Decrease to completions of demonstrations of the ability to extend and demonstrate EW Planning and Management Tool (EWPMT) Program of Record (POR) interfaces.			
Accomplishments/Planned Programs Subtotals	7.791	9.288	2.439

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>				Project (Number/Name) K16 / <i>Non-Commo Ecm Tech Dem</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
K16: <i>Non-Commo Ecm Tech Dem</i>	-	19.028	22.008	22.569	-	22.569	24.086	24.510	25.313	25.842	0.000	163.356

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Multispectral Threat Detection and Countermeasure Technologies	3.045	6.447	6.500
Description: This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against electro-optical (EO), infrared (IR) and radio frequency (RF) guided threats. Work accomplished under Program Element (PE) 0602270A/Project 906 complements this effort.			
FY 2018 Plans: 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 (M&S) to ensure the modular architecture framework supports rapid updates for algorithm maturation and 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.			
FY 2019 Plans: Will develop demonstrator sensor system leveraging previously developed digital readout integrated circuit for threat warning, advanced focal plane array, and processing; will use demonstrator sensor to collect threat signatures and background data; will integrate new sensor model into the M&S environment; will assess algorithm performance with prior data sets and additionally with newly collected data from demonstrator sensor system; will evaluate algorithm performance using models of projected threats with			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K16 / <i>Non-Commo Ecm Tech Dem</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>modified signature characteristics; and will analyze function and capability of demonstrator sensor system as part of an integrated survivability suite and demonstrate end-to-end functionality of demonstrator sensor system in laboratory environment.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned increase of the effort.</p>				
<p>Title: Advanced Tactical EW Countermeasure Technologies</p> <p>Description: This effort matures and demonstrates integrated electronic warfare (EW)/direction finding technologies that provide protection of ground and dismounts from emerging radio frequency (RF) threats at standoff distances. Work accomplished under Program Element (PE) 0602270A/Project 906 and PE 0603270A/Project K15 complements this effort.</p> <p>FY 2018 Plans: 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 (M&S) to assess the ability of learning algorithms to improve platform survivability; and demonstrate capability in a relevant environment.</p> <p>FY 2019 Plans: Will develop functions to intelligently identify threat, assess effectiveness, and optimize soft-kill (SK) countermeasure response for Homing and Laser Beam Rider threat variants; will refine threat and system models that enable training of cognitive algorithms; will conduct hardware breadboarding and techniques development of advanced SK countermeasure system; will provide feedback to Open Standards Community of Interest on EW requirements; will demonstrate integrated SK countermeasure hardware and intelligent software in simulation environment; will perform technology assessment of the advanced SK countermeasure performance in the areas of identification, effectiveness assessment, optimization, improvements to total survivability, and extensibility to unknown threats.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned progression of the effort.</p>		4.546	5.056	5.099
<p>Title: EW Counter Countermeasures</p> <p>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.</p> <p>FY 2018 Plans:</p>		3.500	3.502	3.504

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K16 / <i>Non-Commo Ecm Tech Dem</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will continue maturation and integration of EP software and algorithms in open standards and open architecture designs with a focus on different classes of radar systems across the Army portfolio; will continue to conduct hardware in the loop (HWIL) analysis of prioritized emerging threat interference techniques; will 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; will mature and complete EP algorithms for detection, localization and neutralization of electronic interference, and will demonstrate their performance against a current threat; leverage HWIL assessment capabilities to support a future threat analysis and develop techniques for mitigating future threats; and will expand efforts into developing advanced EA capabilities based on predicted future threats to create a red-team / blue-team EA/EP optimization loop for development of more advanced EP techniques.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned increase of the effort.</p>				
<p>Title: Active Protection System (APS) Soft Kill (SK)/Hard Kill (HK) Sensors (formerly titled Active Protection System (APS) Soft Kill)</p> <p>Description: This effort matures and demonstrates hardware, software and techniques to provide an electronic warfare (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.</p> <p>FY 2018 Plans: Complete soft-kill (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 hard-kill (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</p>		7.250	3.251	3.466

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K16 / <i>Non-Commo Ecm Tech Dem</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>of multiple subsystems (cueing and tracking sensors, controller and SKCM); and integrate tracking sensor into the controller to prepare for the HK/SK demonstration.</p> <p>FY 2019 Plans: Will demonstrate soft-kill (SK) and hard-kill (HK) capability and perform system analysis of their respective passive electro-optic/infrared and active radar sensors, SKCM, and Modular APS (MAPS) Controller on the MAPS platform demonstrator and MAPS Virtual software and hardware integration laboratories; passive and active sensor interface designs will be verified with modular active protection framework by demonstrating real time cueing, tracking and handoff of the threat message to the SKCM and hard-kill countermeasure (HKCM); will develop, integrate and demonstrate the message pass through of multiple subsystems (cueing and tracking sensors, controller, SKCM and HKCM); will continue integration of the passive and active sensors into the additional SK and HK APS; and integrate new passive and active sensor techniques into the SKCM and HKCM software/hardware to address a wider list of current and emerging threats.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned progression of the effort.</p>				
<p>Title: Modeling Simulation and Technique Maturation for Integrated RF Operations (formerly titled Integrated RF Operations)</p> <p>Description: This effort matures and demonstrates a capability to perform modeling and simulation (M&S) of geographically dispersed radio frequency (RF) systems to provide a coordinated, collaborative and interoperable suite of electronic warfare (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.</p> <p>FY 2018 Plans: Continued 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; and optimized methods to conduct M&S of complex environments with multiple geographically dispersed SOIs and blue force systems in a timely manner with sufficient fidelity to provide validated performance estimates to system developers.</p> <p>FY 2019 Plans: Will mature and extend the collaborative sensor M&S environment to be capable of assessing system of systems performance for EW and other sensors across various scenarios to support analysis of performance requirements and development of concepts of employment; will mature EW techniques and methods (i.e. active, reactive, surgical and protocol based software) developed in FY18 under the Multi-Function Electronic Warfare (MFEW) Technique Development effort.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		0.687	1.751	1.250

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) K16 / <i>Non-Commo Ecm Tech Dem</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Reduced to support Army Modernization Priorities.				
Title: Intelligence Processing and Architecture Modernization		-	2.001	2.750
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.				
FY 2018 Plans: 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.				
FY 2019 Plans: Will integrate electronic situational awareness assets into a multifunction system capable of demonstrating integrated intelligence, surveillance and reconnaissance (ISR)/electronic warfare (EW) enabling enhanced performance through sensor fusion and agility to changing threat environments; will integrate distributed sensing algorithms with the high frequency (HF) software defined radio within a modular multifunction open radio frequency (RF) architecture and will demonstrate single sensor geolocation techniques in a laboratory environment for use within existing ES and EW sensors; and demonstrate mitigation techniques for noise within the HF frequency band from small unmanned air systems to facilitate deployment of HF applications on platforms.				
FY 2018 to FY 2019 Increase/Decrease Statement: Planned progression of the effort.				
Accomplishments/Planned Programs Subtotals		19.028	22.008	22.569
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	113.683	62.850	61.132	-	61.132	56.578	54.093	55.332	63.490	0.000	467.158
206: <i>Missile Simulation</i>	-	2.342	2.476	2.488	-	2.488	2.573	2.623	2.678	2.731	0.000	17.911
263: <i>Future Msl Tech Integr(FMTI)</i>	-	22.387	34.725	39.212	-	39.212	30.163	31.320	38.654	39.441	0.000	235.902
704: <i>Advanced Missile Demo</i>	-	25.454	25.649	19.432	-	19.432	23.842	20.150	14.000	21.318	0.000	149.845
NA6: <i>Missile and Rocket Initiatives (CA)</i>	-	63.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.500

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.

The work in this PE is performed by the Army Research, Development and Engineering Command (RDECOM).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	52.190	62.850	64.396	-	64.396
Current President's Budget	113.683	62.850	61.132	-	61.132
Total Adjustments	61.493	0.000	-3.264	-	-3.264
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	63.500	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.982	-			
• Adjustments to Budget Years	-	-	-3.264	-	-3.264
• Other Adjustments 2	-0.025	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: NA6: *Missile and Rocket Initiatives (CA)*

- Congressional Add: *Congressional Program Increase*
- Congressional Add: *Cybersecurity and supply chain risk management research*
- Congressional Add: *GPS-guided weapon performance improvement*
- Congressional Add: *next generation close combat missile*
- Congressional Add: *Armament systems concepts*
- Congressional Add: *Armament systems integration*

Congressional Add Subtotals for Project: NA6

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	30.000	-
	10.000	-
	5.000	-
	8.500	-
	5.000	-
	5.000	-
Congressional Add Subtotals for Project: NA6	63.500	-
Congressional Add Totals for all Projects	63.500	-

Change Summary Explanation

FY17 Congressional increase in NA6 Missile and Rocket Initiatives

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>				Project (Number/Name) 206 / <i>Missile Simulation</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
206: <i>Missile Simulation</i>	-	2.342	2.476	2.488	-	2.488	2.573	2.623	2.678	2.731	0.000	17.911

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Missile Simulation	2.342	2.476	2.488
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 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 electro-optical (EO)/infrared (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 .			
FY 2019 Plans: Will mature and demonstrate algorithms for forecasting air and missile tactical threat maneuvers, improve the missile threat maneuver forecaster, and will mature algorithms for engagement tailoring and predicted intercept point (pip) management and demonstrate capabilities in experiments to quantify engagement performance; will validate a System-of-Systems simulation which			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 206 / <i>Missile Simulation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>provides a virtual context for research, development, and evaluation of advanced fire control and missile guidance algorithms; will mature and demonstrate cross cutting technologies that enable rapid and cost effective integration of new weapon and sensor technologies into complex system architectures; will expedite the engineering of complex software intensive systems by transforming models of interactive algorithmic behaviors into prototype software; will further mature cost-estimating tools for propulsion systems, software, modular systems, and for converting commercial off-the-shelf cost to military off-the-shelf cost; will establish behind armor debris prediction capabilities for multiple shaped charge materials and designs.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Increase due to inflation.</p>			
Accomplishments/Planned Programs Subtotals	2.342	2.476	2.488

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 263 / <i>Future Msl Tech Integr(FMTI)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
263: <i>Future Msl Tech Integr(FMTI)</i>	-	22.387	34.725	39.212	-	39.212	30.163	31.320	38.654	39.441	0.000	235.902

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Low Cost Tactical Extended Range Missile	11.362	8.538	9.470
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 2018 Plans: Continue to mature and validate the long range fires missile systems 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 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			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 263 / <i>Future Msl Tech Integ(FMTI)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will further mature and evaluate the long range fires missile components in the areas of navigation, propulsion, and payload technologies; will conduct system simulation to assess improved missile performance provided by these technologies and guide their continued development; will continue to develop and test navigation integration architectures and algorithms and refine navigations system design concepts based on updated program requirements and technology developments and begin testing of enhanced navigation system designs at the sub-system level; will conduct fabrication and testing of high strength fiber and high temperature matrix materials for the solid rocket motorcase and missile airframe to meet objective requirements. Will conduct analysis of results from Single Warhead for Area and Point Targets (SWAP) warhead testing to facilitate technology transition for multi-effects lethality for Fire Support applications.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase due to efforts to fabricate and assemble navigation and propulsion systems into a fully functional components and subsystems.</p>				
<p>Title: Active Protection System Interceptor Demonstration</p> <p>Description: This effort matures, integrates and demonstrates modular hard-kill Active Protection System (APS) technologies with the Hit Avoidance Architecture and APS Common Controller and matures modeling and simulation for system integration and demonstration. Specifically the hard-kill APS portion and modeling and simulation efforts will be addressed by 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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans:</p>		6.010	6.250	3.516

