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**Department of Defense
Fiscal Year (FY) 2015 Budget Estimates**

March 2014



Army

Justification Book

Research, Development, Test & Evaluation, Army

RDT&E – Volume I, Budget Activity 2

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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, \$6,593,898,000, to remain available for obligation until September 30, 2016.

The following Justification Books were prepared at a cost of \$139,860.00: 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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 Total Obligational Authority
 (Dollars in Thousands)

February 28, 2014

Appropriation	FY 2013 (Base & OCO)	FY 2014 Base Enacted	FY 2014 OCO Enacted	FY 2014 Total Enacted	FY 2015 Base
Research, Development, Test & Eval, Army	8,010,810	7,122,681	13,500	7,136,181	6,593,898
Total Research, Development, Test & Evaluation	8,010,810	7,122,681	13,500	7,136,181	6,593,898

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Summary Recap of Budget Activities	FY 2013 (Base & OCO)	FY 2014 Base Enacted	FY 2014 OCO Enacted	FY 2014 Total Enacted	FY 2015 Base
Basic Research	384,636	436,493		436,493	424,176
Applied Research	910,391	954,451		954,451	862,611
Advanced Technology Development	961,060	1,063,636		1,063,636	917,791
Advanced Component Development & Prototypes	421,655	408,552	6,500	415,052	323,156
System Development & Demonstration	2,785,237	2,052,576	7,000	2,059,576	1,719,374
RDT&E Management Support	1,241,684	1,163,091		1,163,091	1,000,430
Operational Systems Development	1,306,147	1,043,882		1,043,882	1,346,360
Total Research, Development, Test & Evaluation	8,010,810	7,122,681	13,500	7,136,181	6,593,898
Summary Recap of FYDP Programs					
Strategic Forces	142,508	83,406		83,406	54,076
General Purpose Forces	610,249	575,129		575,129	963,970
Intelligence and Communications	383,165	208,332		208,332	170,244
Research and Development	6,821,245	6,199,708	13,500	6,213,208	5,329,383
Central Supply and Maintenance	53,461	56,106		56,106	76,225
Administration and Associated Activities	182				
Total Research, Development, Test & Evaluation	8,010,810	7,122,681	13,500	7,136,181	6,593,898

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

Line No	Program Element Number	Item	Act	FY 2013 (Base & OCO)	FY 2014 Base Enacted	FY 2014 OCO Enacted	FY 2014 Total Enacted	FY 2015 Base
1	0601101A	In-House Laboratory Independent Research	01	18,836	21,792		21,792	13,464
2	0601102A	Defense Research Sciences	01	197,690	221,783		221,783	238,167
3	0601103A	University Research Initiatives	01	72,243	79,317		79,317	69,808
4	0601104A	University and Industry Research Centers	01	95,867	113,601		113,601	102,737
		Basic Research		384,636	436,493		436,493	424,176
5	0602105A	Materials Technology	02	54,578	55,569		55,569	28,006
6	0602120A	Sensors and Electronic Survivability	02	40,842	43,148		43,148	33,515
7	0602122A	TRACTOR HIP	02	20,638	36,273		36,273	16,358
8	0602211A	Aviation Technology	02	46,828	55,586		55,586	63,433
9	0602270A	Electronic Warfare Technology	02	13,838	17,575		17,575	18,502
10	0602303A	Missile Technology	02	43,277	59,500		59,500	46,194
11	0602307A	Advanced Weapons Technology	02	23,140	26,148		26,148	28,528
12	0602308A	Advanced Concepts and Simulation	02	21,075	24,051		24,051	27,435
13	0602601A	Combat Vehicle and Automotive Technology	02	62,267	64,555		64,555	72,883
14	0602618A	Ballistics Technology	02	55,113	75,263		75,263	85,597
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	4,010	4,487		4,487	3,971
16	0602623A	Joint Service Small Arms Program	02	6,378	7,814		7,814	6,853
17	0602624A	Weapons and Munitions Technology	02	46,097	52,778		52,778	38,069
18	0602705A	Electronics and Electronic Devices	02	85,099	58,990		58,990	56,435
19	0602709A	Night Vision Technology	02	48,069	43,403		43,403	38,445
20	0602712A	Countermine Systems	02	28,875	30,563		30,563	25,939

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21	0602716A	Human Factors Engineering Technology	02	18,161	21,328		21,328	23,783
22	0602720A	Environmental Quality Technology	02	18,259	20,304		20,304	15,659
23	0602782A	Command, Control, Communications Technology	02	26,200	34,191		34,191	33,817
24	0602783A	Computer and Software Technology	02	8,886	10,434		10,434	10,764
25	0602784A	Military Engineering Technology	02	71,553	70,027		70,027	63,311
26	0602785A	Manpower/Personnel/Training Technology	02	15,979	17,645		17,645	23,295
27	0602786A	Warfighter Technology	02	53,206	31,529		31,529	25,751
28	0602787A	Medical Technology	02	98,023	93,290		93,290	76,068
		Applied Research		910,391	954,451		954,451	862,611
29	0603001A	Warfighter Advanced Technology	03	36,975	66,025		66,025	65,139
30	0603002A	Medical Advanced Technology	03	99,924	100,999		100,999	67,291
31	0603003A	Aviation Advanced Technology	03	57,364	81,037		81,037	88,990
32	0603004A	Weapons and Munitions Advanced Technology	03	69,788	73,885		73,885	57,931
33	0603005A	Combat Vehicle and Automotive Advanced Technology	03	128,463	146,992		146,992	110,031
34	0603006A	Space Application Advanced Technology	03	3,702	5,862		5,862	6,883
35	0603007A	Manpower, Personnel and Training Advanced Technology	03	8,756	7,796		7,796	13,580
36	0603008A	Electronic Warfare Advanced Technology	03	45,254	45,394		45,394	44,871
37	0603009A	TRACTOR HIKE	03	6,792	9,161		9,161	7,492
38	0603015A	Next Generation Training & Simulation Systems	03	15,404	13,620		13,620	16,749
39	0603020A	TRACTOR ROSE	03	8,762	10,662		10,662	14,483
40	0603105A	Military HIV Research	03	20,920				

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41	0603125A	Combating Terrorism - Technology Development	03	9,199	15,046		15,046	24,270
42	0603130A	TRACTOR NAIL	03	3,207	3,192		3,192	3,440
43	0603131A	TRACTOR EGGS	03	2,560	2,366		2,366	2,406
44	0603270A	Electronic Warfare Technology	03	19,561	25,335		25,335	26,057
45	0603313A	Missile and Rocket Advanced Technology	03	80,379	83,975		83,975	44,957
46	0603322A	TRACTOR CAGE	03	12,026	11,077		11,077	11,105
47	0603461A	High Performance Computing Modernization Program	03	202,969	220,565		220,565	181,609
48	0603606A	Landmine Warfare and Barrier Advanced Technology	03	24,448	22,794		22,794	13,074
49	0603607A	Joint Service Small Arms Program	03	5,478	5,027		5,027	7,321
50	0603710A	Night Vision Advanced Technology	03	33,328	44,387		44,387	44,138
51	0603728A	Environmental Quality Technology Demonstrations	03	12,398	11,739		11,739	9,197
52	0603734A	Military Engineering Advanced Technology	03	30,503	23,705		23,705	17,613
53	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	22,900	32,995		32,995	39,164
		Advanced Technology Development		961,060	1,063,636		1,063,636	917,791
54	0603305A	Army Missile Defense Systems Integration	04	22,340	23,289		23,289	12,797
55	0603308A	Army Space Systems Integration	04	9,038	13,584		13,584	13,999
56	0603619A	Landmine Warfare and Barrier - Adv Dev	04	4,089				
57	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	2,430				
58	0603639A	Tank and Medium Caliber Ammunition	04	27,114	30,596		30,596	29,334
59	0603653A	Advanced Tank Armament System (ATAS)	04	11,116	49,963		49,963	
60	0603747A	Soldier Support and Survivability	04	15,936	5,185	6,500	11,685	9,602

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61	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	7,960	6,890		6,890	8,953
62	0603774A	Night Vision Systems Advanced Development	04	9,556	9,061		9,061	3,052
63	0603779A	Environmental Quality Technology - Dem/Val	04	4,060	2,631		2,631	7,830
64	0603782A	Warfighter Information Network-Tactical - DEM/VAL	04	161,505	122,319		122,319	
65	0603790A	NATO Research and Development	04	4,393	3,872		3,872	2,954
66	0603801A	Aviation - Adv Dev	04	7,227	5,015		5,015	
67	0603804A	Logistics and Engineer Equipment - Adv Dev	04	13,028	11,549		11,549	13,386
68	0603805A	Combat Service Support Control System Evaluation and Analysis	04	4,499				
69	0603807A	Medical Systems - Adv Dev	04	22,514	15,594		15,594	23,659
70	0603827A	Soldier Systems - Advanced Development	04	30,793	14,152		14,152	6,830
71	0603850A	Integrated Broadcast Service	04	96	79		79	
72	0604100A	Analysis Of Alternatives	04					9,913
73	0604115A	Technology Maturation Initiatives	04	12,636	11,110		11,110	74,740
74	0604120A	Assured Positioning, Navigation and Timing (PNT)	04					9,930
75	0604131A	TRACTOR JUTE	04	54				
76	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	25,710	79,190		79,190	96,177
77	0604785A	Integrated Base Defense (Budget Activity 4)	04	3,604	4,473		4,473	
78	0305205A	Endurance UAVs	04	21,957				
		Advanced Component Development & Prototypes		421,655	408,552	6,500	415,052	323,156
79	0604201A	Aircraft Avionics	05	60,472	76,547		76,547	37,246
80	0604220A	Armed, Deployable Helos	05	80,934	69,807		69,807	

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81	0604270A	Electronic Warfare Development	05	102,812	144,543		144,543	6,002
82	0604280A	Joint Tactical Radio	05		31,809		31,809	9,832
83	0604290A	Mid-tier Networking Vehicular Radio (MNVR)	05	2,556	23,328		23,328	9,730
84	0604321A	All Source Analysis System	05	5,601	4,837		4,837	5,532
85	0604328A	TRACTOR CAGE	05	11,297	23,829		23,829	19,929
86	0604601A	Infantry Support Weapons	05	83,224	85,054		85,054	27,884
87	0604604A	Medium Tactical Vehicles	05	2,908	2,139		2,139	210
88	0604611A	JAVELIN	05	4,540	5,000		5,000	4,166
89	0604622A	Family of Heavy Tactical Vehicles	05	17,975	21,310	7,000	28,310	12,913
90	0604633A	Air Traffic Control	05	10,140	514		514	16,764
91	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	2,795				6,770
92	0604710A	Night Vision Systems - Eng Dev	05	29,352	43,382		43,382	65,333
93	0604713A	Combat Feeding, Clothing, and Equipment	05	1,901	1,938		1,938	1,335
94	0604715A	Non-System Training Devices - Eng Dev	05	40,470	18,971		18,971	8,945
95	0604716A	Terrain Information - Eng Dev	05	928				
96	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	42,876	18,284		18,284	15,906
97	0604742A	Constructive Simulation Systems Development	05	25,828	17,004		17,004	4,394
98	0604746A	Automatic Test Equipment Development	05	10,307	6,697		6,697	11,084
99	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	12,427	12,569		12,569	10,027
100	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	16,005	27,619		27,619	42,430
101	0604798A	Brigade Analysis, Integration and Evaluation	05	191,065	99,947		99,947	105,279

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102	0604802A	Weapons and Munitions - Eng Dev	05	12,999	15,712		15,712	15,006
103	0604804A	Logistics and Engineer Equipment - Eng Dev	05	45,135	41,682		41,682	24,581
104	0604805A	Command, Control, Communications Systems - Eng Dev	05	18,543	7,376		7,376	4,433
105	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	38,712	39,447		39,447	30,397
106	0604808A	Landmine Warfare/Barrier - Eng Dev	05	37,769	92,236		92,236	57,705
107	0604814A	Artillery Munitions - EMD	05	3,576	8,205		8,205	
108	0604818A	Army Tactical Command & Control Hardware & Software	05	50,279	22,945		22,945	29,683
109	0604820A	Radar Development	05	3,734	1,548		1,548	5,224
110	0604822A	General Fund Enterprise Business System (GFEBs)	05	24,742	226		226	
111	0604823A	Firefinder	05	18,303	20,210		20,210	37,492
112	0604827A	Soldier Systems - Warrior Dem/Val	05	28,358	18,467		18,467	6,157
113	0604854A	Artillery Systems - EMD	05	149,667	121,270		121,270	1,912
114	0604869A	Patriot/MEADS Combined Aggregate Program (CAP)	05	348,234				
115	0604870A	Nuclear Arms Control Monitoring Sensor Network	05	7,093				
116	0605013A	Information Technology Development	05	44,684	68,778		68,778	69,761
117	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	122,168	69,253		69,253	138,465
118	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05		28,285		28,285	92,353
119	0605030A	Joint Tactical Network Center (JTNC)	05		68,112		68,112	8,440
120	0605031A	Joint Tactical Network (JTN)	05					17,999
121	0605035A	Common Infrared Countermeasures (CIRCM)	05					145,409
122	0605350A	WIN-T Increment 3 - Full Networking	05					113,210