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 263 / <i>Future Msl Tech Integr(FMTI)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Will continue maturation and adaptation of a hard-kill countermeasure and fire control sensor to improve performance of survivability equipment; will improve modeling and simulation of APS countermeasure and fire control sensor alternatives.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to Modeling and Simulation work beginning to taper as work shifts focus to other technologies being developed for this effort.</p>				
<p>Title: Affordable Extended Range Precision Missile Demonstration</p> <p>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.</p> <p>FY 2018 Plans: 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 include: target detection, target acquisition, target classification, target tracking, target aim point selection, trajectory management, thermal characterization and lethality assessment.</p> <p>FY 2019 Plans: Will further develop radio frequency (RF) sensor technology, perform integration and will demonstration for multiple platforms to improve performance of missiles in an Anti-Access/Anti-Denial environment; critical attributes will include target detection, target acquisition, target classification, target tracking and target aim point selection.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to funding being transferred into new start, Multi-Domain Lethality Demonstration.</p>		3.500	13.149	7.700
<p>Title: Close Combat Weapons Technology</p> <p>Description: This effort addresses close combat weapon systems trade studies, and technology maturation and demonstration for a next generation close combat precision missile system for dismounted and mounted maneuver.</p> <p>FY 2018 Plans: 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,</p>		1.515	6.788	5.572

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 263 / <i>Future Msl Tech Integr(FMTI)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will mature optimized missile design with multi-effects lethal mechanism and integrate with expeditionary launcher for short to medium range precision strike with man-in-the-loop and loitering capability with lethal effects against hard and soft targets; will begin validation of the optimized design through lab and field demonstration.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to work associated with flight demonstration of a precision maneuverable missile in a relevant environment being completed.</p>				
<p>Title: Multi-Domain Lethality Demonstration</p> <p>Description: This effort focuses on the maturation, fabrication, integration, Hardware-in-the-Loop (HWIL) development and test, and flight demonstration of critical missile technology that supports Multi-Domain Battle Concept/Cross-Domain Fires and Manned-Unmanned Teaming (MUM-T) System of Systems. The objective is to develop capability for missile systems to destroy enemy air defenses in the land and the maritime domains. This effort will develop and demonstrate appropriate sensor and payload component technologies for engaging and destroying maritime- and land-based air defense systems; integrate these component technologies into prototype missile hardware; and demonstrate hardware in a relevant flight environment.</p> <p>FY 2019 Plans: Will mature component development of 1) multi-mode seeker (anti-radiation homing and imaging infrared) for target classification/discrimination and aim-point selection on critical target features and 2) warhead and fuze that maximizes lethal effects against multi-domain target sets; will conduct critical design review of component technologies; will perform test and evaluation of key enabling component technologies; will refine concepts for system integration; will mature modeling and simulation HWIL capabilities for testing and validation of integrated components.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: New start</p>		-	-	12.954
Accomplishments/Planned Programs Subtotals		22.387	34.725	39.212
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 263 / <i>Future Msl Tech Integr(FMTI)</i>

C. Other Program Funding Summary (\$ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 704 / <i>Advanced Missile Demo</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>704: Advanced Missile Demo</i>	-	25.454	25.649	19.432	-	19.432	23.842	20.150	14.000	21.318	0.000	149.845

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Counter Rockets, Artillery, Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missile Tracking and Fire Control	7.729	7.497	2.359
Description: This effort matures and demonstrates system technology to provide 360 degree, near hemispherical coverage for tracking and intercept of UAS and/or Cruise Missile threats. This effort matures fire control methodology for engagement of threat UAS and/or Cruise Missile to generate firing solutions and determine interceptors available for an air defense mission. These efforts will be evaluated through Hardware-in-the-Loop (HWIL) experiments and multiple interceptor flights. Effort will also mature tactical launcher configurations and designs for alternative mission profiles. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC) and other Air and Missile Defense programs.			
FY 2018 Plans: 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.			
FY 2019 Plans: Will mature and integrate digital data link ground station, inertial network alignment technology, and ground station components with a surrogate demonstration launcher for demonstration; will mature fire control methodology and software for air defense engagement planning and flight test demonstration planning. Will exploit data gathered from multi-mission radar and other			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 704 / <i>Advanced Missile Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
sensors in order to mature algorithm to autonomously detect, track, identify, rank and defeat counter-Unmanned Aerial System threat.				
FY 2018 to FY 2019 Increase/Decrease Statement: Work completed on the HWIL experiments and determination of available interceptors for an air defense mission.				
Title: Low-cost Extended Range Air Defense		8.876	8.882	8.293
Description: This effort matures key technologies of a lower-cost interceptor system with a low- to medium-altitude, medium- to long-range capability. This effort will enable lower cost interceptor integration into a net-enabled Air and Missile Defense Task Force for the protection of high value assets. Technologies will address the defeat of air defense threats such as Unmanned Aerial System (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 2018 Plans: 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 (HWIL) flight simulation of the digital data link, mission computer, power system, navigation system, and control actuation system.				
FY 2019 Plans: Will further integrate the guidance electronics unit (GEU) and control system into HWIL for demonstration of the entire guidance, navigation, and control system. Will begin HWIL flight simulation, demonstrating GEU and control system performance with a false target generator and flight motion simulator using an emulated target with the correct radar signature and kinematics, and the emulated body motion and loading of simulated flight environments.				
FY 2018 to FY 2019 Increase/Decrease Statement: Completed work on HWIL compact range and target generator.				
Title: Seeker and Guidance Technology for Air Defense		7.263	7.267	6.785
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, Unmanned Aerial System (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 2018 Plans: Demonstrate active radio frequency (RF) seeker in hardware-in-the-loop flight simulation with guidance electronics unit (GEU) and in field testing in a relevant environment; continue maturation of guidance algorithms for accurate mid-course and terminal homing				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 704 / <i>Advanced Missile Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will continue maturation of the active RF seeker in the HWIL simulation facility; will refine seeker calibration, optimizing acquisition and track algorithms, optimizing seeker control algorithms, and debugging software; will continue maturation of guidance algorithms in hardware-in-the-loop (HWIL) for accurate mid-course and terminal homing guidance at extended ranges; will provide flight control scripts for testing the speed, accuracy, and stability of the flight control system for use in future flight testing.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Completed work on initial datalink HWIL testing.</p>				
<p>Title: Multi-Role Missile Demonstration</p> <p>Description: This effort focuses on the maturation, fabrication, integration, hardware-in-the-loop (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.</p> <p>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.</p> <p>FY 2019 Plans: Will continue demonstration in a ground-launched flight test the guidance and control performance of the guided forward firing configuration and will 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; will perform laboratory testing and simulation evaluations; will integrate modular missile technology subsystems; and will perform air dropped, unguided/ballistic flight tests to verify mechanical and electrical integrity of the drop/glide variant.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement:</p>		1.586	2.003	1.995

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) 704 / <i>Advanced Missile Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
Completed initial payload determination work.			
Accomplishments/Planned Programs Subtotals	25.454	25.649	19.432

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) NA6 / <i>Missile and Rocket Initiatives (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
NA6: <i>Missile and Rocket Initiatives (CA)</i>	-	63.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.500

Note

Congressional increase

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 2017	FY 2018
Congressional Add: Congressional Program Increase <i>FY 2017 Accomplishments:</i> N/A	30.000	-
Congressional Add: Cybersecurity and supply chain risk management research <i>FY 2017 Accomplishments:</i> N/A	10.000	-
Congressional Add: GPS-guided weapon performance improvement <i>FY 2017 Accomplishments:</i> N/A	5.000	-
Congressional Add: next generation close combat missile <i>FY 2017 Accomplishments:</i> N/A	8.500	-
Congressional Add: Armament systems concepts <i>FY 2017 Accomplishments:</i> N/A	5.000	-
Congressional Add: Armament systems integration <i>FY 2017 Accomplishments:</i> N/A	5.000	-
Congressional Adds Subtotals	63.500	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / <i>Missile and Rocket Advanced Technology</i>	Project (Number/Name) NA6 / <i>Missile and Rocket Initiatives (CA)</i>

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603322A / TRACTOR CAGE
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	11.107	12.323	16.845	-	16.845	17.661	17.986	18.820	19.196	0.000	113.938
B92: DB92	-	11.107	12.323	16.845	-	16.845	17.661	17.986	18.820	19.196	0.000	113.938

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)

	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019 Base</u>	<u>FY 2019 OCO</u>	<u>FY 2019 Total</u>
Previous President's Budget	11.107	12.323	12.400	-	12.400
Current President's Budget	11.107	12.323	16.845	-	16.845
Total Adjustments	0.000	0.000	4.445	-	4.445
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	4.445	-	4.445

Change Summary Explanation

FY19 funding increase for higher priority effort

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603461A / High Performance Computing Modernization Program
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	215.462	182.331	183.322	-	183.322	186.329	190.046	193.929	197.808	0.000	1,349.227
DS7: High Performance Computing Modernization Program	-	170.462	182.331	183.322	-	183.322	186.329	190.046	193.929	197.808	0.000	1,304.227
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	0.000	45.000

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 Environment and Terrain 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	177.190	182.331	183.322	-	183.322
Current President's Budget	215.462	182.331	183.322	-	183.322
Total Adjustments	38.272	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	45.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.643	-			
• FFRDC	-0.085	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*

Congressional Add: *Program increase*

	FY 2017	FY 2018
Congressional Add Subtotals for Project: DW5	45.000	-
Congressional Add Totals for all Projects	45.000	-

Change Summary Explanation

Congressional increase in project DW5 for High Performance Computing Modernization

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
DS7: High Performance Computing Modernization Program	-	170.462	182.331	183.322	-	183.322	186.329	190.046	193.929	197.808	0.000	1,304.227

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 Environment and Terrain 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 2017	FY 2018	FY 2019
Title: Department of Defense Supercomputing Resource Centers	92.313	97.298	97.121
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			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>	Project (Number/Name) DS7 / <i>High Performance Computing Modernization Program</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>DoD Research, Development, Test and Evaluation (RDTE) community to effectively and efficiently investigate, demonstrate, and mature a broad range of technologies through advanced computational methods.</p> <p>FY 2018 Plans: 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 Department of Defense (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. 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; 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; 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; 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; mature shared above secret capabilities to address critical DoD mission requirements.</p> <p>FY 2019 Plans: Will continue to 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. 2019) 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 continue to 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 continue to further mature the ability to use both general purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer)</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>	Project (Number/Name) DS7 / <i>High Performance Computing Modernization Program</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>to expand the breadth of DoD use cases that can be addressed by supercomputing; will continue to 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 continue to mature shared above secret capabilities to address critical DoD mission requirements.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned program decrease.</p>				
<p>Title: Defense Research and Engineering Network</p> <p>Description: This effort investigates, demonstrates, and matures state-of-the-art digital networking technologies to ensure a robust distributed environment among High Performance Computing Modernization Program (HPCMP) sites, the DoD High Performance Computing (HPC) Research, Development, Test and Evaluation (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.</p> <p>FY 2018 Plans: Refine and exploit Defense Research and Engineering Network (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; 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; 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; continue to mature the advanced network technologies and complex cybersecurity mechanisms required to implement logically-separated networked COIs at multiple classification levels; continue to demonstrate hardware architecture and software stack enhancements for network sensors to simultaneously allow (1) active support for the HPCMP's Defense Information Systems Agency (DISA)-accredited Tier 2 cybersecurity service provider capabilities and (2) active experimentation for novel, adaptive cybersecurity detection and intervention methods; continue to demonstrate the ability to employ SDNs to allow traditional IP and experimental protocol networks to coexist within a common DoD networking infrastructure; 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.</p> <p>FY 2019 Plans:</p>		28.159	31.284	32.150