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123	0605380A	AMF Joint Tactical Radio System (JTRS)	05		10,213		10,213	6,882
124	0605450A	Joint Air-to-Ground Missile (JAGM)	05	9,686	15,119		15,119	83,838
125	0605456A	PAC-3/MSE Missile	05	63,123	68,807		68,807	35,009
126	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	247,407	369,452		369,452	142,584
127	0605625A	Manned Ground Vehicle	05	570,121	100,147		100,147	49,160
128	0605626A	Aerial Common Sensor	05	108,566	10,377		10,377	17,748
129	0605766A	National Capabilities Integration (MIP)	05		21,132		21,132	15,212
130	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	59,205	84,185		84,185	45,718
131	0605830A	Aviation Ground Support Equipment	05					10,041
132	0210609A	Paladin Integrated Management (PIM)	05					83,300
133	0303032A	TROJAN - RH12	05	3,892	3,463		3,463	983
134	0304270A	Electronic Warfare Development	05	12,828	10,801		10,801	8,961
		System Development & Demonstration		2,785,237	2,052,576	7,000	2,059,576	1,719,374
135	0604256A	Threat Simulator Development	06	16,409	23,921		23,921	18,062
136	0604258A	Target Systems Development	06	12,583	13,481		13,481	10,040
137	0604759A	Major T&E Investment	06	45,057	46,647		46,647	60,317
138	0605103A	Rand Arroyo Center	06	18,892	18,909		18,909	20,612
139	0605301A	Army Kwajalein Atoll	06	162,089	193,555		193,555	176,041
140	0605326A	Concepts Experimentation Program	06	24,720	22,246		22,246	19,439
141	0605502A	Small Business Innovative Research	06	169,555				
142	0605601A	Army Test Ranges and Facilities	06	334,087	340,477		340,477	275,025

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143	0605602A	Army Technical Test Instrumentation and Targets	06	61,711	66,025		66,025	45,596
144	0605604A	Survivability/Lethality Analysis	06	40,865	43,256		43,256	33,295
145	0605606A	Aircraft Certification	06	5,258	6,022		6,022	4,700
146	0605702A	Meteorological Support to RDT&E Activities	06	6,668	7,345		7,345	6,413
147	0605706A	Materiel Systems Analysis	06	18,622	19,799		19,799	20,746
148	0605709A	Exploitation of Foreign Items	06	5,501	5,938		5,938	7,015
149	0605712A	Support of Operational Testing	06	64,458	55,475		55,475	49,221
150	0605716A	Army Evaluation Center	06	57,037	65,240		65,240	55,039
151	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	1,375	1,282		1,282	1,125
152	0605801A	Programwide Activities	06	75,662	81,993		81,993	64,169
153	0605803A	Technical Information Activities	06	48,995	33,835		33,835	32,319
154	0605805A	Munitions Standardization, Effectiveness and Safety	06	50,838	58,309		58,309	49,052
155	0605857A	Environmental Quality Technology Mgmt Support	06	4,276	5,191		5,191	2,612
156	0605898A	Management HQ - R&D	06	16,844	54,145		54,145	49,592
157	0909999A	Financing for Cancelled Account Adjustments	06	182				
		RDT&E Management Support		1,241,684	1,163,091		1,163,091	1,000,430
158	0603778A	MLRS Product Improvement Program	07	110,860	96,424		96,424	17,112
159	0607141A	Logistics Automation	07		3,715		3,715	3,654
160	0607664A	Biometric Enabling Capability (BEC)	07					1,332
161	0607865A	Patriot Product Improvement	07	44,581	35,034		35,034	152,991
162	0102419A	Aerostat Joint Project Office	07	142,508	83,406		83,406	54,076

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163	0203726A	Adv Field Artillery Tactical Data System	07	26,216	25,507		25,507	22,374
164	0203728A	Joint Automated Deep Operation Coordination System (JADOCs)	07					24,371
165	0203735A	Combat Vehicle Improvement Programs	07	189,396	177,437		177,437	295,177
166	0203740A	Maneuver Control System	07	60,948	36,475		36,475	45,092
167	0203744A	Aircraft Modifications/Product Improvement Programs	07	193,404	239,696		239,696	264,887
168	0203752A	Aircraft Engine Component Improvement Program	07	804	315		315	381
169	0203758A	Digitization	07	34,225	6,183		6,183	10,912
170	0203801A	Missile/Air Defense Product Improvement Program	07	17,863	1,577		1,577	5,115
171	0203802A	Other Missile Product Improvement Programs	07		62,067		62,067	49,848
172	0203808A	TRACTOR CARD	07	58,174	18,768		18,768	22,691
173	0205402A	Integrated Base Defense - Operational System Dev	07					4,364
174	0205410A	Materials Handling Equipment	07					834
175	0205412A	Environmental Quality Technology - Operational System Dev	07					280
176	0205456A	Lower Tier Air and Missile Defense (AMD) System	07					78,758
177	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07					45,377
178	0208053A	Joint Tactical Ground System	07	29,187	7,104		7,104	10,209
179	0208058A	Joint High Speed Vessel (JHSV)	07	32				
180	0301359A	Special Army Program	07					
181	0303028A	Security and Intelligence Activities	07	6,778	7,596		7,596	12,525
182	0303140A	Information Systems Security Program	07	14,314	9,351		9,351	14,175
183	0303141A	Global Combat Support System	07	108,506	41,203		41,203	4,527

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Department of the Army
 FY 2015 President's Budget
 Exhibit R-1 FY 2015 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

February 28, 2014

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

Line No	Program Element Number	Item	Act	FY 2013 (Base & OCO)	FY 2014 Base Enacted	FY 2014 OCO Enacted	FY 2014 Total Enacted	FY 2015 Base
184	0303142A	SATCOM Ground Environment (SPACE)	07	14,101	18,188		18,188	11,011
185	0303150A	WWMCCS/Global Command and Control System	07	13,208	14,208		14,208	2,151
186	0304348A	Advanced Geospatial Intelligence (AGI)	07					
187	0305204A	Tactical Unmanned Aerial Vehicles	07	28,466	33,515		33,515	22,870
188	0305208A	Distributed Common Ground/Surface Systems	07	38,673	27,607		27,607	20,155
189	0305219A	MQ-1C Gray Eagle UAS	07	68,694	10,895		10,895	46,472
190	0305232A	RQ-11 UAV	07	3,716	2,320		2,320	
191	0305233A	RQ-7 UAV	07	28,554	12,025		12,025	16,389
192	0307665A	Biometrics Enabled Intelligence	07	15,225	12,443		12,443	1,974
193	0310349A	Win-T Increment 2 - Initial Networking	07					3,249
194	0708045A	End Item Industrial Preparedness Activities	07	53,461	56,106		56,106	76,225
Operational Systems Development				1,306,147	1,043,882		1,043,882	1,346,360
Total Research, Development, Test & Eval, Army				8,010,810	7,122,681	13,500	7,136,181	6,593,898

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

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6	02	0602120A	Sensors and Electronic Survivability.....	12
7	02	0602122A	TRACTOR HIP.....	29
8	02	0602211A	AVIATION TECHNOLOGY.....	33
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12	02	0602308A	Advanced Concepts and Simulation.....	70
13	02	0602601A	Combat Vehicle and Automotive Technology.....	80
14	02	0602618A	BALLISTICS TECHNOLOGY.....	97
15	02	0602622A	Chemical, Smoke and Equipment Defeating Technology.....	109
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***Budget Activity 02: Applied Research
Appropriation 2040: Research, Development, Test & Evaluation, Army***

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21	02	0602716A	HUMAN FACTORS ENGINEERING TECHNOLOGY.....	179
22	02	0602720A	Environmental Quality Technology.....	188
23	02	0602782A	Command, Control, Communications Technology.....	200
24	02	0602783A	COMPUTER AND SOFTWARE TECHNOLOGY.....	210
25	02	0602784A	MILITARY ENGINEERING TECHNOLOGY.....	216
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Advanced Concepts and Simulation	0602308A	12	02.....	70
BALLISTICS TECHNOLOGY	0602618A	14	02.....	97
COMPUTER AND SOFTWARE TECHNOLOGY	0602783A	24	02.....	210
Chemical, Smoke and Equipment Defeating Technology	0602622A	15	02.....	109
Combat Vehicle and Automotive Technology	0602601A	13	02.....	80
Command, Control, Communications Technology	0602782A	23	02.....	200
Countermine Systems	0602712A	20	02.....	170
ELECTRONICS AND ELECTRONIC DEVICES	0602705A	18	02.....	137
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Environmental Quality Technology	0602720A	22	02.....	188
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Sensors and Electronic Survivability	0602120A	6	02.....	12
TRACTOR HIP	0602122A	7	02.....	29
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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602105A / <i>MATERIALS TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	54.578	55.569	28.006	-	28.006	28.481	30.448	30.844	31.567	-	-
H7B: <i>Advanced Materials Initiatives (CA)</i>	-	26.724	28.998	-	-	-	-	-	-	-	-	-
H7G: <i>Nanomaterials Applied Research</i>	-	4.378	3.987	3.325	-	3.325	3.700	5.490	5.393	5.885	-	-
H84: <i>Materials</i>	-	23.476	22.584	24.681	-	24.681	24.781	24.958	25.451	25.682	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 Adjustments attributed to Congressional Add funding (32.000 million); Congressional General Reductions (-107 thousand); SBIR/STTR transfers (-376 thousand); and Sequestration reductions (-5.980 million)
 FY 14 Adjustments attributed to Congressional Add funding (29.000 million) and FFRDC reduction (-16 thousand)

A. Mission Description and Budget Item Justification

This program element (PE) evaluates materials for lighter weight and more survivable armor and for more lethal armaments. Project H7G researches and explores nanostructure materials properties and exploits the strength and durability of these materials to enable lighter weight, increased performance in Soldier weapons and protection applications. Project H84, researches a variety of materials and designs, fabricates and evaluates performance of components for lighter weight Soldier and vehicle armors, armaments, and electronics.

Work in this PE builds on the materials research transitioned from PE 0601102A (Defense Research Sciences), project H42 (Materials and Mechanics) and PE 0601104A (University and Industry Research Centers), project J12 (Institute for Soldier Nanotechnologies). This work complements and is fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Ballistics Technology), PE 0602786A (Warfighter Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), and PE 0708045A (Manufacturing Technology).

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

Work is performed by the U.S. Army Research Laboratory (ARL), Adelphi, MD and Aberdeen Proving Ground, MD, and the Massachusetts Institute of Technology.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602105A / <i>MATERIALS TECHNOLOGY</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	29.041	26.585	29.955	-	29.955
Current President's Budget	54.578	55.569	28.006	-	28.006
Total Adjustments	25.537	28.984	-1.949	-	-1.949
• Congressional General Reductions	-0.107	-0.016			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	32.000	29.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.376	-			
• Adjustments to Budget Years	-	-	-1.949	-	-1.949
• Other Adjustments 1	-5.980	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H7B / Advanced Materials Initiatives (CA)
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H7B: <i>Advanced Materials Initiatives (CA)</i>	-	26.724	28.998	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Advanced Materials Initiatives.

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

	FY 2013	FY 2014	FY 2015
<p>Title: Nanotechnology Research</p> <p>Description: This is a Congressional Interest Item.</p> <p>FY 2013 Accomplishments: Developed tools and methodologies to create and retain unique nano-derived properties from nano-synthesis through component processing.</p> <p>FY 2014 Plans: This is a Congressional Interest Item.</p>	7.516	4.000	-
<p>Title: Materials Research</p> <p>Description: This is a Congressional Interest Item</p> <p>FY 2013 Accomplishments: Researched non-flammable high voltage battery electrolytes for safe high energy density lithium ion power sources; researched rechargeable high energy density proton conducting power sources; researched domestic sources and recovery processes for rare earth metals.</p> <p>FY 2014 Plans: This is a Congressional Interest Item</p>	10.857	14.999	-
<p>Title: Advanced Coating Technologies for Corrosion Mitigation</p> <p>Description: This is a Congressional Interest Item</p>	8.351	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H7B / Advanced Materials Initiatives (CA)

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Researched corrosion mitigation mechanisms and failures of Army substrates and coatings; develop and characterize advanced coatings that use no chemicals that pose significant hazards to human health or the environment and/or are derived from renewable resources.</p> <p><i>Title:</i> Silicon Carbide Research</p> <p><i>Description:</i> This is a Congressional Interest Item</p> <p><i>FY 2014 Plans:</i> This is a Congressional Interest Item</p>	-	9.999	-
Accomplishments/Planned Programs Subtotals	26.724	28.998	-

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H7G / Nanomaterials Applied Research
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H7G: <i>Nanomaterials Applied Research</i>	-	4.378	3.987	3.325	-	3.325	3.700	5.490	5.393	5.885	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This effort conducts nanoscience research relevant to the Soldier focused on new materials, properties and phenomena in five research areas: (1) lightweight, multifunctional nanostructured materials and hybrid assemblies, (2) soldier medicine, (3) multiple blast and ballistic threats, (4) hazardous substances sensing, recognition, and protection, and (5) nanosystem integration for protected communications, diagnostic sensing, and operational flexibility in complex environments. This project funds collaborative applied research and integration of government, academic, and industry scientific research on nanomaterials derived from PE 0601104A/ project J12 (Institute for Soldier Nanotechnologies (ISN)) to advance innovative capabilities.

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

Work in this project builds on the materials research transitioned from PE 0601104A. This work complements and is fully coordinated with PE 0602618A (Ballistics Technology), PE 0602786A (Warfighter Technology), and PE 0603001A (Warfighter Advanced Technology).

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Adelphi, MD and Aberdeen Proving Ground, MD, the Massachusetts Institute of Technology, and the ISN industrial partners.

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

	FY 2013	FY 2014	FY 2015
Title: Nanomaterials Applied Research	4.378	3.987	3.325
Description: Devise and validate improved physics-based, materials property models and concepts for multifunctional, lightweight, and responsive materials. Exploit breakthroughs in nanomaterials and multifunctional fiber processing technologies, such as scale-up of processes and fabrication into woven materials,) to enable revolutionary future Soldier capabilities.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H7G / Nanomaterials Applied Research

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Continued to design novel sensor and imaging devices based on carbon nanotube, quantum dot, and photonic crystal technologies; and scaled-up nanometallic aluminum alloy processing to characterize performance for potential ballistic protective materials. FY 2014 Plans: Develop quantum dot-based optical taggant system that will enable daylight visible tag, track, and locate (TTL) and combat identification capabilities; validate hydrophobic and antimicrobial coating technology on fabrics; and validate high rate response of nanometallic aluminum alloys for use in lightweight protection systems. FY 2015 Plans: Will develop new materials capable of selective energy absorption based on novel coating technologies using nano- and microparticle; synthesize unique molecules for use as additives in transparent eye protection materials that simultaneously solve processing issues and enhance material performance; and demonstrate stability and performance of a daylight visible taggant system based on a quantum dot-enabled paint for covert tracking and combat identification applications.			
Accomplishments/Planned Programs Subtotals	4.378	3.987	3.325

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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY				Project (Number/Name) H84 / Materials			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H84: <i>Materials</i>	-	23.476	22.584	24.681	-	24.681	24.781	24.958	25.451	25.682	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, fabricates, and evaluates a variety of materials (including metals, ceramics, polymers, and composites) that have potential to enable more survivable, lighter weight Soldier and vehicle armor, chemical and biological protection, armaments, and electronics. Research conducted focuses on unique and/or novel material properties, developing physics-based models, materials characterization techniques, non-destructive testing methods and advanced fabrication/processing methodologies.

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

Work in this project makes extensive use of high performance computing and experimental validation and builds on research transitioned from PE 0601102A (Defense Research Sciences), project H42 (Materials and Mechanics) and project H43 (Ballistics). The work complements and is fully coordinated with efforts in PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Survivability and Lethality Technologies), PE 0602786A (Warfighter Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle 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.

The work is conducted by the U.S. Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Structural Armor	3.261	2.521	5.417
Description: Conduct applied research to design and evaluate lightweight armor materials and structures, investigate novel processing methodologies for cost effective manufacturing, and utilize existing and emerging modeling and simulation tools to enable formulation of lightweight, frontal, and structural armor materials for current and future platform applications.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H84 / Materials		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Investigated novel mechanical deformation processing of magnesium alloy plates that potentially provide very lightweight metal structural materials; provided corrosion mapping for promising aluminum and magnesium alloys and investigated corrosion inhibitors to enable the alloys use for future applications; documented materials properties information (such as adhesive strength) for an adhesive database to be used in close collaboration with manufacturers and research universities; fabricated novel boron sub-oxide ceramic materials for use in protection applications; and validated progressive failure analysis methods and progressive fatigue damage model of composites under various loadings and composite configurations to improve long term reliability of composite materials.</p> <p>FY 2014 Plans: In ceramic armor materials, determine relationships between electronic signals from non-destructive characterization tools and microscopically observed structural details and develop analysis algorithms used for modeling, process feedback and ballistic characteristics; develop aluminum alloys for blast and penetration resistance, emphasizing full scale fabrication for alloy chemistries optimized for the most beneficial metallurgical, mechanical and formability characteristics; and develop novel processing strategies for polymer compositions to enable tunable mechanical response; and apply processing science, and modeling and simulation to validate processing technology for the metallic encapsulation of ceramic armor tiles.</p> <p>FY 2015 Plans: Will develop improved delamination resistance and damage tolerance of thick composites using innovative, cost-effective manufacturing concepts; demonstrate ballistic performance of monolithic baseline magnesium (Mg) alloy and layered ceramic/Mg alloy/ultra-high-molecular-weight polyethylene (UHMWPE) sandwich structure variants with weight reduction goal of 5-12% over current designs; develop validated physics-based models for fatigue of Mg alloy structures for lightweight vehicles that eliminate traditional empirical modeling approaches; and validate novel algorithms to identify links between the microstructure of armor ceramics and ballistic performance, enabling both screening of as-processed tiles as well as development of next generation armor ceramics.</p>				
<p>Title: Soldier-Borne Armor Materials</p> <p>Description: Utilizing understanding of defeat mechanisms from PE62618/project H80, conduct applied research of emerging lightweight armor materials and structures to enable affordable design of multifunctional ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new lethal mechanisms/protection schemes for the individual Warfighter.</p> <p>FY 2013 Accomplishments: Investigated novel materials such as three-dimensional (3D) ceramics and fabrics to provide breakthrough technologies for protecting the dismounted soldier under ballistic and blast conditions based on human tissue response data; designed novel hybrid material systems with associated processing science to provide lighter, more flexible, more durable and affordable</p>		4.162	5.398	5.402

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H84 / Materials

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>protection to Soldiers and vehicles; and transitioned fabric ballistic modeling tools to armor designers at the U.S. Army Natick Soldier Research, Development, and Engineering Center (NSRDEC) and the U.S. Army Tank and Automotive Research, Development, and Engineering Center (TARDEC).</p> <p>FY 2014 Plans: Develop synthesis and processing routes for low density boron-based ceramic compositions, provide model validation using high resolution electron microscopy; develop soft polymers through computational methods and experimental validation to match the rate dependent response of relevant human tissues; develop a robust fiber ballistic modeling tool to investigate penetration resistance of up to 10 layers of 2D fabric with multiple fiber or material architectures and validate with ballistic testing; and develop a refined process model to describe the deformation characteristics and fiber-matrix adhesion, provide experimental validation.</p> <p>FY 2015 Plans: Will develop a filament-level 3D textile model for use in the development of soft body armor; develop and characterize new materials for extremity armor; and develop validated numerical modeling capability to analyze new materials for the range of personnel protection options that utilize the inherent multifunctional nature of composite materials to enhance survivability.</p>			
<p>Title: Composites</p> <p>Description: This effort designs, models, validates, and optimizes advanced materials (such as ceramic, composite, polymers, lightweight and high-strength metals) including processing techniques for protection against smaller but more lethal penetrators/warheads using affordable, lightweight, high performance armaments for revolutionary weapons effectiveness in urban and irregular operations.</p> <p>FY 2013 Accomplishments: Evaluated composite cladding for reduced gun barrel erosion and transitioned to the U.S. Army Armaments Research, Development, and Engineering Center (ARDEC); and demonstrated structures in various media for active and passive wave mitigation and pulsation management for blast applications and acoustic damping.</p> <p>FY 2014 Plans: Validate improved multi-hit ballistic capability of three-dimensional, through-thickness reinforced (3D-TTR) hybridized composite test coupons; through the use of computational and experimental methods, design and prepare polymer resins derived from renewable sources that provide properties at least equivalent to conventionally prepared polyether ether ketone (PEEK); and develop materials models and experimental techniques to validate >50% improvement in the adhesion of dissimilar materials used in vehicle protection platforms.</p> <p>FY 2015 Plans:</p>	2.923	2.932	4.494

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H84 / Materials		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will develop metal matrix composites to meet thermal requirements of gun barrels at reduced weight; utilize combination of consolidation and diffusion processes to create nanostructured copper materials for coatings/liners that enable reduction in shape charge jet size while maintaining jet effect; and explore interfacial/bonding effects on the coupled and high loading rate failure modes in thermoplastic composites.				
<p>Title: Multifunctional Armor Materials</p> <p>Description: This effort researches novel multifunctional armor materials for Army applications such as structural energy storage, armor embedded command, control and communications (C3) antennas, and self healing materials. Soldier personnel protection materials transition to PE 0602786A/project H98. Reactive armor and electromagnetic armor materials transition to PE 0602618A/project H80 and PE 0602601A/project C05.</p> <p>FY 2013 Accomplishments: Designed, synthesized, and characterized fiber materials based on biological material mechanics; transitioned new self-healing technologies to composite fabricators to enhance materials durability; created analytical models to design battery storage composites that can be used in future multifunctional structural composite materials that provide structure and energy storage; and investigated improvements in resins, reinforcements, electrodes, and processing techniques to fabricate relevant-size structural capacitors for future multifunctional structural composite materials.</p> <p>FY 2014 Plans: Research comprehensive armor materials technologies which include multifunctional batteries and/or capacitors (combined structural armor/power storage materials) with minimum of 1 Wh/kg (energy density), 100 mW/Kg (power density), 20 GPa strength (fiber direction); support total armor materials development via formulation of chemical agent resistive coatings (CARC) to reduce corrosion, improve decontamination and lessen solar loading; assess non-local theory and numerical methods for the failure of complex materials subjected to strong electromagnetic fields, validate with experiments; and determine synthetic viability of novel third generation chromophores for use in thick polymer laser protective materials.</p> <p>FY 2015 Plans: Will validate new embedded power and enhanced survivability capabilities in multifunctional composite materials using enhanced modeling and processing techniques ; develop new additive manufacturing capabilities using three dimensional (3-D) printing, cold spray, and/or related techniques to explore methods for low-volume production as well as expanding design space (e.g., bio-inspired protection concepts); establish electric field effects on select ceramics and metals to enable Electric Field Assisted Sintering (EFAS) of new multifunctional materials; and identify inelastic deformation mechanisms as a function of strain rate in silicon carbide armor ceramics through development of novel experimental techniques.</p>		11.553	9.929	7.362
Title: Nanomaterials		1.577	1.804	2.006

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602105A / MATERIALS TECHNOLOGY	Project (Number/Name) H84 / Materials

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: Mature and scale-up nanomaterials processes, fabrication, characterization and performance measures to enable revolutionary concepts for future force lethality and survivability beyond those addressed for individual Soldier protection in PE 062105/project H7G.</p> <p>FY 2013 Accomplishments: Designed synthetic, strain rate dependent polymers to mimic human body tissue; designed and evaluated blast resistant cellular topologies using bio-inspired computational algorithms; demonstrated transparent, nano-architected cellulose based composite materials; and investigated nano-tungsten materials to evaluate engineering properties for ballistic launch survivability.</p> <p>FY 2014 Plans: Develop thermally stable, dispersible nanocrystalline cellulose for use in transparent materials to improve the stiffness by 25% without optical penalty; develop powder production technology for reliable, cost effective production of domestic nanocrystalline tungsten; and identify tungsten carbide microstructures and properties for rigid body penetration of armor; and develop environmentally friendly binder materials for tungsten carbide.</p> <p>FY 2015 Plans: Will develop thermally stable nanocrystalline cellulos particles and networks for incorporation into impact resistant transparent polymers used for personnel protection; establish bulk mechanical properties of thermally stabilized nanocrystalline alloys to expand design space for structural and armor applications; and synthesize novel third generation chromophores and incorporate into thick polymer laser protective materials used in anti-laser sensor devices.</p>			
Accomplishments/Planned Programs Subtotals	23.476	22.584	24.681

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	40.842	43.148	33.515	-	33.515	38.631	38.648	35.993	35.394	-	-
H15: <i>Ground Combat Id Tech</i>	-	1.984	2.327	-	-	-	-	-	-	-	-	-
H16: <i>S3I Technology</i>	-	19.509	20.797	17.936	-	17.936	21.305	21.518	18.005	18.129	-	-
SA2: <i>Biotechnology Applied Research</i>	-	4.011	4.035	2.860	-	2.860	2.993	1.873	2.195	2.120	-	-
TS1: <i>Tactical Space Research</i>	-	3.795	5.304	4.778	-	4.778	5.850	6.752	7.079	7.124	-	-
TS2: <i>Robotics Technology</i>	-	11.543	10.685	7.941	-	7.941	8.483	8.505	8.714	8.021	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 reductions attributed to General Congressional Reductions (-89 thousand); SBIR/STTR transfers (-696 thousand); and Sequestration reductions (-3.633 million) FY15 funding realigned to support higher Army priorities.

A. Mission Description and Budget Item Justification

This program element (PE) investigates designs and evaluates sensors and electronic components and software that enhance situational awareness, survivability, lethality, and autonomous mobility for tactical ground forces. Project H15 focuses on Combat Identification (CID) technologies, which include devices to locate, identify, track, and engage targets in the Joint fires environment. Project H16 investigates sensors, signal processing and information fusion technologies to increase target detection range and speed of engagement. Project SA2 conducts applied research on biological sensors and biologically derived electronics that exploits breakthroughs in biotechnology basic research in collaboration with the Institute for Collaborative Biotechnology (ICB) a University Affiliated Research Center (UARC) led by the University of California, Santa Barbara in partnership with California Institute of Technology and Massachusetts Institute of Technology and their industry partners. Project TS1 researches and evaluates space-based remote sensing, signal, and information processing software in collaboration with other Department of Defense (DoD) and government agencies to support space force enhancement and space superiority advanced technology integration into Army battlefield operating systems. Project TS2 focuses on advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors, human-robot interaction, robotic manipulation, and unique mobility for unmanned vehicles.