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>	Project (Number/Name) DS7 / <i>High Performance Computing Modernization Program</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Adjustment due to inflation.</p>				
<p>Title: Software Applications</p> <p>Description: This effort optimizes, enhances, demonstrates, and matures software applications to provide for the adaptation of widely used applications and algorithms to address Research, Development, Test and Evaluation (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</p>		49.990	53.749	54.051

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>	Project (Number/Name) DS7 / <i>High Performance Computing Modernization Program</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>science and engineering workflows, and (3) demonstrates and matures leading-edge computational technology from academia and industry.</p> <p>FY 2018 Plans: 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 matures 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 includes, 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 includes 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 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 are 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, further mature computational electromagnetics capabilities to assist in design and evaluation of next generation radar for aircraft, ships, and ground-based platforms; demonstrate capability for assessment of electromagnetic hazards on ordnance and optimize computational methods for electronic warfare assessments and evaluation of multiple antenna systems on a single platform. For Naval Ships (surface and submarine), 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.</p> <p>FY 2019 Plans: Will continue to 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 continue maturing 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</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / <i>High Performance Computing Modernization Program</i>	Project (Number/Name) DS7 / <i>High Performance Computing Modernization Program</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Adjustment due to inflation.</p>				
Accomplishments/Planned Programs Subtotals		170.462	182.331	183.322
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

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)
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	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	0.000	45.000

Note
Congressional increase for Program increase

A. Mission Description and Budget Item Justification

This is a Fiscal Year 2017 Congressional increase to the High Performance Computing Modernization Program.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program increase	45.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	45.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603606A / <i>Landmine Warfare and Barrier Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	16.798	17.948	11.104	-	11.104	11.238	11.873	12.018	7.922	0.000	88.901
608: <i>Countermine & Bar Dev</i>	-	14.888	15.957	11.104	-	11.104	11.238	11.873	12.018	7.922	0.000	85.000
683: <i>Area Denial Sensors</i>	-	1.910	1.991	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.901

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 Research, Development, and Engineering Command (RDECOM).

B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	17.451	17.948	13.097	-	13.097
Current President's Budget	16.798	17.948	11.104	-	11.104
Total Adjustments	-0.653	0.000	-1.993	-	-1.993
• Congressional General Reductions	-	-	-	-	-
• Congressional Directed Reductions	-	-	-	-	-
• Congressional Rescissions	-	-	-	-	-
• Congressional Adds	-	-	-	-	-
• Congressional Directed Transfers	-	-	-	-	-
• Reprogrammings	-	-	-	-	-
• SBIR/STTR Transfer	-0.645	-	-	-	-
• Adjustments to Budget Years	-	-	-1.993	-	-1.993
• FFRDC	-0.008	-	-	-	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army Date: February 2018

Appropriation/Budget Activity
2040: *Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)*

R-1 Program Element (Number/Name)
PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*

Change Summary Explanation

The FY19 funding reduction occurred in order to support funding shifts to other higher priority efforts that impact C3I/Network senior leader priorities.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603606A / <i>Landmine Warfare and Barrier Advanced Technology</i>				Project (Number/Name) 608 / <i>Countermine & Bar Dev</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
608: <i>Countermine & Bar Dev</i>	-	14.888	15.957	11.104	-	11.104	11.238	11.873	12.018	7.922	0.000	85.000

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 both day and night. Activities include maturation and demonstration of modular, semi-autonomous, and autonomous air, ground, and Soldier borne technologies to enable standoff and close-in detection and neutralization of explosive threats. 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Ground Vehicle Explosive Hazard Detection</p> <p>Description: This effort 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. This effort 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.</p> <p>FY 2018 Plans: Demonstrate and evaluate an integrated forward looking electro-optical (EO)/infrared (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 Ground Penetrating Radar (GPR) sensor cueing with integrated graphical user interface; demonstrate and evaluate Light Detection and Ranging (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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.</p>	14.888	15.957	-
<p>Title: Autonomous Explosive Hazard Detection</p> <p>Description: This effort demonstrates an integrated modular sensor and sensor data processing capability to enable remote and semi-autonomous detection of mines, other explosive hazards, and indicators of emplacement, such as command wires and initiation devices from a safe standoff distance using small unmanned ground and air platforms. This effort also matures and demonstrates explosive hazard (EH) detection technologies that can be adapted to address near-peer threats in multiple environments.</p>	-	-	11.104

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603606A / <i>Landmine Warfare and Barrier Advanced Technology</i>	Project (Number/Name) 608 / <i>Countermine & Bar Dev</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2019 Plans:</i> Will mature sensors to detect wire components from standoff distances and sensor configurations for implementation on unmanned platforms; exploit novel sensor phenomenologies for optimization of explosive threat detection approaches; improve threat detection algorithms and signal processing techniques for the detection of buried explosive hazards using data collected in near-peer environments; mature low contrast target marking schemas and approaches; improve performance of close-in explosive threat confirmation sensors.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> Investment to support explosive threat detection efforts.</p>			
Accomplishments/Planned Programs Subtotals	14.888	15.957	11.104

<p>C. Other Program Funding Summary (\$ in Millions) N/A</p> <p>Remarks</p> <p>D. Acquisition Strategy N/A</p> <p>E. Performance Metrics N/A</p>
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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603606A / <i>Landmine Warfare and Barrier Advanced Technology</i>				Project (Number/Name) 683 / <i>Area Denial Sensors</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
683: <i>Area Denial Sensors</i>	-	1.910	1.991	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.901

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) and related maneuver barriers. 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 matures and optimizes components and system architectures, and it validates components 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Area Denial Sensors	1.910	1.991	-
Description: This effort matures and demonstrates networked sensor and sensor fusion technology efforts to provide detection, identification, and classification in support 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 2018 Plans: 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.			
FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.			
Accomplishments/Planned Programs Subtotals	1.910	1.991	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603606A / <i>Landmine Warfare and Barrier Advanced Technology</i>	Project (Number/Name) 683 / <i>Area Denial Sensors</i>

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603607A / <i>Joint Service Small Arms Program</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	5.615	5.796	5.885	-	5.885	4.604	4.696	6.249	6.374	0.000	39.219
627: <i>Jt Svc Sa Prog (JSSAP)</i>	-	5.615	5.796	5.885	-	5.885	4.604	4.696	6.249	6.374	0.000	39.219

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.

The work in this PE is performed by the Army Research, Development and Engineering Command (RDECOM).

B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	5.839	5.796	5.885	-	5.885
Current President's Budget	5.615	5.796	5.885	-	5.885
Total Adjustments	-0.224	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.221	-			
• FFRDC	-0.003	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

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)
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
627: Jt Svc Sa Prog (JSSAP)	-	5.615	5.796	5.885	-	5.885	4.604	4.696	6.249	6.374	0.000	39.219

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 Army Science and Technology Lethality 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Volume Effects	2.272	2.373	1.945
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 2018 Plans: Continue to support technology development for Next Generation Squad Automatic Rifle (NGSAR) requirements; investigate weapon systems, fire control, and ammunition technologies to increase the current performance of the lightweight medium machine gun.			
FY 2019 Plans: Will mature technology concepts to inform NGSAR requirements and optimize designs for the next generation carbines and Squad Designated Marksman (SDM) weapon systems; will mature weapon system, fire control, and ammunition technologies to increase the current performance of the lightweight medium machine gun.			
FY 2018 to FY 2019 Increase/Decrease Statement: Decrease is due to component technologies being matured for a demonstration of a next generation squad weapon.			
Title: Precision Effects	1.521	1.428	1.013

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
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 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will optimize and demonstrate anti-material, improved performance and subsonic precision ammunition in three different calibers to support requirements for extended range and increased accuracy and terminal effects required to meet those needs across multiple fielded or emerging weapon platforms.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease is due to technologies for small arms precision being matured for a demonstration in three different calibers.</p>				
<p>Title: Small Arms Systems Integration and Demo</p> <p>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.</p> <p>FY 2018 Plans: Continue to increase lethality capabilities and assess small arms effectiveness.</p> <p>FY 2019 Plans: Will demonstrate next Generation Small Arms Squad Technologies at the Army Expeditionary Warrior Experiment (AEWE) in support of increasing small unit effectiveness.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase is due to the leadtime for and during the demonstration of the next generation squad weapons a live fire warfighter exercise.</p>		0.380	0.495	1.500
<p>Title: Joint Service Small Arms Science and Technology Collaboration</p> <p>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</p>		1.442	1.500	1.427

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603607A / <i>Joint Service Small Arms Program</i>	Project (Number/Name) 627 / <i>Jt Svc Sa Prog (JSSAP)</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Services' efforts to improve Small Arms capabilities thus reducing duplication of ongoing and planned technology, acquisition and sustainment activities.				
FY 2018 Plans: 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.				
FY 2019 Plans: Will continue to manage Joint Services Small Arms Programs; will continue technology developmental efforts on material solutions for transitioning to small arms programs of record; will continue to influence small arms technology maturation activities in collaboration with North Atlantic Treaty Organization (NATO) partners.				
FY 2018 to FY 2019 Increase/Decrease Statement: Decrease due to reduced level of effort in support of technology maturation activities with NATO partners.				
Accomplishments/Planned Programs Subtotals		5.615	5.796	5.885
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	42.798	47.135	61.376	-	61.376	62.280	53.442	54.776	55.872	0.000	377.679
K70: <i>Night Vision Adv Tech</i>	-	26.260	21.529	32.750	-	32.750	35.059	35.725	36.552	37.284	0.000	225.159
K86: <i>Night Vision, Abn Sys</i>	-	16.538	25.606	28.626	-	28.626	27.221	17.717	18.224	18.588	0.000	152.520

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 provide our Warfighters with a Common Operating Picture (COP) to enable increased situational understanding and combat overmatch. Specific areas of maturation and demonstration include technologies that integrate disparate sensor architectures, perform multispectral aided target detection (AiTD), enable passive long range target identification (ID), improve day/night visualization systems, allow rapid wire area search, and facilitate augmented reality. Project K86 matures and validates airborne platform sensors and algorithms designed to detect targets (vehicles and personnel) in camouflage, concealment, and deception. This Project provides pilotage and situational understanding imagery to multiple pilots/crew members independently to 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 (Countermeasure 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 Research, Development, and Engineering Command (RDECOM).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	44.468	47.135	61.419	-	61.419
Current President's Budget	42.798	47.135	61.376	-	61.376
Total Adjustments	-1.670	0.000	-0.043	-	-0.043
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.649	-			
• Adjustments to Budget Years	-	-	-0.043	-	-0.043
• FFRDC	-0.021	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>			Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>				
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>K70: Night Vision Adv Tech</i>	-	26.260	21.529	32.750	-	32.750	35.059	35.725	36.552	37.284	0.000	225.159