Work in this program element (PE) complements and is fully coordinated with efforts in PE 0602307A (Advanced Weapons Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602709A (Night Vision Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603006A (Command, Control, Communications Advanced Technology), PE 0603008A (Command Electronic Warfare Advanced Technology), PE 0603710A (Night Vision Advanced Technologies), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology),

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>
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The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy

Work is performed by the U.S. Army Research Laboratory, Adelphi, MD and Aberdeen Proving Ground, MD; the Communications-Electronics Research, Development, and Engineering Center, Aberdeen Proving Ground, MD; and the US Army Space and Missile Defense Technical Center, Huntsville, AL.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	45.260	43.170	47.802	-	47.802
Current President's Budget	40.842	43.148	33.515	-	33.515
Total Adjustments	-4.418	-0.022	-14.287	-	-14.287
• Congressional General Reductions	-0.089	-0.022			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.696	-			
• Adjustments to Budget Years	-	-	-14.287	-	-14.287
• Sequestration	-3.633	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H15 / <i>Ground Combat Id Tech</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H15: <i>Ground Combat Id Tech</i>	-	1.984	2.327	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts applied research and investigates emergent techniques, devices and software for combat identification (CID) of Joint, allied, and coalition forces, including air-to-ground and ground-to-ground for mounted, dismounted, forward observer, and forward air controller missions. Efforts include research to enable a common battlespace picture for Joint and coalition situation awareness and fusion efforts to increase the survivability and lethality of coalition forces by fusing battlefield sensor and situational awareness data to identify friend from foe.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Soldier and Ground Maneuver portfolios. Efforts in this project are complimentary of PE 0602270A (EW Techniques), PE 0603270A (EW Technology).

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

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

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

	FY 2013	FY 2014	FY 2015
<p>Title: Combat Identification (CID) Technologies</p> <p>Description: This effort evaluates and enhances CID modeling and simulation tools, concepts, and algorithms to improve anti-fratricide and combatant/non-combatant identification capabilities. Soldier-to-Soldier CID algorithms that interoperate with non-traditional CID sensors (air and ground) are developed to increase situational awareness (SA), feed the common operating picture, and increase the combat effectiveness of Soldier and Brigade Combat Teams (BCTs). Work being accomplished under PE 0603270A/project K16 complements this effort.</p> <p>FY 2013 Accomplishments: Evaluated tactical and emerging commercial communications, wireless personal area networks and position location information beaconing through modeling and simulation to assess their potential as components of a Soldier-to-Soldier CID capability; evaluated capacity of existing mobile/handheld platforms to perform CID display and training; investigated signature data from multiple sensor types (infrared, RF and other) to support non-cooperative CID technology development.</p> <p>FY 2014 Plans:</p>	1.984	2.327	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H15 / <i>Ground Combat Id Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Design and integrate tactical and commercial communications, wireless personal area networks and position location beaconing for a Soldier-to-Soldier CID capability utilizing equipment that is already employed by Soldiers; design CID display and training tools to implement on existing mobile and handheld platforms being targeted by applicable programs of record.			
Accomplishments/Planned Programs Subtotals	1.984	2.327	-

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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>				Project (Number/Name) H16 / <i>S3I Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H16: <i>S3I Technology</i>	-	19.509	20.797	17.936	-	17.936	21.305	21.518	18.005	18.129	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, investigates and evaluates advanced sensor components, signal processing, and information fusion algorithms that will provide the future Soldier decisive new capabilities to locate, identify, decide and engage battlefield targets in tactical environments. The ultimate impact and utility of this work will be to greatly increase the lethality, range, and speed of engagement of the Soldier. Emphasis is on solving critical Army-specific battlefield sensing and information management problems such as false targets, complex terrain (including urban applications), movement of sensors on military vehicles, and exploitation of multimodal sensors. Significant areas of research include: low cost sensors designed to be employed in large numbers of networked sensors for force protection, hostile fire defeat, homeland defense, counter terrorism operations, and munitions; fusion of disparate sensors such as non-imaging acoustic, seismic, electric-field (E-field), magnetic, radar; imaging infrared (IR), forward looking IR (FLIR), laser detection and ranging (LADAR), visible imagers; low cost acoustic, seismic, and magnetic sensors that can passively detect, classify, and track battlefield targets such as personnel, heavy/light vehicles, and helicopters. Other areas of research include sensing technologies for tagging, tracking, and locating (TTL) non-traditional targets as well as the location of direct and indirect fires and other hostile threats. Further areas of research include ultraviolet (UV) optoelectronics for battlefield sensors, networked compact radar for vehicle and dismount identification and tracking; ultra wideband radar for buried and concealed threat detection, enhanced robotic mobility, stand-off characterization of infrastructure; and the detection, classification, and tracking of humans in urban terrain. Additional areas of research are aided/automatic target recognition (ATR) allowing sensors to autonomously locate and identify targets; advanced battlefield sensor and information processing to conduct a dynamic and real time situational assessment to present a common picture of the battlespace focused on low echelon commanders; protection of sensors (including Soldier's eyes) from battlefield laser threats; and advanced information processing methods to provide automatic information technologies that utilize widely dispersed sensor and legacy information sources.

This project supports Army science and technology efforts in the Command Control and Communications, Ground and Soldier portfolios. The work in this project complements efforts funded in PE 0601104A (University and Industry Research Centers), PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technologies), and PE 0603001A (Warfighter 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 area is performed by the U.S. Army Research Laboratory (ARL), Adelphi, MD.

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H16 / <i>S3I Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Title: Non-Imaging Intelligence, Surveillance, and Reconnaissance (ISR) Sensing</p> <p>Description: This effort evaluates and designs technologies for multi-modal low-cost networked sensors to enhance persistent sensing capabilities with increased probability of target detection and reduced false alarms. A key focus is on acoustic, seismic, magnetic, E-field, and passive radio frequency (RF) with unique capabilities for Army & DoD applications such as technologies that enable detection of underground facilities.</p> <p>FY 2013 Accomplishments: Continued to investigate, design, and code new algorithms and assess sensor performance to enable faster identification and localization of transient/hostile threat events such as gunfire, explosions, weapon launches, etc. to enable rapid counter responses in urban environment and for base camps; and investigated and coded new algorithms for fusing the output of multi-modal sensors to differentiate, with very high confidence, the presence of humans versus animals to reduce the costs for sensor deployment required for target classification.</p> <p>FY 2014 Plans: Evaluate combination of collocated passive IR sensors to discriminate humans from animals with high confidence; investigate new algorithms to detect digging using seismic and magnetic sensors; and develop and evaluate algorithms to fuse input from acoustic velocity sensors, electric-field charge detectors, burn-product sensor and infrared flash detector to improve detection and classification of hostile threats such as gunfire, mortars, and rockets.</p> <p>FY 2015 Plans: Will exploit multimodal sensing, fusion, and sensor processing to detect and locate diverse threats using static and mobile sensors and networked systems; enhance sensors and algorithms to provide persistent surveillance and actionable information; and exploit target features and mitigate environmental interference to enhance intelligence, surveillance, and reconnaissance (ISR) capabilities.</p>		5.109	5.340	5.539
<p>Title: Networked Sensing and Data Fusion</p> <p>Description: This effort will develop and assess a concept to link physical sensors and information sources to Soldiers and small units. Specifically the research focuses on (1) multimodal sensor fusion for detection and classification of human activities and infrastructures such as personnel, vehicles, machinery, RF emissions, chemicals and computers in hidden and confined spaces, such as tunnels, caves, sewers and buildings, (2) interoperability and networking of disparate sensors and information sources, (3) distributed information for decision making and (4) devise approaches for fusing results of processed outputs of multimodal sensors such as visible, IR and hyperspectral imagers, and acoustic, magnetic & electric field sensors. This effort is complementary with PE 0601104A/H50 and PE0601104A/J22.</p> <p>FY 2013 Accomplishments:</p>		5.425	5.772	4.843

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H16 / <i>S3I Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Continued to develop and assess novel multimodal sensing and processing algorithms for acquiring information on human activity; investigated and performed experiments in a realistic or simulated environment to evaluate distributed networking and interoperability algorithms and tools (developed in FY12) for coalition information sharing and decision making; and implemented quality of information (QoI) based data discovery, collection and fusion techniques to extract desired information from large data sets.</p> <p>FY 2014 Plans: Develop pattern of life algorithms and statistics to discriminate between potential threat activities and normal behavior; develop and evaluate fusion algorithms that correlates bearing information from multiple soldier-worn gunfire detection systems for localization of shooter with reduced errors and uncertainties; develop protocols and message formats to enable interoperability between disparate sensor systems; develop tools to understand value and quality of information based on data discovery, collection and fusion of large datasets; evaluate fusion of acoustic and electric field sensing systems to enable passive ranging of near-miss bullets based on wave propagation velocity differences; and develop passive electromagnetic (EM) target detection and localization using multi-axis electric-field and magnetic field sensors.</p> <p>FY 2015 Plans: Will implement anomaly detection algorithms by fusing the output of social network with disparate multimodal sensors to determine patterns of behavior; enhance acoustic, magnetic and electric-field sensors and algorithms to detect, classify, and localize hostile transient threat events such as mortars, rockets, gunfire, and moving ground/air vehicles, to include unmanned aerial systems (UAS); and mitigate background noise resulting from mobile sensor systems in complex environments.</p>				
<p>Title: Tagging Tracking and Locating (TTL)</p> <p>Description: Conduct applied research to support advances in state-of-the-art clandestine TTL for non-traditional hostile forces and non-cooperative targets. Specific technical details related to this effort are classified.</p> <p>FY 2013 Accomplishments: Investigated alternate technologies including UV, IR, RF, and acoustic modalities for application to TTL; designed advanced hyperspectral algorithms for locating and tracking targets of interest; and developed advanced biometric techniques for locating and identifying humans of interest.</p> <p>FY 2014 Plans: Investigate battery-free tags for extending the operating life of tags; and develop and extract signals from targets of interest using mechanical and electromechanical coupling methods combined with applicable sensing modalities.</p>		1.793	2.089	-
<p>Title: Ultra Wideband Radar (UWB)</p>		2.030	2.379	2.913

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H16 / <i>S3I Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
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Description: Conduct research to examine the technical underpinnings of UWB radar for several key Army concealed target detection technology requirements including landmine and improvised explosive device (IED) detection, sensing through-the-wall (STTW), and obstacle detection. Use a combination of advanced computational electromagnetic algorithms, radar measurements and advanced signal processing techniques to define the performance boundaries of state of the art airborne and ground-based UWB radar for concealed target detection.

FY 2013 Accomplishments:

Completed FY12 assessments that combine electromagnetic models, rough surface models, measurement data and signal processing techniques to recommend forward looking radar parameters for optimized detection of IEDs to improve detection performance at increasing standoff distances; and continued to investigate utilizing radar data to build interior structure maps as well as stationary target detection techniques using three dimensional (3-D) computer-generated radar images.

FY 2014 Plans:

Develop techniques for combining UWB radar with complementary sensors, such as video, thermal IR, for improving probability of detection and confirmation of targets; and investigate computational electromagnetic models of the radar signature of RF devices placed in a complex building environment.

FY 2015 Plans:

Will assess performance of UWB radar with complementary sensor (techniques and technologies) and compare to the current target detection capabilities and performance metrics; and investigate computational electromagnetic models to address new target deployments.

Title: Networked Compact Radar, Wide Bandgap Optoelectronics, and Laser Protection Technologies

Description: Investigate RF networking technology in support of integrated RF systems for use on ground, air, and Soldier platforms to support radio, radar, and control functions to allow communications, combat identification (ID), and target acquisition/tracking. Research semiconductor-based ultraviolet (UV) optoelectronics for communications, water/air/surface purification, and detection and identification of biological threats. Research novel materials and high speed switching technology for sensor and eye protection.

FY 2013 Accomplishments:

Assessed the application of RF micro-doppler algorithms to the remote sensing of human activities for counter-IED applications; investigated non-traditional radar modes in a compact radar device for force protection and surveillance; improved performance of UV lasers, light emitting diodes (LEDs), and detectors operating at wavelengths of 230-275-nanometers for enabling

	2.502	2.433	3.141

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H16 / <i>S3I Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
communications, water/air/surface purification, and detection and identification of biological threats; and investigated new optical limiting components for detecting emerging laser threats. FY 2014 Plans: Create software and hardware architectures that enable compact radars to network with other unattended ground sensors for small unit force protection; evaluate nonlinear optical materials and tune their properties to optimize performance of the overall vision protection system; and grow and characterize gallium nitride materials for extending the spectral range of UV lasers, LEDs, and detectors to wavelengths of 230-365-nanometers for enabling communications, water/air/surface purification, detection and identification of biological threats, and electro-optic countermeasures. FY 2015 Plans: Will grow and characterize wide bandgap semiconductor materials and develop device designs to extend the spectral range of UV lasers, LEDs, and detectors to wavelengths from 200 to 365 nanometers to enable water/air/surface purification and detection and identification of biological threats; investigate different materials and evaluate solutions for eye and sensor protection against ultra-short pulses and near-IR high power threats.				
Title: Adaptive Information Collection and Fusion Description: This effort develops network and processing infrastructure concepts, and validates algorithms to enable assets to dynamically modify their physical and information producing behaviors to adaptively operate within the dynamics and timelines of small unit decision makers. FY 2013 Accomplishments: Assessed cloud-based cellular architectures and explored implementation of decision support tools at the sensor level to more effectively support the collection and dissemination of information specifically tailored to the Soldier's cognitive requirements for more accurate decision making. FY 2014 Plans: Evaluate decision-adaptive anomaly detection techniques as a means of filtering data at the sensor level to improve situation understanding for small unit decision makers and evaluate the impact of these techniques on data latency and situation awareness; integrate these filtering algorithms into an autonomous collaborative collection framework and assess the impact on delay and situation awareness.		2.650	2.784	-
Title: Multi-Mode Air Defense Radar Description: This research supports the current and future technical challenges associated with air defense radar technology. In particular, this effort will analyze current and emerging RF spoofing, RF jamming and RF signature management technology to determine their impact on the performance of air defense radar technology. Electromagnetic modeling, RF measurements and		-	-	1.500

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) H16 / <i>S3I Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>experiments will be used to mitigate the effects of spoofing, jamming and signature management technology. This will include research extending from electronic devices, subassembly design, and laboratory prototypes to advance the state-of-the-art of air defense technology operating in contested environments.</p> <p>FY 2015 Plans: Will investigate current and emerging technologies, across a broad RF spectrum, which may limit the performance of current air defense radar systems; modify existing physics-based electromagnetic modeling techniques to assess performance and identify critical areas of research; and examine performance in contested environments and research techniques to mitigate performance limitations.</p>				
Accomplishments/Planned Programs Subtotals		19.509	20.797	17.936
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) SA2 / <i>Biotechnology Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>SA2: Biotechnology Applied Research</i>	-	4.011	4.035	2.860	-	2.860	2.993	1.873	2.195	2.120	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, develops and evaluates biotechnology with application to sensors, electronics, photonics, and network science. This project funds collaborative applied research and integration of government, academic and industry scientific research on biotechnology from PE 0601104/H05, Institute for Collaborative Biotechnologies (ICB) to advance innovative capabilities. Areas of applied research include bio-array sensors, biological, and bio-inspired power generation and storage, biomimetics, proteomics, genomics, network science, DNA research and development, control of protein, and gene expression.

The ICB is a collaborative effort led by the University of California, Santa Barbara (Santa Barbara, CA) in partnership with the California Institute of Technology (Pasadena, CA), the Massachusetts Institute of Technology (Cambridge, MA), the Army Laboratories and Research, Development and Engineering Centers, and the ICB industrial partners.

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 is performed by the Army Research Laboratory, Adelphi, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Biotechnology Applied Research	4.011	4.035	2.860
Description: This effort exploits breakthroughs in biotechnology basic research invented at the ICB to enable capabilities in sensors, electronics, photonics, and network science.			
FY 2013 Accomplishments: Completed the design and fabricated hardware and software required to image single cells in three dimensional (3D) to better understand the interactions between biological materials and inorganic surfaces; experimentally validated increased electron acceptors ability to improve fermentation for bioprocessing and monitoring systems; analyzed wastewater treatment on increased laboratory scale to optimize bioremediation; characterized artificial biofilms doped with organic conductive structures for increased			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) SA2 / <i>Biotechnology Applied Research</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>current density microbial fuel cells; evaluated bio-inspired algorithms for control of swarms of micro-unmanned aerial vehicles; and evaluated yeast cell based electrodes and membranes in a microbial fuel cell for powering unattended ground sensors.</p> <p>FY 2014 Plans: Improve biofuel cell electrode and membrane materials design, and validate for powering unattended ground sensors and other monitoring systems; complete and validate bio-inspired algorithms for control of swarms of micro-unmanned aerial vehicles; evaluate the use of a virus to template electrode materials to design improved batteries for small-scale, unmanned aerial vehicles; and evaluate protein capture agents and synthetic bio-molecules as materials to improve stability, affinity for overall environmental tolerance.</p> <p>FY 2015 Plans: Will investigate performance limits of hybrid biofuel cells for powering unattended ground sensors or other remote, stand-alone monitoring systems; study interface technologies for small-scale batteries using virus templated materials for use on unmanned aerial vehicles (UAVs); and develop and study rapid screening, selection and production bio-based processes for recognition and targeting of emerging threats to the soldier.</p>			
Accomplishments/Planned Programs Subtotals	4.011	4.035	2.860

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) TS1 / <i>Tactical Space Research</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
TS1: <i>Tactical Space Research</i>	-	3.795	5.304	4.778	-	4.778	5.850	6.752	7.079	7.124	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project researches and evaluates technologies for space-based, high altitude, and cyberspace applications for Army tactical ground forces. Applied research efforts include the design and development of sensors and electronic components, communications, signal and information processing, target acquisition, position/navigation, and threat warning within space and high altitude environments as well as the design and development of technologies and analytical tools for cyber risk assessment and mitigation in acquisition systems. The applied research and technology evaluations conducted under this Project leverage other DoD space science and technology applications to support Army space force enhancement and cooperative satellite payload development.

Work in this project complements and is fully coordinated with PE 0603006A (Space Applications Technology).

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Tactical Space Research	2.814	4.242	3.765
Description: This effort designs, develops, and evaluates space-based technologies, components, and tools that lead to smaller, lighter, more responsive payloads and applications. These technologies allow for the rapid integration and development of tactical payloads in support of responsive space environments.			
FY 2013 Accomplishments: Designed and developed optics, processor, and gimbaled systems component technologies for small satellite Electro-Optical (EO) imagery subsystems, small satellite deployable arrays, and small satellite constellation enablers.			
FY 2014 Plans: Design and develop tracking system and antenna pointing component technologies for small satellites; develop orbit planning and analysis tools to support small satellite constellation concept of operation feasibility studies; research and develop propulsion concepts for small satellite station keeping and maneuvering.			
FY 2015 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) TS1 / <i>Tactical Space Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will develop payload deployer subsystem for affordable launch vehicle; design and develop advanced attitude determination and control and propulsion subsystems for nanosatellites to change orbits in flight.				
<p>Title: Space and Analysis Lab</p> <p>Description: This effort provides an in-house capability to design and conduct analytic evaluations of space, high altitude, and cyberspace technologies.</p> <p>FY 2013 Accomplishments: Designed payload ground systems to monitor health and status of small satellite systems during flight operations.</p> <p>FY 2014 Plans: Design and implement a communications satellite testbed to conduct and evaluate nanosatellite assembly, payload integration, ground testing and preflight checkout; improve ground station capabilities within the lab to support on-orbit communications and imagery nanosatellite demonstrations.</p> <p>FY 2015 Plans: Will validate performance of Hardware In The Loop nanosatellite attitude control, to include attitude control software, device integration, and in-flight simulation of commanded motion.</p>		0.981	1.062	1.013
Accomplishments/Planned Programs Subtotals		3.795	5.304	4.778
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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>				Project (Number/Name) TS2 / <i>Robotics Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
TS2: <i>Robotics Technology</i>	-	11.543	10.685	7.941	-	7.941	8.483	8.505	8.714	8.021	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, evaluates, and investigates autonomous technologies to enable robotics to assist military missions. Technical efforts are focused on advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors, human-robot interaction, robotic manipulation, and improved mobility for unmanned vehicles of scales from micro-systems through tactical vehicles. The project provides the underpinning research of the Robotics Collaborative Technology Alliance (CTA), a cooperative arrangement with industry and academia to conduct a concerted, collaborative effort advancing key enabling robotic technologies required for future unmanned systems.

This project sustains Army science and technology efforts supporting the Air and Ground portfolios.

This project leverages basic research conducted under PE 0601102A, project T63 and PE 0601104A, project H09 and transitions knowledge and emerging technologies to PE 0603005A (Combat Vehicle Advanced Technology) for maturation and demonstration.

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL) at the Aberdeen Proving Ground, MD, and the Robotics Collaborative Technology Alliance consisting of: Boston Dynamics, Carnegie Mellon University, Florida A&M University, General Dynamics Robotics Systems, Jet Propulsion Laboratory, QinetiQ North America, University of Central Florida, and University of Pennsylvania.

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

	FY 2013	FY 2014	FY 2015
Title: Robotics CTA	5.195	4.808	3.573
Description: Conduct applied research to provide essential capabilities for advanced perception, intelligent control and tactical behavior, human-robot interaction, robotic manipulation, and unique mobility for unmanned systems to conduct multiple military missions for a full range of robots from man-portable to larger systems. Research focuses on new sensor and sensor processing algorithms for rapid detection and classification of objects in cluttered and unknown environments, enabling autonomous mobility and intelligent tactical behavior by future unmanned systems; implementing adaptive control strategies that will enable unmanned			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) TS2 / <i>Robotics Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>systems to display intelligent tactical behavior, formulation of control strategies that will facilitate use of unmanned systems in populated environments and minimize the cognitive workload on Soldier operators enabling more dexterous manipulation of objects.</p> <p>FY 2013 Accomplishments: Designed algorithms to enable both improved comprehension of the sensed environment by small unmanned systems and adaptability in planning and execution of tactical behaviors; and investigated concepts for more efficient locomotion by small, legged unmanned systems to improve mobility.</p> <p>FY 2014 Plans: Continue to design perception and intelligence algorithms that will permit unmanned systems to team with soldiers in moderately complex environments and conduct missions; instantiate learning algorithms to enable robots to continually learn from experience and recognize intent of other agents; and focus on the implementation of hybrid cognitive/metric architecture to minimize the workload placed upon soldier, including the implementation of non-traditional control techniques; and implement concepts for manipulation of objects and improved ground mobility for complex and constrained environments.</p> <p>FY 2015 Plans: Will incorporate perception and intelligence algorithms into effective teaming of humans and robots as part of a mixed team to successfully conduct missions; will conduct technology assessments of components and integrated systems to determine performance and technology maturity levels; and implement perception and reasoning skills with technology testbeds employing unique mobility modes, e.g., legs, and manipulation skills to assess technology performance levels.</p>				
<p>Title: Perception and Intelligent Control</p> <p>Description: Advance perception and intelligent control technologies required to achieve autonomous tactical behaviors and other objective capabilities for future unmanned vehicles of multiple size scales and to transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle and Automotive Advanced Technology)/project 515 (Robotic Ground Systems) for integration into test bed systems.</p> <p>FY 2013 Accomplishments: Investigated previously learned understanding of tactical environment between soldier and unmanned systems to improve autonomous tactical behaviors and to validate technologies in collaboration with CTA efforts; investigated and evaluated the state-of-the-art in intelligent control; and focused on the technology gaps.</p> <p>FY 2014 Plans:</p>		6.348	5.877	4.368

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602120A / <i>Sensors and Electronic Survivability</i>	Project (Number/Name) TS2 / <i>Robotics Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Implement algorithms for perception of the local environment employing a hybrid cognitive/metric architecture; incorporate advanced algorithms for whole body manipulation on to testbed platforms; and implement novel approaches to mobility in complex and constrained environments; and assess performance of algorithms in an integrated context. <i>FY 2015 Plans:</i> Will develop the perceptual and reasoning capabilities necessary to enable an unmanned system to deduce the intent of actions/ activity; and explore and implement on testbed platforms the mechanisms and control algorithms that will enable autonomous unmanned systems to dexterously manipulate objects and maneuver through complex terrain, with an emphasis on increased efficiency.			
Accomplishments/Planned Programs Subtotals	11.543	10.685	7.941

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602122A / TRACTOR HIP
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	20.638	36.273	16.358	-	16.358	6.929	7.041	7.166	7.213	-	-
622: D622	-	2.442	2.438	2.218	-	2.218	2.413	2.286	2.325	2.342	-	-
B72: AB72	-	11.675	23.455	14.140	-	14.140	4.516	4.755	4.841	4.871	-	-
B73: AB73	-	6.521	10.380	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 15 funding reduced to support other higher Army priorities

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 2013</u>	<u>FY 2014</u>	<u>FY 2015 Base</u>	<u>FY 2015 OCO</u>	<u>FY 2015 Total</u>
Previous President's Budget	22.439	36.293	29.575	-	29.575
Current President's Budget	20.638	36.273	16.358	-	16.358
Total Adjustments	-1.801	-0.020	-13.217	-	-13.217
• Congressional General Reductions	-0.032	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-13.217	-	-13.217
• Other Adjustments 1	-1.769	-0.020	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602122A / TRACTOR HIP	Project (Number/Name) 622 / D622
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
622: D622	-	2.442	2.438	2.218	-	2.218	2.413	2.286	2.325	2.342	-	-

The FY 2015 OCO Request will be submitted at a later date.

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602122A / TRACTOR HIP	Project (Number/Name) B72 / AB72
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
B72: AB72	-	11.675	23.455	14.140	-	14.140	4.516	4.755	4.841	4.871	-	-

The FY 2015 OCO Request will be submitted at a later date.

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602122A / TRACTOR HIP				Project (Number/Name) B73 / AB73			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
B73: AB73	-	6.521	10.380	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

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)

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	46.828	55.586	63.433	-	63.433	57.290	66.288	66.255	68.995	-	-
47A: <i>AERON & ACFT Wpns Tech</i>	-	41.627	48.786	55.409	-	55.409	48.729	56.473	55.759	58.230	-	-
47B: <i>Veh Prop & Struct Tech</i>	-	5.201	6.800	8.024	-	8.024	8.561	9.815	10.496	10.765	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 funding decreased to accomodate Congressional Undistributed Reductions (-112 thousand), SBIR/STTR transfers (-602 thousand) and Sequestration reductions (-4065 thousand)

FY15 funding increased for Degraded Visual Environment, Rotorcraft Transmission, the National Rotorcraft Technology Center, and system design efforts.