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. This Project provides improved capabilities and Common Operating Picture (COP) 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Advanced Sensors for Precision</p> <p>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 technologies, 3-Dimensional (3D) imaging sensor techniques, emerging laser technologies, and precise far target location technologies to increase situational understanding and enable early warning, Hostile Fire Detection (HFD), and active countermeasure capabilities. This effort 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?.</p> <p>This effort ends in FY17.</p>	4.003	-	-
<p>Title: Sensor Interoperability</p> <p>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 of this effort is to develop standards, 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 of this effort are increased sensor collaboration, reduced decision timelines, reduced soldier load, and reduced integration costs.</p> <p>FY 2018 Plans: 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</p>	2.500	3.004	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will improve methods for distributed interoperability management to support autonomous sensor data requesting, processing, and distribution decisions; improve methods for interoperability to optimize operation on limited-bandwidth communication networks and survive and recover from communication network denial; exploit internal interoperability management metadata to provide indicators of abnormal network behavior consistent with intrusion; mature and demonstrate methods allowing two-way interoperability across security domains; demonstrate interoperability integration and operation strategies across tactical and intelligence assets, to include joint and multinational assets.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Decrease in application layer reliability to support science and technology (S&T) Strategy and senior leader priorities.</p>				
<p>Title: Soldier System Architecture</p> <p>Description: This effort matures 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 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.</p> <p>This effort ends in FY18 and deliverables transition to Program Executive Office (PEO) Soldier and Research, Development, and Engineering Command (RDECOM).</p> <p>FY 2018 Plans: 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.</p>		1.005	1.001	-
<p>Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE)</p> <p>Description: This effort provides uncooled infrared (UCIR) sensor technologies to improve survivability through increased Situational Awareness (SA) in all conditions and environments, to include Degraded Visual Environments (DVE), for manned</p>		5.556	5.112	7.849

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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-functional (360 degree SA, Hostile Fire Detection (HFD), Aided Driving), low cost SA systems with in-vehicle displays that can be tailored to the ground platform and mission requirements will bring timely and useful information to the vehicle crew and squad. This is a Joint effort with the Tank Automotive Research, Development and Engineering Center (TARDEC) under PE 0602601/Project C05 and PE 0603005/Project 221. This effort is fully coordinated with PE 0602709/Project H95.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will conduct system validation of real time driving and maneuver capabilities in DVEs (dust, fog) on vehicle platforms with imaging sensors, an overlay of driving aids on sensor displays, and image enhancement algorithms; continue performance improvements from fusing COTS active sensors including MMW/Radar and scene based terrain knowledge to supplement UCIR imagery and optimize low latency cues suitable for driving; incorporate advanced UCIR sensors and image processing into unmanned systems to enhance target detection performance of convoy operations under degraded environments; demonstrate stationary hostile fire detection/cueing capabilities in real time through use of dual band UCIR with high performance detection against subsonic vehicular threats; optimize HFD algorithms for both short/long range scenarios to demonstrate low false alarm rates and validate the potential for OTM applications.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Validation investment increased in DVE environments to support senior leader priorities for Next Generation Combat Vehicle.</p>				
Title: Soldier Maneuver and Lethality Sensors		5.935	2.892	3.933
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				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>sensors, head mounted displays, and tactical lasers will be provided to users to gain feedback about performance and utility. 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. In FY 2019, work in this effort are realigned to support the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will provide design approaches for a multi-band leader weapon sight with multifunction sensors and lasers for target handoff, threat detection, and facial identification; improve sensor resolution for threat discrimination; exploit existing biometrics databases to provide standoff tactical capabilities; mature existing target detection algorithms to recognize complex obstacles using data collected with prototype high resolution airborne detection sensor system to improve situational awareness for dismounted units.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increased investment in target detection algorithms to support Soldier Lethality senior leader priorities.</p>				
<p>Title: Advanced Wide Area Search Sensors</p> <p>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. This work ends in FY17 and transitions to PEO Soldier.</p>		7.261	-	-
<p>Title: Augmented Reality for Tactical Operations</p> <p>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</p>		-	2.002	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will provide vision based orientation sensors to support geo-registration of information; provide initial demonstration of Blue Force Tracking (BFT), threat icons, and Situational Awareness (SA) information display on existing vehicle displays; demonstrate video from vehicle imagers displayed on Soldier Helmet Mounted Display (HMD) via wireless connection.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increased investment to support orientation sensor work.</p>				
<p>Title: New Long Range Advanced Scout Surveillance System (LRAS3)</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will integrate 3rd Generation FLIR and mature high power multi-spectral laser technologies for advanced threat detection at tactical ranges; improve laser detector technology to increase range performance and range resolution; optimize optical assemblies to yield high throughput multi-wavelength designs, lowering overall system Size, Weight, and Power (SWAP); validate</p>		-	5.412	4.883

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
target handoff subsystem performance; demonstrate initial digital read-out integrated circuit (DROIC) and cooled long wave infrared (LWIR) camera under required environmental conditions. FY 2018 to FY 2019 Increase/Decrease Statement: Decrease investment in performance modeling to support Soldier Lethality senior leader priorities.				
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 effort will mature and demonstrate sensing and imaging technologies to measure crosswinds and target range to provide an aim-point compensation of the bullet trajectory and increase the first round probability of hit. FY 2018 Plans: 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. FY 2019 Plans: Will mature and demonstrate a system brass board concept for a crew served electro-optical (EO) wind sensing system with weapon sight and reticle aim point adjustment; improve rifle display assembly to provide more direct optical flow of disturbed reticle. FY 2018 to FY 2019 Increase/Decrease Statement: Investment increase to accelerate wind sensing capabilities in support of Soldier Lethality priorities.		-	2.106	2.908
Title: One Sensor for Fire Support/Scout Operations Description: This effort will optimize and demonstrate a modular and tailorable single sensor solution for both Scouts and Forward Observers integrating advanced sensor technologies with increased identification (ID) range and improved target location accuracy. The effort will enable a synchronized Situational Awareness (SA) picture to enhance overall lethality and survivability. A single sensor approach will increase human performance with common training, common materiel repair parts, and economy of scales to support expeditionary operations. FY 2019 Plans:		-	-	2.078

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Will provide trade studies to optimize single sensor design approach for both Scouts and Forward Observers; improve design for increased range performance and reduced target location error; validate design approach via sensor range performance predictive modeling.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Investment to support sensor applications for Scouts and Forward Observers.</p> <p>Title: Asymmetric Vision / Decide Faster</p> <p>Description: This effort will mature and demonstrate sensing, image processing, display and mission decision aid capabilities to provide disaggregated mounted and dismounted teams with the ability to act autonomously, outmaneuver, and outthink the enemy in close combat with limited and intermittent access to higher echelon command and control systems. In FY19, this effort is developed from realigned funds in support of the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army.</p> <p>FY 2019 Plans: Will demonstrate tactical augmented reality, 3-Dimensional enriched terrain and mission planning tools; validate initial system of systems level concepts in tactically relevant environments; optimize concept data management and interoperability approaches.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Investment to support terrain and mission planning capabilities associated with the S&T Strategy and senior leader priorities for Soldier Lethality.</p>		-	-	5.099
Accomplishments/Planned Programs Subtotals		26.260	21.529	32.750
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>				Project (Number/Name) K86 / <i>Night Vision, Abn Sys</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
K86: <i>Night Vision, Abn Sys</i>	-	16.538	25.606	28.626	-	28.626	27.221	17.717	18.224	18.588	0.000	152.520

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, 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 Environments (DVE). UAS payload efforts mature and demonstrate small, lightweight, and modular payloads (e.g. 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).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Local Area Intelligence, Surveillance, and Reconnaissance (ISR) for Tactical Small Units	4.863	5.089	5.322
Description: This effort develops and demonstrates sensors enabling simultaneous display of wide and narrow field-of-view (FOV) infrared imagery for enhanced Situational Awareness (SA)/targeting. This effort optimizes multi-band image fusion and the ability to image battlefield laser spot locations for improved targeting accuracy and reduced fratricide caused by laser misalignment.			
FY 2018 Plans: 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.			
FY 2019 Plans: Will demonstrate and validate CSP turret system performance/capability improvements from a surrogate manned airborne platform to include simultaneous wide/narrow field-of-view, imaging of battlefield lasers, and extended range performance under adverse weather conditions.			
FY 2018 to FY 2019 Increase/Decrease Statement: Increase in funding to support additional validation efforts in adverse weather conditions.			
Title: Sensors and Sensor Fusion for Rotorcraft Degraded Visual Environment (DVE) Mitigation	11.675	9.257	11.054

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K86 / <i>Night Vision, Abn Sys</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Description: This effort leverages work previously accomplished under the ?Multifunction Imagers for Rotary Wing? and ? Pilotage Sensor Fusion? efforts. This effort matures sensing and processing approaches to improve pilotage in DVEs. This effort optimizes Long Wave Infrared (LWIR) imaging sensors capable of providing actionable imagery over a wide range of DVEs. This effort 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 (SA). The effort provides 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 PE0603003A, Aviation Advanced Technology, Project 313.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will mature real-time computing hardware and implement previously identified software approaches for sensor fusion, DAS and synthetic scene rendering, coherent 3D world model generation, and advanced navigation/location; integrate flight-worthy real-time computing hardware/software along with baseline sensor suite (high-sensitivity cooled LWIR, RADAR, active IR and wide field of view uncooled IR) onto airborne rotary wing testbed platform; conduct a series of airborne data collections to demonstrate the achieved system performance of the baseline and several alternate sensor/processing configurations; validate demonstrated performance of DVE sensor/processing configurations and identify modifications to improve performance; demonstrate operability of data interfaces to allow 3D world model queries from the flight control, guidance, and cueing systems.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase in funding to support additional demonstrations and data validation efforts to meet senior leader priorities for Future Vertical Lift.</p>				
Title: Digital Dual Use Sensors (DDUS)		-	11.260	12.250
Description: This effort will mature and demonstrate 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				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>	Project (Number/Name) K86 / <i>Night Vision, Abn Sys</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>survivability by providing hostile fire and missile warning cues while simultaneously providing pilotage and situational understanding in Degraded Visual Environments (DVEs). This effort leverages technology from the Dual Band Infrared Focal Plane Arrays (IRFPA) ManTech as well as from the 3D Digital Read-Out Integrated Circuit (DROIC) Science and Technology Objective (STO) to fabricate the digital multi-function readout circuit to enable the multi-function capability.</p> <p>FY 2018 Plans: 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 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.</p> <p>FY 2019 Plans: Will mature multiple dual band DROIC designs; optimize DROICs based on the two most promising designs; electrically probe DROIC parts will be validated for functionality and performance in preparation to bond DROICs to the dual band Midwave/ Longwave Infrared (MWIR/LWIR) detector material; mature the integrated dewar and cooler assemblies (IDCAs) required for DDUS FPAs; mature optical lenses to demonstrate and validate performance of DDUS sensor technology.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Investment increase to support additional DROIC validation efforts.</p>				
Accomplishments/Planned Programs Subtotals		16.538	25.606	28.626
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	21.415	10.421	9.136	-	9.136	9.352	9.538	9.735	9.931	0.000	79.528
002: <i>Environmental Compliance Technology</i>	-	3.682	2.203	2.353	-	2.353	2.455	2.503	2.554	2.606	0.000	18.356
025: <i>Pollution Prevention Technology</i>	-	1.431	1.488	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.919
03E: <i>Environmental Restoration Technology</i>	-	6.302	6.730	6.783	-	6.783	6.897	7.035	7.181	7.325	0.000	48.253
03F: <i>Environmental Quality Tech Demonstrations (CA)</i>	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates technologies that assist the Army to reduce or eliminate environmental impacts both in the United States and abroad, and provide science and technology solutions to Army environmental challenges as a force multiplier in mission planning, material acquisition and soldier preparedness. 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. The Army also requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This project matures and demonstrates tools for robotic and autonomous agile infrastructure modification and custom designed construction for expeditionary structures on demand. 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 technologies for advanced life cycle analysis, advanced sensing, and technologies to empower rapid fielding of next generation energetics, propellants and munitions.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Priorities for Air Missile Defense, Next Generation Combat Vehicle, and Network/C3I, 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	11.137	10.421	10.624	-	10.624
Current President's Budget	21.415	10.421	9.136	-	9.136
Total Adjustments	10.278	0.000	-1.488	-	-1.488
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	10.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.468	-			
• SBIR/STTR Transfer	-0.187	-			
• Adjustments to Budget Years	-	-	-1.488	-	-1.488
• FFRDC	-0.003	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 03F: *Environmental Quality Tech Demonstrations (CA)*

Congressional Add: *Program Increase*

	FY 2017	FY 2018
	10.000	-
Congressional Add Subtotals for Project: 03F	10.000	-
Congressional Add Totals for all Projects	10.000	-

Change Summary Explanation

FY17 Congressional increase in project 03F Environmental Quality Tech Demonstrations
Decrease in FY19 due to removal of pollution prevention task.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>				Project (Number/Name) 002 / <i>Environmental Compliance Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
002: <i>Environmental Compliance Technology</i>	-	3.682	2.203	2.353	-	2.353	2.455	2.503	2.554	2.606	0.000	18.356

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, and PE 0602784 (Military Engineering), Projects T41 and T45. This project assists 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. In addition, this project matures capabilities to assess, establish, upgrade, and construct infrastructure to project power and enable deployed force operations. Current and planned efforts enable the Army to perform additive and advanced manufacturing for deployed force infrastructure, support robotic and autonomous engineering during combat operations, and ensure infrastructure resiliency. Technologies demonstrated aim to reduce the cost of resolving compliance issues for the Army, sustain the viability of testing and training ranges, protect critical resources, and expand capacity to perform construction and supporting tasks in high risk/threat and dynamic environments.

Work in this Project supports the Army Science and Technology Military Engineering and Environmental Technology, Simulation and Computing Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas, supports the Army Strategy for the Environment, and supports the Army Modernization Priority for Next Generation Combat Vehicle, Air Missile Defense and Network/C3I.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Sustainable Ranges and Lands	1.059	1.106	-
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 2018 Plans: Integrate and mature methodologies for high-resolution permafrost/ground-ice mapping for improved risk characterization. Extended 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.			
FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends FY18.			
Title: Infrastructure for Combat Operations (Previous Titled: Adaptive & Resilient Installations)	2.623	1.097	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 002 / <i>Environmental Compliance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>Description: The Army requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This effort matures and demonstrates tools for the assessment of physical and ecological impacts on operations, agile infrastructure modification, and custom?designed construction for expeditionary structures on?demand.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends FY18.</p>				
<p>Title: Robotics for Engineer Operations</p> <p>Description: Mature and demonstrate robotic and autonomous technologies for Engineer operations supporting mobility, countermobility, and advanced construction methods for deployed operations.</p> <p>FY 2019 Plans: Will mature risk mitigation frameworks associated with contingency autonomous construction methods and activities. Mature algorithms and decision making software for control processes (bandwidth needs, response time lag, and override response times) developed to facilitate autonomous methods necessary for expedient point of need construction.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Initiate effort in FY19.</p>		-	-	2.353
Accomplishments/Planned Programs Subtotals		3.682	2.203	2.353
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 025 / <i>Pollution Prevention Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>025: Pollution Prevention Technology</i>	-	1.431	1.488	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.919

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 the 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 Environment and Terrain 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Pollution Prevention Technology	1.431	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 2018 Plans: Mature and characterize nanoporous silicon-based energetic materials as potential alternatives to lead-based primary explosives; demonstrate the use of Chemical Agent Resistant Coating formulations that replace hazardous isocyanate compounds with polysiloxane-based resins; demonstrate alternative refrigerants with low global warming potential in military environmental control unit applications.			
FY 2018 to FY 2019 Increase/Decrease Statement: Effort ended in FY18.			
Accomplishments/Planned Programs Subtotals	1.431	1.488	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 025 / <i>Pollution Prevention Technology</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
Remarks		
D. Acquisition Strategy N/A		
E. Performance Metrics N/A		

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>				Project (Number/Name) 03E / <i>Environmental Restoration Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
03E: <i>Environmental Restoration Technology</i>	-	6.302	6.730	6.783	-	6.783	6.897	7.035	7.181	7.325	0.000	48.253

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 with focus on impacts of new materiel that will enter the Army inventory within the next decade and beyond; shape and protect Army investments in next generation fires by delivering proactive scientifically sound risk and environmental impact management strategies; environmental factors in mission planning activities impacting the battlefield landscape of future threats; and opportunities and impacts to mission success in sparse data environments, enabling mission planners to identify the industrial/commercial resources used as components of weapons development. Technologies matured within this Project inform the Army of potential environmental threats, opportunities and impact to mission; to understand the environmental threat in urban and industrial contested environments; and rapidly sense and assess the presence and extent of dangerous compounds in battlefield environments. 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. Efforts also identify ways to economically comply with myriad federal, state, and host country regulations dealing with contaminated soil and water. 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 Military Engineering and Environmental Technology, Simulation and Computing 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 Priority for Network/C3I, Air Missile Defense, and Long Range Precision Fires, and supports the Army Strategy for the Environment.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Hazard Assessment for Military Materials	2.400	1.398	0.278
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 2018 Plans: 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.			
FY 2019 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 03E / <i>Environmental Restoration Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
Will characterize environmental fate, degradation and transport of obscurants and tone-down materials in different environments ranging from open lands to dense urban areas. FY 2018 to FY 2019 Increase/Decrease Statement: Program reduction to support priority objectives.				
Title: Technologies for Sustainable and Green Operations and Acquisition Description: This effort exploits and matures technologies to control contaminant transport in environmental media on Army lands and mission spaces as well as assesses and demonstrates novel detection, remediation, and mitigation capabilities for existing and emerging contaminants. FY 2018 Plans: Demonstrate an operational field effluent treatment system that will minimize water demand, decontaminated waste, and reduce logistic demands. 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. Validate an artificial intelligence model that will predict adverse outcomes based on chemical-biological interactions for assessment of military compounds. FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.		1.095	3.331	-
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 2018 Plans: Validate an environmental lifecycle forecasting tool designed to provide quantitative environmental impact assessment for emerging materials and technologies. Mature qualitative and quantitative methods for assessing synthetic biology environmental impacts of military relevance. FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends in FY18.		2.807	2.001	-
Title: Rapid Risk Analysis of Fires		-	-	2.874

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018	
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 03E / <i>Environmental Restoration Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018
<p>Description: This effort is focused on health implications of new, to-be fielded munitions and investigates the overall life cycle of the materials to shape and protect Army investments in next generation fires supporting Army Modernization Priority Long Range Precision Fires.</p> <p>FY 2019 Plans: Demonstrate proactive environment, safety, and occupational health risk assessment tools to ensure rapid fielding of energetics, propellants, and munitions. Validate models to predict chemical impacts on select species using embryo gene expression, and demonstrate new computational technologies with high potential for meeting the Army's needs to predict the toxicity of new and novel chemical agents used in munitions, smoke screens, and energetics.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: New start effort for FY19.</p>			
<p>Title: Understanding the Environment as a Threat</p> <p>Description: This effort provides environmental conditions and hazards in contested environments to enable operational planning and decisions to understand environmental threats from informed modeling and simulation supporting Modernization Priority Network/C3I Mission Planning Applications.</p> <p>FY 2019 Plans: Will demonstrate predictive tools to inform engineer reconnaissance and provide environmental situational awareness for mission planning. Demonstrate in silico prediction of physical, chemical and biological properties of insensitive munitions compounds and their transformation products in the natural water, arid and semi-arid environments, and mature models capable of predicting chemical behavior in complex environments to support scientifically defensible knowledge, tools, and guidance.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: New start effort in FY19.</p>		-	-
<p>Title: Chemical Sensing in Contested Environments</p> <p>Description: This effort provides robust tools for environmental reconnaissance missions and environmental sensing technologies for mission readiness. Supports Modernization Priority C3I Persistent Surveillance. Enhanced situational understanding reduces surprise, and can prevent detection, acquisition and engagement.</p> <p>FY 2019 Plans: Will demonstrate advanced environmental sensor technologies to enable rapid collection and data analysis of environmental information. Will demonstrate printed, functionalized carbon nano-tube sensor elements to promote properties critical for sensing</p>		-	-
		1.938	1.693

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 03E / <i>Environmental Restoration Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
contaminants of interest (e.g., copper, arsenic, and nitrites), and demonstrate/validate experimental protocols for improved selectivity for passive samplers. FY 2018 to FY 2019 Increase/Decrease Statement: New start effort for FY19.				
Accomplishments/Planned Programs Subtotals		6.302	6.730	6.783
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / <i>Environmental Quality Technology Demonstrations</i>	Project (Number/Name) 03F / <i>Environmental Quality Tech Demonstrations (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>03F: Environmental Quality Tech Demonstrations (CA)</i>	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

Note

Congressional increase for Program increase

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	10.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	10.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	59.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	225.266
T08: <i>Combat Eng Systems</i>	-	21.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	187.266
T15: <i>MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)</i>	-	38.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.000

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 counter-mobility to support ground force operations including manned-unmanned teaming; demonstrates material technologies and tools for force projection, and sustainment. This PE also demonstrates 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 Priorities.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology).

Work in this PE is led by the Army Engineering Research and Development Center (ERDC)

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	20.684	32.448	25.864	-	25.864
Current President's Budget	59.101	32.448	25.864	-	25.864
Total Adjustments	38.417	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	38.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.000	-			
• SBIR/STTR Transfer	-0.576	-			
• FFRDC	-0.007	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*

Congressional Add: *Program Increase*

Congressional Add: *Secure management of energy generation and storage*

Congressional Add: *Installation energy efficiency enhancements*

Congressional Add Subtotals for Project: T15

Congressional Add Totals for all Projects

	FY 2017	FY 2018
	30.000	-
	3.000	-
	5.000	-
Congressional Add Subtotals for Project: T15	38.000	-
Congressional Add Totals for all Projects	38.000	-

Change Summary Explanation

FY17 Congressional increase in project T15 Military Engineering Technology Demonstration.