A. Mission Description and Budget Item Justification

This program element (PE) conducts air vehicle component design, fabrication and evaluation to enable Army aviation transformation. Emphasis is on developing aviation platform technologies to enhance manned and unmanned air vehicle combat and combat support operations for attack, reconnaissance, air assault, survivability, logistics and command and control missions. Project 47A researches and evaluates components and subsystems for air vehicles in the areas of aviation and aircraft weapons technology. Project 47B researches and evaluates components and subsystems for air vehicles in the areas of propulsion and structures. Focus areas include: engines & drive trains; rotors & vehicle management systems; platform design & structures; aircraft & occupant survivability; aircraft weapons & sensors; maintainability & sustainability; and unmanned & optionally manned systems. This PE supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry, and academia.

Work in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0603003A (Aviation-Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602303A (Missile Technology) and PE 0603710A (Night Vision Advanced 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 U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC), located at Redstone Arsenal, AL; Joint Base Langley Eustis, VA; NASA Ames Research Center, Moffett Field, CA; NASA Langley Research Center, Hampton, VA; and at the U.S. Army Research Laboratory (ARL), located at Adelphi, MD; Aberdeen Proving Ground, MD; Hampton, VA; and Cleveland, OH.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	51.607	55.615	57.280	-	57.280
Current President's Budget	46.828	55.586	63.433	-	63.433
Total Adjustments	-4.779	-0.029	6.153	-	6.153
• Congressional General Reductions	-0.112	-0.029			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.602	-			
• Adjustments to Budget Years	-	-	6.153	-	6.153
• Sequestration	-4.065	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY				Project (Number/Name) 47A / AERON & ACFT Wpns Tech			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
47A: AERON & ACFT Wpns Tech	-	41.627	48.786	55.409	-	55.409	48.729	56.473	55.759	58.230	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project designs and evaluates technologies for Army/Department of Defense (DoD) vertical lift and unmanned air systems to increase strategic and tactical mobility/deployability, improve combat effectiveness, increase aircraft and crew survivability; and improve combat sustainability. Areas of research address desired characteristics applicable to all aviation platforms, such as enhanced rotor efficiencies, improved survivability, increased structure and airframe capability, improved engine performance, improved sustainability, improved mission avionics performance, and reduced cost. This project supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry, and academia. This project leverages work accomplished in collaboration with the National Aeronautics and Space Administration (NASA). Technologies within this project transition to advanced technology development programs with application to future, as well as current, Army/DoD aircraft systems.

Work in this project is fully coordinated with PE 0603003A (Aviation Advanced Technology) and work in this project related to aircraft weapons integration is also fully coordinated with PE 0602624A (Weapons and Munitions Technology), PE 0602303A (Missile Technology), and PE 0603710A (Night Vision Advanced 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 project is performed by the Aviation Development Directorate of the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC), (located at the NASA Ames Research Center, Moffett Field, CA, NASA Langley Research Center, Hampton, VA; and Joint Base Langley Eustis, VA).

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

	FY 2013	FY 2014	FY 2015
Title: National Rotorcraft Technology Center (NRTC)	1.000	3.064	5.071
Description: The goal of the NRTC is to focus government, U.S. rotorcraft industry and academia resources on pre-competitive, high priority, military focused technology development to maintain U.S. preeminence in rotorcraft capabilities.			
FY 2013 Accomplishments: Conducted test of tail rotor in icing tunnel to provide data for validation; initiated testing on composite structures and investigated severe pull-up maneuvers using high-fidelity computational fluid dynamic/structural analyses for UH-60.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
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<p>Develop modeling tools to determine lubricated/loss-of-lube gear performance; develop measurable criteria for repairable gear tooth damage and standardized repair methods; and execute extensive correlation efforts for time-accurate, analytic coupling methods for model-scale rotors in hover and full scale rotors in forward flight.</p> <p>FY 2015 Plans: Will develop industry accepted criteria and repair methods for lightly damaged gear tooth repair, enhance understanding of surface finish effect on gear noise; improve fatigue life and stress corrosion cracking mitigation for magnesium castings; and explore laser scanning technology to improve the fidelity and speed of housings and dynamic components inspection techniques.</p>			
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<p>Title: Rotors & Vehicle Management Technologies</p> <p>Description: Design and investigate advanced airfoil and rotor blade technologies, including active control elements, to support goals of increased hover and cruise efficiency. Design and evaluate advanced flight control and vehicle management component technologies to support goals of increased maneuverability, reliability, and reduced weight and cost.</p> <p>FY 2013 Accomplishments: Assessed advanced computational methods for prediction of helicopter main rotor and pylon aerodynamic interaction with fixed tail surfaces; performed post-test computations for an international active twist rotor experiment; continued to analyze rotorcraft configurations for improved performance; completed development of new software that includes the ability to model full vehicle interactional aerodynamics including main-rotor, fuselage and tail-rotor interactions; and initiated flight mechanics modeling and handling qualities criteria development for advanced aircraft configurations.</p> <p>FY 2014 Plans: Conduct a sub-scale rotor test to refine current modeling and simulation tools for rotor structural loads; conduct sub-scale experimental studies in drag reduction using active and passive techniques where combined rotor and fuselage flows are complex; analyze rotorcraft configurations for improved performance, including both aerodynamics and structural dynamics; complete new software that includes the ability to model high fidelity simulations of helicopter missile launch; conduct analysis and simulation to evaluate autonomous multi-ship teaming (e.g., twin lift); develop and validate flight simulation models of compound high-speed configurations for handling qualities requirements; and initiate development of flight control architectures for advanced configurations with many control surfaces and widely changing dynamic responses over the flight envelope.</p> <p>FY 2015 Plans: Will conduct studies on the highly complex, non-linear, downwash/outwash flow field beneath a sub-scale rotor in hover to refine current physical understanding and non-intrusive diagnostics techniques; improve the accuracy and efficiency of computational software that models full-vehicle rotorcraft aerodynamics on high-performance parallel computers; analyze performance, aerodynamics and structural dynamics for advanced rotorcraft configurations; update Aeronautical Design Standards (ADS-33) to integrate lessons learned from degraded visual environment mitigation and slung load handling qualities measurements into</p>	8.360	8.856	8.698
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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
new requirements; develop and simulate methods of controlling dual lift configurations; and analyze and simulate flight control concepts for advanced rotorcraft configurations.				
<p>Title: Aircraft and Occupant Survivability Technologies</p> <p>Description: Investigate advanced technologies to reduce susceptibility and vulnerability of aircraft to damage from threats or accidents, as well as technologies to defeat small arms, rocket and missile threats.</p> <p>FY 2013 Accomplishments: Researched advanced infrared (IR)/signature control materials to counter current and emerging threat sensors; continued investigation of improved materials and airframe structural configurations that provide threat protection against conventional and nonconventional weapons, to include directed energy, blast/overpressure, and high velocity low mass fragments; designed and validated active crash energy management subsystems; and evaluated and validated fuel containment technologies that provide self-sealing capability independent of fuel type.</p> <p>FY 2014 Plans: Conduct coupon testing of developed electro-optical (EO)/IR materials for signature control and environmental durability; begin design of advanced systems/subsystems and configurations that provide threat protection against conventional ballistic threats and non-conventional weapons to include directed energy, active crash protection for full spectrum crashworthiness, and crashworthy ballistic tolerant fuel containment systems independent of fuel type.</p> <p>FY 2015 Plans: Will complete performance and material analyses of lightweight composite transparent armor system and validate analyses through laboratory test; complete chemical analysis of JP-8 and alternative fuel blends; complete fabrication of test specimens for crashworthy ballistic fuel containment systems, and validate analyses through laboratory tests; leverage flight test in part and full mission simulators to validate performance models of active crash protection system algorithms; complete the development of EO/IR materials, and conduct sub-scale testing of developed EO/IR materials for signature control and environmental durability; investigate preliminary near real-time survivability route planning algorithms; investigate Adaptive IR engine suppressor capability designed to optimize IR signature reduction and aircraft lift and range performance.</p>		6.149	9.917	9.382
<p>Title: Engine and Drives Technologies</p> <p>Description: Design and evaluate advanced turboshaft engine component technologies to support goals of reduced fuel consumption, engine size, weight, and cost, as well as improved reliability and maintainability. Design and evaluate advanced drive system component technologies to support multi-speed transmissions, lighter weight gearboxes, and reduced costs, while improving reliability and maintainability.</p> <p>FY 2013 Accomplishments:</p>		3.024	5.028	5.083

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Completed component testing of advanced mechanical systems technology in a dynamic laboratory environment for improved engine performance and structural life; completed fabrication of advanced combustor design for reduced size, weight, and cost; and completed design of advanced power turbine design for improved performance and operational capability.</p> <p>FY 2014 Plans: Complete component testing of advanced combustor designs for reduced size, weight, and cost; fabricate an advanced power turbine for improved performance and operational capability; investigate clutch and gear systems to permit multi-speed transmissions required for high speed rotor and prop/rotor operation.</p> <p>FY 2015 Plans: Will complete test and evaluation of advanced variable speed power turbine for improved performance and operational capability; complete alternate engine concepts design and analysis effort; perform conceptual design analysis of advanced integrated engine/flight controls with integrated health management for reduced weight/cost and improved reliability/fault detection; design/fabricate clutches concepts for multi-speed gearbox component testing; develop integral shaft/bearing races to reduce weight in large gearboxes and investigate new high-strength, corrosion resistant materials for drive system applications.</p>				
<p>Title: Platform Design & Structures Technologies</p> <p>Description: Enables new rotorcraft configurations by evaluating critical advanced aviation technologies using design and analysis methods with greater modeling fidelity with an ultimate goal of reducing the timelines associated with overall design of new aircraft. Introduces high fidelity methodology for improved performance and design predictions earlier in the development and acquisition process. Use physics of failure modeling and coupled discipline analysis to drastically improve component and system reliability. Work is coordinated with Aviation Component Failure Modeling efforts in PE 0602211, Project 47B at Army Research Laboratory (ARL).</p> <p>FY 2013 Accomplishments: Updated advanced technology representations at the component level for design codes used for joint vertical lift aircraft concept size, weight, and performance estimation; assessed modeling and simulation methods for rotorcraft application, including rotor hubs, airfoils, blades, and interactional aerodynamics of rotors and fuselage with focus on performance improvements; and applied modeling and simulation technologies developed to inform Joint Multi-Role and future aircraft designs.</p> <p>FY 2014 Plans: Expand the vehicle design analysis and modeling environment to improve analytic efficiency, including enhanced component weights methodology, incorporation of vehicle cost methodologies, and linkage of design tools to specialized higher fidelity analytic codes.</p> <p>FY 2015 Plans:</p>		4.932	5.377	7.493

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Will continue enhancement and refinement of vehicle costing methodologies and analytical efficiencies and accuracy; apply modeling and simulation tools to design and analysis of the Family of Systems (FoS) for Future Vertical Lift (FVL) to support "Zero Maintenance" helicopter concepts; investigate and develop physics of failure modeling to improve reliability of system components, and to enable damage tolerant component design; investigate methods to monitor component loads and integrate with aircraft controls to stay within component failure limits; and investigate modeling and simulation methods to reduce the time required to design and develop new aircraft.</p>				
<p>Title: Unmanned and Optionally Manned Technologies</p> <p>Description: Design and develop collaboration and cooperation algorithms to support goal of intelligent teaming for manned-unmanned operations. Design and develop advanced unmanned aerial system (UAS) components to support goal of improved small UAS performance. When applicable, technologies in this area are leveraged to support mitigation of degraded visual environments.</p> <p>FY 2013 Accomplishments: Validated UAS supervisory control techniques from the cockpit for manned-unmanned teaming in high fidelity simulation; and completed UH-60 flight test of symbology sets for degraded visual environment and integrated forward perspective displays for improved flight path and landing precision.</p> <p>FY 2014 Plans: Complete evaluation of brown-out symbology software (BOSS) in actual brown-out conditions at Yuma Proving Ground for approach-to-landing, hover and take-off flight regimes; and evaluate simulation of BOSS symbology for forward tactical flight regimes; evaluate the use of high priority "plays", or pre-defined UAS operational functions, based on pilot feedback from Manned/Unmanned-Teaming (MUM-T) simulation studies.</p> <p>FY 2015 Plans: Will develop optimal human-machine visual, aural, and tactile interfaces for manned-unmanned teaming that supports efficient mission execution and safe flight operations with high situation awareness for pilots and unmanned aerial system operators. Building upon previous sensor and symbology efforts, will design and develop methods to optimally blend forward-looking synthetic and enhanced vision sensor information with cueing symbology that aids the helicopter pilot or operator in control of the helicopter in degraded visual environments; and investigate advanced technologies to increase task and mission effectiveness of unmanned aerial systems when partnered with ground and airborne soldiers, including autonomous behaviors, perception, autonomy architectures, and human aiding.</p>		3.251	5.311	6.489
<p>Title: Aircraft Weapon & Sensor Technologies</p> <p>Description: Design and develop innovative approaches for integrating advanced weapons and sensors on aircraft platforms, including smart dispensers, data transfer, and post-launch weapon communication.</p>		1.509	1.624	1.613