FY18 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.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>				Project (Number/Name) T08 / <i>Combat Eng Systems</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
T08: <i>Combat Eng Systems</i>	-	21.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	187.266

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 and critical fixed and semi-fixed assets. Protection measures support force projection in areas such as air and sea ports of debarkation, dispersed small units, and units operating in complex and urban environments, which may include subterranean challenges. Work is in support of current and future ground force operations and future vertical lift. 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 in disbursed small units over complex and urban terrain 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 blast and weapon effects from advanced and emerging threats. 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. Force protection activities are also focused on protection of critical assets and infrastructure required to project forces into denied access areas. 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 and manned-unmanned teaming and demonstrates infrastructure health monitoring assessment technologies to support emerging projection challenges in complex, contested environments such as distributed sustainment over large distances. 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 priorities for Next Generation Combat Vehicle, Air Missile Defense, Network/C3I, and Future Vertical Lift. 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 (Combat Vehicle and Automotive Advanced

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T08 / <i>Combat Eng Systems</i>
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Tech) / Project 515 (Robotic Ground Systems), and PE 0602601A (Combat Vehicle and Automotive Technology) / Project H77 (National Automotive Center), and 0602601A (Combat Vehicle and Automotive Technology) / H91 (Ground Vehicle Technology) in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC). Autonomous ground resupply activities are also coordinated with PEs 0603001A (Warfighter Advanced Technology) / Project 543 (Ammunition Logistics), PE 0604639A (Weapons and Munitions - Advanced Development) / EC3 (Ammunition Logistics Prototyping), and 0605805A (Munitions Standardization, Effectiveness and Safety) / Project 297 (Mun Survivability & Log). Unconventional Countermeasure activities are coordinated with PE 0602720A (Environmental Quality Technology) / Project 835 (Mil Med Environ Crit) and PE 0603728 (Environmental Quality Technology Demonstrations) / Project 03E (Environmental Restoration Technology).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Geo-Enabled Mission Command Enterprise</p> <p>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.</p> <p>FY 2019 Plans: Will mature a flexible Army geospatially-enabled planning environment that enables mission analysis and development of staff estimates (such as Intelligence Preparation of the Battlefield) at the tactical level that enables data synchronization with the Command Post Computing Environment systems.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: New start in FY19</p>	-	-	2.923
<p>Title: Map-Based Planning Services (MBPS)</p> <p>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.</p> <p>FY 2018 Plans: 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</p>	1.756	9.630	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T08 / <i>Combat Eng Systems</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>authoritative data from Joint sources in a map-based environment; mature and demonstrate Joint mission planning capabilities that will allow concurrent and collaborative planning by operational, logistics, and intelligences staffs to create, compile, and consolidate Operational Plans.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Mission planning capabilities were matured and transitioned. Funds used to support JPES PDM as well as to mature a flexible Army geospatially-enabled planning environment</p>				
<p>Title: GeoIntelligence - Enabling Technology Demonstration</p> <p>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.</p> <p>FY 2018 Plans: 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.</p> <p>FY 2019 Plans: Will develop man/machine learning algorithms to automate production processes, to enable change detection, and to support learning by manned and autonomous systems with the capability to collect and/or complete 3D high-resolution common operating picture of complex and urban terrain.</p>		0.729	2.000	2.000
<p>Title: Human Geography Demonstration</p> <p>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 for mission planning and awareness. 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.</p> <p>FY 2018 Plans:</p>		-	1.000	1.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T08 / <i>Combat Eng Systems</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will demonstrate methods for military assessment of population vulnerability and resilience disruptors as a result of combat, disasters, disease, etc., within dense urban and complex environments; will demonstrate computational models to support a federated model approach for complex urban systems; and will develop methodologies to support the military decision making process addressing the impacts of the physical, ecological, and sociocultural environments relative to contingency base site selection, design, operations and maintenance.</p>				
<p>Title: Austere Entry and Maneuver Support Demonstrations</p> <p>Description: This effort matures and demonstrates improved means for achieving force projection in austere and complex environments and integrated sensing and simulation systems for predicting physical conditions in these operational environments. This effort matures and demonstrates technologies to assess, construct, or repair infrastructure required to support entry, sustainment, and maneuver operations in complex and contested battlespaces. This effort matures and demonstrates simulation technology for manned-unmanned teaming maneuver.</p> <p>FY 2018 Plans: Demonstrate technologies for planning and conducting Anti-Access/Area Denial (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.</p> <p>FY 2019 Plans: Will mature real-time hardware-in-the-loop simulator to validate autonomous vehicle maneuver configurations and will demonstrate performance through field experiments. Will demonstrate obstacle detection software to support real-time mobility decisions in urban environments. Will mature and demonstrate near-real time infrastructure monitoring technology that automates analyses of seismic-infrasound-acoustic-meteorological (SIAM) data to eliminate subject matter expert requirement and will mature toolkits to support littoral zone maneuver and vehicle operating surfaces assessment. Will mature all-season austere entry and sustainment node decision support tools for site selection.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase due to inflation.</p>		7.141	6.889	6.897
<p>Title: Adaptive Protection Demonstrations</p>		6.616	7.929	8.044

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T08 / <i>Combat Eng Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)

Description: This effort validates protection solutions for facilities and critical assets, including fixed and semi-fixed. A focus will be on technologies to defeat new and emerging 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 unconventional countermeasures to increase the effectiveness of protection to critical assets. This effort also demonstrates rapidly deployable protective measures and retrofit technologies for use in urban environments.

FY 2018 Plans:

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 mature rapidly deployable protective technologies for dismounted urban operations; demonstrate unconventional 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 subterranean activities for protection of forces and critical assets.

FY 2019 Plans:

Will mature and demonstrate urban building assessment tool and will mature retrofit technologies to ensure safe building occupation decisions for dismounted soldiers in urban environments. Will mature and demonstrate rapid signature reduction methods to increase critical asset survivability. Will mature perimeter security and surveillance monitoring and detection systems to detect, track, and classify subterranean and other threat activities. Will mature and demonstrate new protective technologies to defeat future near-peer adversarial threats.

FY 2018 to FY 2019 Increase/Decrease Statement:

Increased investments to support advancements of new protective technologies to defeat future near-peer adversarial threats

Title: Engineered Resilient Systems

Description: This effort matures and demonstrates capabilities (tools and methodologies) to rapidly create high-fidelity environmental data to support the simulation of system performance for different Army missions in various geographic settings worldwide; provide input to and obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. 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 2018 Plans:

FY 2017	FY 2018	FY 2019
4.859	5.000	5.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T08 / <i>Combat Eng Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will validate environmental effects as they relate to the acquisition of Army aviation, ground vehicle, and sensor platforms; will develop workflow automation processes for these platforms; will integrate mission effectiveness into the resulting tradespaces; will leverage emerging data analytics techniques and machine learning algorithms to optimizes insight prior to acquisition decision points; and will develop novel methodologies through the use of environmental simulation, tradespace analytics, and computational prototyping of Army systems.</p>			
Accomplishments/Planned Programs Subtotals	21.101	32.448	25.864

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / <i>Military Engineering Advanced Technology</i>	Project (Number/Name) T15 / <i>MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
T15: <i>MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)</i>	-	38.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.000

Note

Congressional Program Increase for FY17

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 2017	FY 2018
Congressional Add: Program Increase	30.000	-
FY 2017 Accomplishments: N/A		
Congressional Add: Secure management of energy generation and storage	3.000	-
FY 2017 Accomplishments: N/A		
Congressional Add: Installation energy efficiency enhancements	5.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	38.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603772A / Advanced Tactical Computer Science and Sensor Technology
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	52.572	52.206	34.883	-	34.883	39.847	40.926	40.107	41.088	0.000	301.629
101: Tactical Command and Control	-	17.334	22.228	17.598	-	17.598	18.848	18.556	16.410	16.713	0.000	127.687
1AA: Tactical Computer Science Demonstrations (CA)	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000
243: Sensors And Signals Processing	-	25.238	29.978	17.285	-	17.285	20.999	22.370	23.697	24.375	0.000	163.942

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, and the technologies that enable the integration of Robotics and Autonomous Systems (RAS) through Mission Command. 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 Research, Development, and Engineering Command, Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	44.239	52.206	48.151	-	48.151
Current President's Budget	52.572	52.206	34.883	-	34.883
Total Adjustments	8.333	0.000	-13.268	-	-13.268
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	10.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.646	-			
• Adjustments to Budget Years	-	-	-13.268	-	-13.268
• FFRDC	-0.021	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 1AA: *Tactical Computer Science Demonstrations (CA)*

Congressional Add: *Program Increase*

	FY 2017	FY 2018
	10.000	-
Congressional Add Subtotals for Project: 1AA	10.000	-
Congressional Add Totals for all Projects	10.000	-

Change Summary Explanation

FY17 Congressional increase in 1AA Tactical Computer Science Demonstrations.
FY19 funding moved to higher priority classified effort

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 101 / <i>Tactical Command and Control</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
101: <i>Tactical Command and Control</i>	-	17.334	22.228	17.598	-	17.598	18.848	18.556	16.410	16.713	0.000	127.687

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Integrated Mission Command (MC)	9.093	6.425	7.551
Description: This effort matures and demonstrates technologies to simplify mission command (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 2018 Plans: 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.			
FY 2019 Plans: Will develop and mature software demonstrators that implement artificial intelligence techniques including intelligent agents to assess mission objectives against the current situation to facilitate situational understanding; will optimize software to visualize when the current situation is deviating from the commander's intent with continuous running estimates and an on-going analysis			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 101 / <i>Tactical Command and Control</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>of risks and opportunities; and will mature software and algorithms to integrate Robotics and Autonomous Systems (RAS) with MC information systems to better allow Commanders the ability to plan, monitor and incorporate RAS into unit formations and missions and assist the development of doctrine.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase to develop and mature software demonstrators that implement artificial intelligence techniques, optimize software visualization, and mature software and algorithms.</p>				
<p>Title: Expeditionary Mission Command (MC)</p> <p>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. In FY19, effort is realigned in support of the Army science and technology (S&T) Modernization priorities for Network/Command, Control, Communications and Intelligence (C3I).</p> <p>FY 2018 Plans: 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 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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Effort completes in FY18. Realigned to accelerate network technologies in support of the Army Modernization priority for Network/ C3I.</p>		-	6.147	-
<p>Title: Assured Positioning, Navigation and Timing (A-PNT)</p> <p>Description: This effort matures, demonstrates and performs modeling and simulation (M&S) of positioning, navigation, and timing (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.</p> <p>FY 2018 Plans:</p>		6.241	7.651	8.047