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Investigated advanced lethality concepts to include on-the-move fire control for improved hit probability and reduced collateral damage, and applied concepts to inform future system level demonstration.</p> <p><i>FY 2014 Plans:</i> Research and determine applicability of advanced sensor technologies for improved situational awareness; research lightweight remote control weapons turrets to eliminate the need for dual door gunners, and advanced weapons system management algorithms for reconnaissance, attack, and utility aircraft.</p> <p><i>FY 2015 Plans:</i> Will investigate integrated targeting/intelligence, surveillance, and reconnaissance (ISR) sensors and alternative targeting sensors; assess emerging lethal and non-lethal deterrent weapons capabilities for development and aircraft integration; and prepare the lightweight remote control system for follow on testing.</p>			
<p><i>Title:</i> Maintainability & Sustainability Technologies</p> <p><i>Description:</i> Develop prognostic and system health assessment technologies to enable transition to a condition based maintenance supportability structure.</p> <p><i>FY 2013 Accomplishments:</i> Developed prognostic technologies for predicting and isolating failures within aircraft electrical wiring systems; validated algorithms for engine controls, sensors, and lubrication systems; developed a multi-functional sensor to provide improved bearing prognostics and reduce system weight; and developed and validated a combined crack and corrosion detection sensor for improved accuracy on airframe structural components.</p> <p><i>FY 2014 Plans:</i> Develop technologies to enable lighter weight designs through loads monitoring of critical components; develop multi-use sensors to monitor cracking and delamination in composites as well as crack growth algorithms; develop wireless sensors for on-component processing of part health and usage history; investigate probabilistic failure initiation and progression analysis methods to estimate remaining component life, including improved analysis techniques for metallic and composite rotating and non-rotating structures; investigate methodologies to allow for probability of failure predictions based on vehicle current state and anticipated mission, and develop improved load and usage spectrum characterization techniques; and investigate durable structural concepts including application of high-strain capability designs through advanced design, analysis and/or material solutions, while also considering repairability.</p> <p><i>FY 2015 Plans:</i></p>	3.535	3.609	3.580

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Will develop embedded multifunctional sensors with built-in processing and communications; develop health assessment systems to support adaptive controls; develop technologies for component self assessment, usage tracking and embedded history; and investigate technologies to provide health monitoring to support and optimize design conservation.</p> <p>Title: Survivability For Degraded Visual Environment Operations</p> <p>Description: Research advanced sensor and cockpit display technologies to provide ability to maintain terrain and obstacle situational awareness during degraded visual environments caused by dust and snow particulates (brown-out & white-out). Work in this area is being done in coordination with efforts at U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC), PE 603710A, Night Vision Advanced Technology.</p> <p>FY 2013 Accomplishments: Characterized sensor transmission as a function of wavelength, particulate size and volumetric density; defined required spatial resolution for safe pilotage, scan rates for terrain updates, and sensor transmission relative to operational dust and snow volumetric densities; investigated multi-band sensor fusion techniques to enhance performance; and investigated cockpit display technology (heads-up and heads-down) to provide terrain representation to aircrew.</p> <p>FY 2014 Plans: Execute studies that include simulation, laboratory, ground test, and flight test to determine the parametric relationship between aircraft handling qualities, sensors and cueing to allow safe flight operations in degraded visual environments; define and test required levels of handling qualities, appropriate sensor trade-offs to include active and synthetic fusion, and visual display (symbology) and tactile cueing.</p> <p>FY 2015 Plans: Will investigate multi-resolution fusion sensor package comprised of a 94 GHz millimeter wave radar, a laser radar (LADAR) and an infrared (IR) camera; will investigate alternative fusion techniques with a different form of LADAR and an IR camera; conduct experiments focused on optimizing the forward flight modernized control laws (MCLAWS) of the UH-60 aircraft in preparation for a planned FY16 NATO capstone flight test; and explore the value of additional cueing techniques such as tactile and aural technologies in the AMRDEC simulation facility at Redstone Arsenal, Alabama. This work will feed a 6.3 Degraded Visual Environment mitigation tech demo effort beginning in FY16.</p>		9.867	6.000	8.000
Accomplishments/Planned Programs Subtotals		41.627	48.786	55.409
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army Date: March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47A / AERON & ACFT Wpns Tech
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D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY				Project (Number/Name) 47B / Veh Prop & Struct Tech			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
47B: Veh Prop & Struct Tech	-	5.201	6.800	8.024	-	8.024	8.561	9.815	10.496	10.765	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project investigates engine, drive train, and airframe enabling technologies such as multifunctional materials, fluid mechanics and high temperature, high strength, low cost shaft materials.

Work in this project complements and is fully coordinated with PE 0603003A (Aviation Advanced Technology) and leverages basic research performed in PE 0601104/Project H54 (Micro Autonomous Systems Technology Collaborative Technology Alliance) and PE 0601104/Project H09 (Robotics Collaborative Technology Alliance).

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 project is performed by the U.S. Army Research Laboratory (ARL) at the NASA Glenn Research Center, Cleveland, OH, the NASA Langley Research Center, Hampton, VA, and the Aberdeen Proving Ground, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Rotor and Structure Technology	1.861	2.269	2.398
Description: Devise improved tools and methodologies to more accurately design for improved component reliability and durability, resulting in platforms that are lighter in weight and less costly to acquire and maintain.			
FY 2013 Accomplishments: Enhanced damage tolerance analysis and analytical methods to support the Army joint multi-role aircraft development; conducted flight studies using an unmanned aircraft vehicle, as a cost effective surrogate for full scale manned and unmanned rotorcraft, equipped with a health and usage monitoring system to assess and validate advanced sensors for prognostics and diagnostics; assessed structural health monitoring methods to optimize sensing strategies for reducing Army maintenance labor; validated a modeling and simulation capability for the study of improved rotor system performance; and investigated nanosecond pulsed plasma actuators for on-blade separated flow control to increase the performance of rotor systems.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47B / Veh Prop & Struct Tech
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
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<p>Develop and demonstrate seat damper technology using "smart magnetic material" that will enhance the crash-worthiness of rotorcraft; evaluate the performance of an advanced, structurally-integrated, trailing edge rotor flap for its simplicity of operation and aerodynamic control authority; perform prognostic and diagnostic (P&D) inspection experiments aimed at improving structural risk assessment; develop self sensing strategies to monitor damage precursors; incorporate optimized sensing strategies into P&D systems; commission operation of, and begin data collection on the full scale helicopter landing gear test stand facility; utilize multi-functional structural materials to augment sensing, power and energy storage, or actuation in micro air and ground vehicles; and develop coupled plasma/fluid models and utilize computational models to quantitatively assess potential impacts of plasma on rotor aerodynamic performance; begin experimental studies to determine the potential of nanosecond pulsed plasma discharges for enhancing current and next-gen rotorcraft speed, range, and payload; develop quantitative technology payoff assessment and analysis models; and expand models from first-order relationships to comprehensive codes to allow researchers to understand which technologies are the most critical to achieving future aviation capabilities.</p> <p>FY 2015 Plans: Will investigate novel approaches to improve rotorcraft vehicle maintainability; investigate the feasibility of aeroelastic/aeromechanical stability enhancement of composite rotor blades through novel material concepts; develop wind-tunnel models to study advanced active-control helicopter rotor systems; develop advanced structural dynamics models of rotorcraft fuselage structures;and explore and evaluate plasma discharge based active flow control techniques for rotor dynamic stall alleviation and diffuser augmented rotor systems.</p>			
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<p>Title: Engine and Drive Train Technology (previously titled Propulsion and Drive Train Technology)</p> <p>Description: Investigate high temperature materials, advanced models for flow physics and improved methods for predicting propulsion system mechanical behavior to increase fuel efficiency and reduce propulsion system weight.</p> <p>FY 2013 Accomplishments: Continued to conduct evaluations of the potential for variable speed power turbines to enable efficient operation of gas turbine engines at reduced power operating conditions to enable faster rotorcraft vehicles; and begin characterization the dynamics of a pericyclic variable transmission (PVT) for use in rotorcraft applications to reduce transmission weight.</p> <p>FY 2014 Plans: Complete evaluation of the potential for variable speed power turbines to enable efficient operation of gas turbine engines at reduced power operating conditions to enable faster rotorcraft vehicles; and complete dynamic characterization of a PVT.</p> <p>FY 2015 Plans: Will evaluate the benefits of advanced technologies such as improved fuel spray, multi-fuel capability, etc., for aviation system engine performance and durability at sea level and simulated altitude conditions; and demonstrate drive train technologies with</p>	3.340	3.931	3.126
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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47B / Veh Prop & Struct Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
50% increase in time-to-scuffing-failure after lubricant supply is terminated in a simulated gear environment and identify promising technologies to achieve +50% oil-out time in support of Next Generation Rotorcraft Transmission objectives.				
<p>Title: Micro/Small Scale Unmanned Aerial Systems</p> <p>Description: Investigate platform, aerodynamic, actuation, transmission, and control technologies for handheld autonomous Unmanned Aerial Systems (UAS); provide small units with significantly increased tactical mobility and deployability by extending soldier perception to real-time local Intelligence, Surveillance, and Reconnaissance (ISR) with handheld organic assets, and by minimizing the supporting infrastructure needed for deployment.</p> <p>FY 2014 Plans: Develop and use various levels of model fidelity, including High-Performance Computing (HPC) modeling and simulation, experimentation, and evaluation, to advance and improve the coupled wing-actuator-control system and its components; where component-level investigation includes, but is not limited to, aspects of low speed airfoil design, airfoil turbulence sensitivity analysis, implementation-plausible (at the handheld-scale) flow control, membrane and tendon-like actuation.</p> <p>FY 2015 Plans: Will transition open loop control strategies employing active aerodynamic or elastic actuation to aircraft form factors for achieving gust and other disturbance rejection capability; incorporate bio-inspired sensors for enhanced state and disturbance awareness, and evaluate technologies addressing the communication and processing needs of size, weight, and power constrained platforms; develop an aeromechanics analysis tool integrating fluid dynamics and structural dynamics solvers; and investigate wing flexibility/morphing for performance enhancements; and will perform quantitative technology and tradeoff analyses of independent flapping wing control for maneuvering micro aerial vehicles (MAVs). This effort is coordinated with PE 0601104/project H54 (Micro Autonomous Systems Technology Collaborative Technology Alliance).</p>		-	0.600	1.500
<p>Title: Aviation Component Failure Modeling</p> <p>Description: Develop failure analysis and prediction models and techniques to support a "zero maintenance helicopter" concept.</p> <p>FY 2015 Plans: Will develop and improve failure models to characterize and categorize specific material damage precursors relevant to aviation components; develop a probabilistic framework for predicting remaining useful life of vehicle platforms; investigate the integration of advanced aviation component health monitoring techniques into health-usage monitoring systems (HUMS); and develop self-sensing structural material technologies that incorporate damage precursor detection philosophy.</p>		-	-	1.000
Accomplishments/Planned Programs Subtotals		5.201	6.800	8.024
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army Date: March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / AVIATION TECHNOLOGY	Project (Number/Name) 47B / Veh Prop & Struct Tech
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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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	13.838	17.575	18.502	-	18.502	19.383	20.555	21.124	21.430	-	-
906: <i>Tactical Electronic Warfare Applied Research</i>	-	13.838	17.575	18.502	-	18.502	19.383	20.555	21.124	21.430	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This program element (PE) designs and validates electronic warfare (EW) components that deny, disrupt, or degrade the enemy's use of the electromagnetic spectrum for offensive or defensive operations. This is accomplished through the investigation of electronic support measures (ESM); countermeasures against communications systems and networks; the design and fabrication of sensors used to identify and locate threat forces in an asymmetric environment; and threat warning and electronic countermeasures (ECM) against munitions sensors, missile guidance systems, targeting systems, and booby traps. Project 906 supports protection of high-value ground platforms, aircraft and the Soldier from threat surveillance and tracking systems, imaging systems, and advanced radio frequency (RF)/electro-optical (EO)/infrared (IR) missiles, artillery, and smart munitions. Information fusion research addresses sensor correlation and fusion, relationship discovery, and management services through use of automated processing, as well as software that applies higher level reasoning techniques to support automated combat assessment. Project 906 also supports research and application of key EW sensors, direction finders and jammers to intercept, locate, and disrupt current and emerging communications and non-communications threat emitters to provide vital quality combat information directly to users in a timely and actionable manner. Specifically, it focuses on detection of threat sensors and emitters associated with weapon systems, targeting systems and command, control, communications, computers, and intelligence systems and networks.