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 101 / <i>Tactical Command and Control</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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 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 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 modeling and simulation (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.</p> <p>FY 2019 Plans: Will improve the performance of a Navigation Warfare (NAVWAR) breadboard that will enable continued operations in hostile, GPS denied environments by integrating electronic attack, electronic protection and electronic support hardware and software; incorporate the new Military Code (M-Code) GPS signal for offensive and defensive NAVWAR operations into the breadboard; will mature and code a PNT situational awareness software tool utilizing existing sensors and GPS receivers; will mature and demonstrate a hardware solution using multi-GNSS signals for integrity monitoring; will integrate PNT technologies such as radio frequency (RF) ranging beacons for in-building navigation to augment PNT solutions for mounted and dismounted platforms; will mature and demonstrate two way time transfer hardware that will provide accurate time to users and systems in the absence of GPS; and conduct advanced modeling and simulation (M&S) of PNT sensors, systems, and platforms to validate M&S environment to support Joint analysis of effects of PNT and PNT based attacks to Joint United States (U.S.) forces.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase to support Army priority for (NGCV and Network/C3I).</p>			
<p>Title: Advanced Intelligent Power Management & Distribution</p> <p>Description: This effort matures and demonstrates advanced power and thermal management and distribution technologies for command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) applications as well as validates and integrates designs in power generation, hybrid energy storage, and assessments Work accomplished under PE 0602705A/Project H11 complements this effort.</p> <p>FY 2018 Plans:</p>	2.000	2.005	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 101 / <i>Tactical Command and Control</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>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 power attached to a tactical power grid system; and integrate new hybrid power trailer with Joint and supporting systems (legacy generator based microgrids).</p> <p>FY 2019 Plans: Will mature and demonstrate alternating current power source self-tuning protocols to manage synchronization in multi-power source configurations in support of ad-hoc arrangements of power equipment for emerging Command, Control, Communications, computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems; will validate tuning protocols to ensure stability and robustness of intelligent power systems to support unique load profiles generated by directed energy, high power sensors, and electromagnetic weapon systems; will integrate multiple-master control methodologies into intelligent power system software controllers to allow power sharing on C4ISR platforms like vehicles, airframes or other platforms with intelligent power loads that must join together in an ad-hoc power network with competing prioritizations; and will validate single-bus vs. multiple-bus implementation of multiple-master control strategy hardware configurations.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: No change in scope of effort.</p>				
Accomplishments/Planned Programs Subtotals		17.334	22.228	17.598
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 1AA / <i>Tactical Computer Science Demonstrations (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
<i>1AA: Tactical Computer Science Demonstrations (CA)</i>	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

Note
congressional increase

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Tactical Computer Science advanced technology development.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	10.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	10.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>					Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>		
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
243: <i>Sensors And Signals Processing</i>	-	25.238	29.978	17.285	-	17.285	20.999	22.370	23.697	24.375	0.000	163.942

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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Collaborative Intelligence, Surveillance and Reconnaissance (ISR) Sensor processing and analytics	3.318	3.746	4.693
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 multiple intelligence (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 2018 Plans:			
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 station and reach-back 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			

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>algorithms (i.e., platform, ground station and reach-back for use in the PED framework for utilization throughout the tactical enterprise to support distributed fusion.</p> <p>FY 2019 Plans: Will evaluate, and mature advanced exploitation and activity detection algorithms against real and operational datasets of full motion video and electronic support data; demonstrate advanced exploitation and activity detection algorithms, including route avoidance, co-traveler, and convoy detection, in a laboratory environment; optimize processing, exploitation and dissemination (PED) workflow development to reduce operator workload and time to develop intelligence products; complete integration into existing PED Army Tactical systems to align algorithms across platforms and ground stations to support distributed processing and intelligence exploitation; complete and transition processing and exploitation algorithms to intelligence collection platforms programs of record (POR) and PED frameworks to ground station POR.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned program increase.</p>				
<p>Title: Omni-directional Situational Awareness (SA) Airborne radar technologies</p> <p>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.</p> <p>FY 2018 Plans: 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 modeling and simulation (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.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Work completed in FY2018.</p>		1.729	4.753	-
<p>Title: Counter-concealment Moving Target Indicator (MTI) Airborne Radar Demonstration</p> <p>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</p>		-	5.355	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p>work being completed under the Omni-directional situational awareness (SA) Airborne radar technologies effort in Fiscal Year (FY) 18.</p> <p>FY 2018 Plans: 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 human, vehicle, animal and clutter (HVAC) discrimination and tracking techniques into the system processor.</p> <p>FY 2019 Plans: Begin development of a Multi-Intelligence airborne ISR/RSTA and targeting radar capability, capitalizing on investments in wide band MTI/SAR radar antennas capable of Electronic Warfare, Electronic Support and Targeting. Develop scalable apertures and processing suitable for both airborne manned and unmanned platforms addressing open architecture, modularity, and scalability of the payloads. Further develop existing active electronically scanned array (AESA) antenna technology investments partnered with modeling and simulation and software development tools compatible with third party mode development within a well-defined Multi-Intelligence architectures.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Realigned to accelerate network technologies in support of the Army Modernization priority for Network/C3I. Impacts development and demonstration of radar systems.</p>				
<p>Title: Advanced All Source Fusion</p> <p>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 intelligence, surveillance and reconnaissance (ISR) planning and execution at the Task Force/Battalion through troop-level, as well as efforts that provide the capability to identify, fuse, and trace/track specific targets in an asymmetric environment. Work accomplished under Program Element (PE) 0602270A/Project 906 complements this effort. In FY 2019, funds from this effort are realigned outside of this project to support the Army science and technology (S&T) Modernization priorities.</p> <p>FY 2018 Plans: Integrate Multi-Int tracking, data fusion and analysis software capabilities into the processing, exploitation and dissemination (PED) framework; will mature and demonstrate the architectures? scalability, ability to move data across the enterprise, to include air sensors and platforms, ground stations and the Distributed Common Ground Station-Army (DCGS-A), and cloud/reach-back PED sites, to create an ISR common operational picture (COP) from the distributed fusion process; and will develop and evaluate</p>		3.841	4.953	-

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
the software interfaces that will provide a "virtual analyst" for collaboration, visualization, alerting and dissemination capabilities across multiple nodes within the enterprise COP.				
FY 2018 to FY 2019 Increase/Decrease Statement: Decrease to support the Army science and technology (S&T) Modernization priority for Network/C3I.				
Title: Multi-mode Air Defense Radar Demonstration		7.447	5.967	5.566
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 2018 Plans: 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; and perform advanced radar concept modeling and simulation (M&S) to refine concepts and requirements.				
FY 2019 Plans: Will leverage the previously developed open radar architecture processing environment for algorithm/mode design, and demonstrate capability to implement additional third party modes, including multi-mission, target identification, and with a large focus on multi-static modes leveraging multiple radars for improved capabilities; will complete design of interface definitions and demonstrate integration of radar antenna and processor hardware using multi-mission and multi-function modes to assess integration of software at the signal processor level; will develop multi-static data alignment and fusion algorithms to leverage multiple radars for improved performance; and will develop concepts for advanced multi-function, multi-system resource management and proactive radar capabilities that allow systems to adapt to changes in threat scenarios, the environment, or concept of operations changes on the fly;				
FY 2018 to FY 2019 Increase/Decrease Statement: Adjustment to planned efforts.				
Title: Degraded Visual Environment (DVE) ? Air		7.009	5.204	4.026

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2018 Plans: Complete integrated software mode development for high resolution SAR, DVE mapping (real beam imaging) and Moving Target Indicator (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.</p> <p>FY 2019 Plans: Will integrate forward looking millimeter wave radar, small low-cost situational awareness (SA) radars, Light Detection and Ranging (LIDAR), and light detection sensors into the ground systems integration lab to support radar assessments for ground and follow-on flight testing activities; will demonstrate integrated sensor data collection and fusion of the data in a multi-sensor environment to provide obscurant penetration for terrain and object awareness using the various sensors; will integrate the radar collocated with SA radar, LIDAR and light detection sensors onto aircraft.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned decrease.</p>			
<p>Title: Intelligence Processing and Architecture Modernization</p> <p>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.</p>	1.894	-	-
Accomplishments/Planned Programs Subtotals	25.238	29.978	17.285

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks
D. Acquisition Strategy N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / <i>Advanced Tactical Computer Science and Sensor Technology</i>	Project (Number/Name) 243 / <i>Sensors And Signals Processing</i>

<u>E. Performance Metrics</u> N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	36.439	33.426	52.387	-	52.387	60.802	71.516	77.942	87.701	0.000	420.213
EL3: <i>C3 Demonstrations (CA)</i>	-	2.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.000
EL4: <i>Tactical Comms and Networking Technology Int</i>	-	19.032	17.346	37.828	-	37.828	44.542	53.990	61.218	70.642	0.000	304.598
EL5: <i>Secure Tactical Information Integration</i>	-	15.407	16.080	14.559	-	14.559	16.260	17.526	16.724	17.059	0.000	113.615

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 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 Priorities.

Work is performed by the Research, Development, and Engineering Center Command, Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology
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B. Program Change Summary (\$ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	35.775	33.426	28.795	-	28.795
Current President's Budget	36.439	33.426	52.387	-	52.387
Total Adjustments	0.664	0.000	23.592	-	23.592
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	2.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.319	-			
• Adjustments to Budget Years	-	-	23.592	-	23.592
• FFRDC	-0.017	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: EL3: *C3 Demonstrations (CA)*

Congressional Add: *Program Increase*

	FY 2017	FY 2018
	2.000	-
Congressional Add Subtotals for Project: EL3	2.000	-
Congressional Add Totals for all Projects	2.000	-

Change Summary Explanation

FY17 Congressional increase in project EL3 C3 Demonstrations. Increases in this Program Element support the Army's Modernization priority for Network/Command, Control, Communications and Intelligence (C3I).

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army **Date:** February 2018

Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology				Project (Number/Name) EL3 / C3 Demonstrations (CA)			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
EL3: C3 Demonstrations (CA)	-	2.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.000

Note

congressional increase

A. Mission Description and Budget Item Justification

Congressional Program increase

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018
Congressional Add: Program Increase	2.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	2.000	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology				Project (Number/Name) EL4 / Tactical Comms and Networking Technology Int			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
EL4: <i>Tactical Comms and Networking Technology Int</i>	-	19.032	17.346	37.828	-	37.828	44.542	53.990	61.218	70.642	0.000	304.598

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 Priority for Network/Command, Control, Communications and Intelligence (C3I).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Antenna and Hardware Technologies	3.847	-	-
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.			
Title: RF Interoperability Through Convergence	3.996	-	-
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.			
Title: Enabling C4ISR Infrastructure, formerly C4ISR On the Move (OTM)	7.555	8.631	3.648

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology	Project (Number/Name) EL4 / Tactical Comms and Networking Technology Int

B. Accomplishments/Planned Programs (\$ in Millions)

Description: This effort provides a venue for the demonstration of new and emerging Command, Control, Communications, computers, Intelligence, Surveillance and Reconnaissance (C4ISR) technologies. This venue performs field based risk reduction (FBRR) and technology readiness assessments (TRAs) by evaluating the Technology Readiness Levels (TRLs) of candidate Army science and technology (S&T) and best of Industry efforts to support tactical network modernization. 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 2018 Plans:

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 congested 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.

FY 2019 Plans:

Will mature and optimize S&T efforts through FBRR demonstration events; support excursions to assess early S&T efforts that are developing technologies to provide robust and adaptive networks; will validate technologies prior to integration and assessment at larger Army-wide events, such as Cyber Quest; conduct an annual event for field demonstration of defensive cyber techniques to provide opportunities for red-team exploitation of defensive techniques to identify mature technologies and optimize current S&T efforts; will exercise novel waveform and non-traditional spectrum technologies to demonstrate sustained communications in congested and contested radio frequency (RF) environments with high throughput and reliability; will conduct a demonstration of electromagnetic spectrum signal protection technologies exercising systems to cloud the spectrum and/or directing enemy

FY 2017	FY 2018	FY 2019

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
systems to non-priority platforms through techniques such as decoying to optimize management of the Army tactical network spectrum signature. FY 2018 to FY 2019 Increase/Decrease Statement: Realigned to accelerate network technologies in support of the Army Modernization priority for Network/C3I. Eliminates maintenance for test bed assets.				
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.		2.679	-	-
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.		0.955	-	-
Title: Communications, Adaptive Networks to Improve Maneuver Operations, formerly Networking to Improve Maneuver 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 maneuver operations, develop situational understanding, and sustain operations while maintaining freedom of movement. FY 2018 Plans: 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 radio frequency (RF) environment; and 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. FY 2019 Plans:		-	4.054	6.598

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>Will exploit technologies operating at higher frequencies to move communications from congested spectrum; validate unconventional waveforms to provide increased capacity and reduced interference for operations such as distributed mission command while remaining elusive to adversary detection; validate mesh networking adaptation to adjust low probability of detection / low probability of intercept (LPI/LPD) and anti-jam enhancements, enabling to ability to adjust to the electromagnetic environment, such as enemy interference from jamming or localized congestion; optimize dismounted distributed beam-forming techniques that will enable distant network nodes to collectively operate as a single emitter to provide enhanced directivity to distant nodes ; provide enhanced situational understanding to enable an increased ability to maintain the network in a near-peer contested environment; will optimize and demonstrate standard protocols and interfaces to leverage additional sensing devices and existing transceivers (e.g. spectrum sensing on networking radios); provide data analytics to parse increased spectrum sensing data to provide functional outputs); demonstrate network technologies in support of the priority Army operational capabilities (e.g. Long Range Precision Fires, Next Generation Combat Vehicle, Future Vertical Lift, Air and Missile Defense, and Soldier Lethality); optimize networking solutions to meet the needs of autonomous platforms to support manned/unmanned-teaming (MUM-T).</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase to support Army modernization priority for Network/C3I.</p>			
<p>Title: Communications, Robust Tactical Systems, formerly Uninterrupted Communications</p> <p>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.</p> <p>FY 2018 Plans: 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 Long Term Evolution (LTE) cellular based tactical communications systems; mature and implement a next</p>	-	4.661	13.582

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018
<p>generation robust narrowband waveform that operates in radio frequency (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 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.</p> <p>FY 2019 Plans: Will demonstrate interference cancellation to maintain uninterrupted satellite communications for a Wideband Global Satellite Communications (WGS) Ka-band configuration; validate ground-based beam-forming algorithms to provide anti-jam access to WGS in close proximity to enemy jamming; validate interference cancellation systems to demonstrate the increased protection for different interferer types and optimize interference cancellation for the satellite modem; mature and demonstrate a cost effective solution to provide protection and operations management in the WGS communications frequency bands; validate interference cancellation systems within a laboratory environment to demonstrate the increased level of protection provided for different interferer types; optimize performance of interference cancellation integrated into satellite modems for enhanced suppression of interference in Army satellite terminals; demonstrate a solution to maintain communications in the presence of enemy jammers and prevent exploitation of the characteristics of Army communication signals through management of spectrum signatures; validate the ability to reduce the probability of detection of tactical waveforms through the use of techniques to camouflage the communications, such as the use of pseudo representative transmissions to cloud the spectrum environment with non-network emissions; improve performance of spectrum accessing waveforms through the implementation of techniques to sense the environment and avoid emissions that would result in interference; optimize deconfliction methods to limit systems from self-jamming; demonstrate protection of tactical networks and tactical assets through the use of decoying; demonstrate brassboard devices to generate varied decoying signals to present multiple signals at a given time, providing the ability to vary the platform projected; validate that decoy signals redirect threats away from valued platform and onto the decoy to enable continued operation of the valued platform; improve performance of assured long range terrestrial communications, such as high-frequency (HF), with the incorporation of low probability of detection / low probability of intercept techniques in contested environments; validate interfaces between developed reach back communication solutions and joint service solutions to enable interoperability.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Increase to support Army priority for Network/C3I.</p>			
Title: Advanced Modular Radio Frequency (RF)		-	-
Description: This effort will enable connectivity in contested & congested spectrum environments by applying modular radio frequency (RF) technologies within an automated network to adapt and continue operation under interference signals. This capability will reduce the rigorous network management through intelligent selection of to diverse network connections to seamlessly transmit data and maintain communications within a contested RF environment.			14.000

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p><i>FY 2019 Plans:</i> Will demonstrate a system architecture for an automated network to provide a common interface to an automation algorithm with the capability to optimally select and negotiate across diverse communication links to execute an automated Primary, Alternative, Contingency, Emergency (PACE) military operational plan in support of maintaining resilient tactical communications in a contested and congested environments; demonstrate detection of locally available network products (e.g. Long Term Evolution [LTE], etc.) and incorporation of these products into the automated PACE plan process, including the ranking of the available networks for the PACE plan execution; optimize the mapping of the nodes into the network topology by the automated network through the association of the nodes and users connected to the sub-networks created by the networking technologies and products; validate standard interface specifications between the automated network and networking technologies to provide adaptability to incorporate a wide range of networking techniques and technologies into the automated network processing; mature and optimize algorithms to perform autonomous selection between network links based on link status and other established criteria in an electromagnetic environment to provide maintain communications and overall network connectivity across multiple disparate network connections; optimize switching algorithms to seamlessly transition data flow between network connections available to the automated network as viable network connections become degraded, disrupted, or otherwise unavailable in order to maintain data integrity and throughput; optimize a common user device as the user?s input mechanism and interface to an automated network and demonstrate the reduced burden place on the user from this single device and the ability of the operator to focus on essential mission tasks rather than establishment and maintenance of the network; demonstrate techniques that will incorporate into an autonomous networking system, an ability to detect available communication systems that are both accessible and viable for the data need, and incorporate the sub-network mapping topology of each system within the autonomous mapping to identify diverse link paths; develop and mature situation-adaptive communications polling and reporting methods to inform contributing networks as to the to status of current spectrum environment changes (e.g. interference, congestion, link loss, etc.) for the network links, to optimize the functional performance based on available resiliency features of the principal links.</p> <p><i>FY 2018 to FY 2019 Increase/Decrease Statement:</i> This is a new effort beginning in FY2019.</p>			
Accomplishments/Planned Programs Subtotals	19.032	17.346	37.828

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology	Project (Number/Name) EL4 / Tactical Comms and Networking Technology Int

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Army										Date: February 2018		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603794A / C3 Adv Technology				Project (Number/Name) EL5 / Secure Tactical Information Integration			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
EL5: <i>Secure Tactical Information Integration</i>	-	15.407	16.080	14.559	-	14.559	16.260	17.526	16.724	17.059	0.000	113.615

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software, algorithms and services that focus on tactical cyber and cyberspace electromagnetic activities (CEMA) 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.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2017	FY 2018	FY 2019
<p>Title: Tactical Defensive Cyber</p> <p>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.</p>	9.006	-	-
<p>Title: Defensive Cyber Operations, Cyber Situational Understanding, formerly titled Cyber/CEMA Operations, Situational Awareness/Understanding</p> <p>Description: This effort matures and demonstrates software and algorithms that facilitate actionable decision making through mission critical Cyber Electro Magnetic Activity (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.</p> <p>FY 2018 Plans: 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 situational</p>	4.000	3.004	1.500

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>awareness (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.</p> <p>FY 2019 Plans: Will mature CEMA workflow management tools to assist automation and decision support for Electronic Warfare Operations (EWO) and CEMA staff elements in execution and coordination of cyber SU across CEMA domains; will mature a cyber SU security architecture that supports data and platform convergence across the Intel, cyber, EWO, and IO functions within a BCT TOC; will mature machine learning based algorithms supporting the synchronization and correlation of DoDIN Ops management and Electromagnetic Spectrum (EMS) management within the cyber SU construct.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Part of the effort completes in FY2018.</p>			
<p>Title: Tactical Public Key Infrastructure (PKI) and Cryptography</p> <p>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.</p>	2.401	-	-
<p>Title: Defensive Cyber Operations, Tactical Cyber Resilient Architectures & Platforms , formerly Cyber/CEMA Operations, Tactical Cyber Resilient Architectures & Platforms</p> <p>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.</p> <p>FY 2018 Plans: 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 integrated information security (INFOSEC) functions; mature capabilities to map cyber threats to mission impact to provide traceability between intruder actions and brigade combat team (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</p>	-	9.070	6.054

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will mature cyber virtualization containment technologies to restrict and block the spread of malware within tactical command applications; will mature stealthy container migration service algorithms to inhibit adversarial knowledge of virtual machine migration/reconstitution; will exploit scanning techniques to monitor, manage, and maintain virtual machine elements to facilitate the detection of anomalies within the element; will provide reference implementation of computing environment to enable system to revert to a known secure state for rapid recovery after a known or suspected intrusion, exploit, or anomaly on a disadvantaged tactical network; will enhance network display capabilities to map an entire network state through the sharing of network configurations via software defined networking message structures; will demonstrate display tools for network state to the end user and associated tools to manipulate network state data; mature software defined networking controller algorithms to support virtual instantiations of tactical network elements to deceive and adversary's knowledge of actual blue force elements; and will mature user-tailorable visualization overlays that enhance convergence and representation of information across Cyber Electro Magnetic Activity (CEMA) elements.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Part of the effort completes in FY2018.</p>			
<p>Title: Defensive Cyber Operations, Trusted Self Defending Networks & Systems, formerly Cyber/CEMA Operations, Trusted Self Defending Networks & Systems</p> <p>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.</p> <p>FY 2018 Plans: 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</p>	-	4.006	7.005

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2017	FY 2018	FY 2019
<p>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.</p> <p>FY 2019 Plans: Will develop a framework to support a common federated identity and access management solution for the Command Post computing environment by coupling next generation non Public Key Infrastructure (PKI) based wearable multi-factor authentication and access control technologies with authorization techniques; will demonstrate access control improvements through removal of hardware focused identification methods (such as card based tokens) and instantiation of virtualized identifications with associated management and distribution solutions for tactical environments; will mature application services (hashing, labeling, and integrity) to capture the lineage of tactical information flows as they traverse the network; will mature data provenance techniques to enable trusted messages between producers and consumers through methods such as concealed file history; will mature an enhanced reprogrammable miniaturized encryption module for tactical handhelds and Internet of Things (IoT) sensors/devices optimized for low power and low cost requirements to enable integration into smaller footprint platforms such as unmanned aerial vehicles and dismount Soldier systems; will optimize a framework incorporating machine learning algorithms to capture data, model, understand, and dynamically tailor user experience and software vulnerability analysis results based on evidence collected; and provide a plug-in to enable rapid insertion of new software assurance methods through automated incorporation and application of the methods to existing software and firmware.</p> <p>FY 2018 to FY 2019 Increase/Decrease Statement: Planned program increase.</p>			
Accomplishments/Planned Programs Subtotals	15.407	16.080	14.559

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A