Work in this PE is complimentary of PE 0602120A (Sensors and Electronic Survivability), PE 0603270A (Electronic Warfare Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology); and fully coordinated with PE 0603008A (Command, Control, Communications Advanced 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 is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	15.068	17.585	18.459	-	18.459
Current President's Budget	13.838	17.575	18.502	-	18.502
Total Adjustments	-1.230	-0.010	0.043	-	0.043
• Congressional General Reductions	-0.042	-0.010			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	0.043	-	0.043
• Other Adjustments 1	-1.188	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) 906 / <i>Tactical Electronic Warfare Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>906: Tactical Electronic Warfare Applied Research</i>	-	13.838	17.575	18.502	-	18.502	19.383	20.555	21.124	21.430	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project designs, fabricates, evaluates, and applies key electronic warfare (EW)/information operations technologies to enhance platform survivability (to include ground combat vehicles, aircraft, and the dismounted Soldier) and to intercept, track and locate current and emerging threat munitions, communications and non-communications threat emitters. This project applies recent advances in radio frequency (RF), infrared (IR), and electro-optical (EO) sensors and jamming sources to detect, locate, deceive, and jam threats (to include radar directed target acquisition systems, target-tracking sensors, surface-to-air missiles (SAMs), air-to-air missiles (AAMs), top attack weapons, and electronically fuzed munitions). This project also pursues the ability to neutralize booby traps. This project designs information systems to provide vital, quality combat information directly to users in a timely, actionable manner in accordance with concepts for future force intelligence operations. This project investigates RF collection and mapping technologies to offer real time emitter detection, location, and identification. In addition, this project enables a remote capability to disrupt, deny, or destroy threat communication signals and enables fusion (automated assimilation and synthesis) of battlefield intelligence data to enable interpretation of current threats and future enemy activities. This allows commanders to develop operational courses of action in time to act decisively and in a pre-emptive manner.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Multi-Intelligence Data Fusion and Targeting	2.994	2.777	2.720
Description: This effort investigates, designs and codes advanced automated exploitation and fusion analysis tools, applications, and software services for the creation of improved intelligence products, common information management and information dissemination systems to facilitate collaboration between intelligence and mission command functions. This will provide relevant and timely information in support of command decisions, such as high value identification and targeting in an asymmetric environment. Work being accomplished under PE 0603772A/project 243 compliments this effort.			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) 906 / <i>Tactical Electronic Warfare Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Created and populated non-cooperative biometrics database and assessed effectiveness of near-real-time matching and fusion algorithms and data templates; interfaced cooperative and non-cooperative biometrics databases together to permit sharing and fusion of data; evaluated ability to simultaneously collect, query and match biometrics data in near-real-time using representative tactical communications system.</p> <p><i>FY 2014 Plans:</i> Investigate cultural, psychological, social and physical environment and time variables for improving automated reasoning and analysis software ability to track and make associations between persons, places and events of interest; research political, military, economic, social, infrastructure and information (PMESII) data standards and develop models to assess how cultural and PMESII factors can influence support or alter decisions during military planning and execution.</p> <p><i>FY 2015 Plans:</i> Will investigate methods to fuse biometric enabled intelligence analysis results with other forms of intelligence data to improve the overall quality of data products; design methods and analysis software tools and algorithms to extract biometric and contextual data from streaming video sources; begin design and coding of software tools to assign quality scores to data gathered from non-dedicated biometric sources.</p>				
<p><i>Title:</i> Offensive Information Operations Technologies</p> <p><i>Description:</i> This effort deigns, codes and evaluates cyber software, tools and techniques that identify and capture data traversing targeted networks for the purpose of computer network operations (CNO) or otherwise countering adversary communications. Cyber capabilities include detection, identification, exploitation, direction finding (DF), geolocation, and denial of service. Work being accomplished under PE 0603270A/project K15 compliments this effort.</p> <p><i>FY 2013 Accomplishments:</i> Investigated denial of service/offensive cyber techniques to counter new threat devices; extended capabilities developed for legacy threat devices to enable a coordinated tactical cyber capability against multiple targets and threat devices simultaneously; designed and evaluated offensive denial of service techniques on tactical cyber-capable platforms, to include software defined radios and other ground/air-based sensors and transmitters.</p> <p><i>FY 2014 Plans:</i> Refine cyber effects and situational awareness techniques for various protocols and signals-of-interest (SOIs); enhance current electronic warfare networking protocol extensions as applicable to enable tactical cyber capabilities; develop advanced cyber techniques.</p> <p><i>FY 2015 Plans:</i></p>		4.146	5.061	5.901

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) 906 / <i>Tactical Electronic Warfare Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Will investigate the impacts on cyber/EW techniques of converging disparate RF devices into a common hardware and software platform; develop coordinated cyber/EW techniques to exploit tactically relevant targets; analyze and develop performance predictions for various techniques being employed on different cyber and EW platforms.</p> <p>Title: Multispectral Threat Warning</p> <p>Description: This effort investigates and evaluates software and sensor/countermeasure components to increase probability of detection of small arms and probability of detection and defeat of man-portable air defense system (MANPADS) type threats for aviation platforms using modeling and simulation (M&S) and hardware in the loop (HIL) simulations.</p> <p>FY 2013 Accomplishments: Created an end-to-end M&S environment to develop countermeasures against advanced imaging missiles consisting of realistic representations of the missile digital seekers, their rotorcraft targets, likely countermeasures, effects and atmospheric effects; used this environment to assess effectiveness of known countermeasures and explore new countermeasure techniques to use against these threats; integrated digital seeker hardware surrogates into this M&S environment for use in HIL simulations.</p> <p>FY 2014 Plans: Validate M&S environment and new countermeasure techniques; validate digital seeker hardware surrogate performance in the modeling environment and HIL simulations; evaluate known countermeasures in the M&S environment to assess effectiveness; investigate new countermeasure techniques to use against advanced threats.</p> <p>FY 2015 Plans: Will evaluate effectiveness of current countermeasures techniques against additional classes of emerging multi-spectral threats required by Common IR Countermeasures program of record; expand laboratory and M&S environment to accommodate assessment of advanced threat countermeasures; initiate design, fabrication and encoding of techniques and technologies that provide countermeasures against multi-spectral IR and RF threats; investigate multi-band signature management exploitation and design correlation techniques for improved threat detection, identification and countermeasures.</p>		3.269	3.678	5.332
<p>Title: Multi-Function Intelligence, Surveillance and Reconnaissance (ISR) Technologies</p> <p>Description: This effort investigates and codes software algorithms and techniques to intelligently integrate tactical ISR sensors, improve their individual performance and increase the effectiveness of battlespace awareness/intelligence data in an area of operations. Efforts focus on networking of sensors in support of area/base camp protection and investigating an open, scalable architecture adaptable for multiple base sizes and environments and other ISR sensors. Work being accomplished under PE 63772/243 complements this effort.</p> <p>FY 2013 Accomplishments:</p>		3.429	3.759	3.349

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) 906 / <i>Tactical Electronic Warfare Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Designed and validated radar waveforms to enable communication and coordination between similar radar sensors without the need for a central node; designed and implemented noise correlation algorithms to mitigate signal interception and compromise, reduce co-site interference and preserve high resolution target detection capability.</p> <p>FY 2014 Plans: Assess radar waveforms designed to coordinate radar sensors without the need for a central interface node, facilitating radar data sharing and cross cueing; investigate and analyze the performance of noise correlation radar algorithms in operationally relevant hardware platforms to assess their ability to mitigate signal interception and compromise, reducing co-site interference and preserving high resolution target detection capability.</p> <p>FY 2015 Plans: Will study the feasibility of combining a series of synthetic aperture radar (SAR) images to develop a motion video-like data product for more reliable entity resolution and real time tracking; establish metrics for measuring and judging the quality of SAR motion video products; investigate techniques to identify and mitigate the impact of intentional red force interference sources on friendly ISR assets.</p>				
<p>Title: Electronic Warfare Architectures and Countermeasures</p> <p>Description: This effort investigates and evaluates the technical specifications of a family of threats to develop nonkinetic countermeasures. Work being accomplished under PE 0603270A/project K16 compliments this effort.</p> <p>FY 2014 Plans: Analyze existing EW system components to determine if they may be dual use to address multiple threats or types of threats; develop extensions to traditional EW system architecture to enable a new EW architecture comprised of distributed peripheral components that can be centrally controlled and managed; identify and assess critical components associated with known and emerging threat devices to support laboratory assessments through component and/or surrogate experiments; design and code modeling and simulation resources to enable live, virtual and constructive electronic warfare laboratory assessments.</p> <p>FY 2015 Plans: Will analyze existing blue force ground EW systems to determine potential deficiencies or weaknesses in the system design and implementation that could be exploited by red forces; investigate emerging red force EW system architectures to identify design characteristics that can be exploited by blue force EW systems to limit their effectiveness.</p>		-	2.300	1.200
Accomplishments/Planned Programs Subtotals		13.838	17.575	18.502
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602270A / <i>Electronic Warfare Technology</i>	Project (Number/Name) 906 / <i>Tactical Electronic Warfare Applied Research</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-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602303A / <i>MISSILE TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	43.277	59.500	46.194	-	46.194	45.382	40.962	41.770	43.277	-	-
214: <i>Missile Technology</i>	-	43.277	51.500	46.194	-	46.194	45.382	40.962	41.770	43.277	-	-
G05: <i>MISSILE TECHNOLOGY INITIATIVES (CA)</i>	-	-	8.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decreases attributed to Congressional General reductions (-95 thousand); SBIR/STTR transfers (-770 thousand); and Sequestration reductions (-5.241 million)
 FY 14 adjustment attributed to Congressional Increase (8.0 million); FFRDC reduction (-28 thousand)
 FY15 funding realigned to support higher Army priorities.

A. Mission Description and Budget Item Justification

This program element (PE) designs, fabricates and evaluates advanced component technologies for tactical missiles, rockets, guided munitions, and their launch systems in order to increase lethality, precision, and effectiveness under adverse battlefield conditions while reducing system cost, size and weight. Major goals in Project 214 include enhancing the survivability of the munition, launch and fire control systems; and increasing kill probabilities against diverse targets.

The work in this PE is complimentary to PE 0603313A (Missile and Rocket Advanced Technology), and fully coordinated with PE 0602307A (Advanced Weapons Technology), PE 0602618A (Ballistics Technology, Robotics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0708045A (End Item Industrial Preparedness Activities).

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 Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602303A / <i>MISSILE TECHNOLOGY</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	49.383	51.528	55.038	-	55.038
Current President's Budget	43.277	59.500	46.194	-	46.194
Total Adjustments	-6.106	7.972	-8.844	-	-8.844
• Congressional General Reductions	-0.095	-0.028			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	8.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.770	-			
• Adjustments to Budget Years	-	-	-8.844	-	-8.844
• Other Adjustments 1	-5.241	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY				Project (Number/Name) 214 / Missile Technology			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
214: <i>Missile Technology</i>	-	43.277	51.500	46.194	-	46.194	45.382	40.962	41.770	43.277	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project designs, fabricates, and evaluates missile and rocket component technologies that support demonstration of affordable, lightweight, highly lethal missiles and rockets. Major areas of research include: guidance, navigation, and controls; target acquisition systems; multi-spectral seekers; high-fidelity simulations; sustainment; aerodynamics and structures; launch systems, fire control technologies; payloads; and propulsion including research to help solve the insensitive munitions requirements. A theme embedded throughout the efforts in this project is smaller, lighter, and cheaper (SLC) missile technology to reduce the cost and logistics burden of precision munitions.

This project supports the ground portfolio.

Major products of this PE transition to PE 0603313A (Missile and Rocket Advanced Technology).

The cited work is consistent with the Director, Defense Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

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

	FY 2013	FY 2014	FY 2015
Title: Smaller, Lighter, Cheaper Tactical Missile Technologies	10.319	6.450	8.809
Description: This effort designs and evaluates innovative smaller, lighter, and cheaper component technologies as well as system concepts to reduce ground tactical precision missile cost per kill and/or logistics burden to meet urban and emerging threats. These technologies transition to PE 0603313A for maturation.			
FY 2013 Accomplishments: Continued design and development of a small, light weight, low power navigation sensor for applications such as precision targeting and miniature precision munitions, based on trade studies for low cost, precision munition components and system concepts, designed, fabricated, and evaluated component technologies for the next generation of precision weapon systems including reduced cost, advanced light weight materials advanced sensor and tracking technologies for improved target acquisition, and advanced propulsion for multiple mission scenarios.			
FY 2014 Plans: Finalize design of a small, light weight, low power, robust navigation sensors developed for on-the-move targeting; complete integration and test of a lightweight composite housing for far target location systems; complete initial design of extended-range,			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>reduced time-of-flight, smaller form-factor insensitive propulsion technology for multiple-mission applications; continue trade studies of the next-generation close-combat, precision weapon systems for performance against increased target sets (e. g., lethality, guidance); develop advanced sensor and tracking technologies for improved target acquisition.</p> <p>FY 2015 Plans: Will complete design, fabricate, and test advanced composite housing for Javelin Light Weight Command Launch Unit (LW CLU); fabricate and test small, light weight, low power inertial navigation sensor developed for robust man-portable close-combat targeting performance, and complete design of an increased accuracy modular inertial navigation sensor with reduced size, weight, and power (SWaP) and on-the-move capabilities (both targeting and navigation); fabricate and test reduced SWaP, increased range acquisition sensor for LW CLU; integrate components into CLU housing and evaluate; continue trade studies of the next-generation close combat, precision weapon systems for performance against increased target sets; develop and test advanced guidance and tracking technologies for improved target acquisition at increased range; investigate, develop and evaluate applications for novel methods and tools to provide increased weapon precision and reduce target location error.</p>			
<p>Title: Missile Seeker Technology</p> <p>Description: This effort focuses on the design and maturation of missile seekers, sensors, and software. The goal is to increase affordability and performance of missile seekers through improvement of algorithms, imaging, and thermal management.</p> <p>FY 2013 Accomplishments: Addressed thermal issues for phased array seekers; optimized operating power levels; integrated components into seeker sub-arrays; designed, fabricated, and demonstrated lower cost imaging infrared seekers with advanced cooling technologies; designed and fabricated an autonomous radar frequency seeker for miniature guided munitions and evaluated in a laboratory; fabricated evaluation test-bed to demonstrate radio frequency seekers in tactical missile applications; designed algorithms to improve image processing, tracking, and handover from air platform capabilities for missile seekers; and evaluated nanotechnology for power storage, sensors, and guidance in small guided munitions.</p> <p>FY 2014 Plans: Integrate and demonstrate sub-components for beam steering, power generation, and thermal management of phased array seeker designs; develop, integrate, and evaluate affordable phased array seeker solutions that enable all-weather operation; complete fabrication and integration of seeker components for very small interceptors to counter unmanned aviation systems (UAS) and integration into reduced-weight weapons to arm small U.S. UAS designs; characterize and field-test novel infra-red camera microcooler technology with performance comparable to current uncooled seekers.</p> <p>FY 2015 Plans: Will continue technology maturation of novel microcooler technologies for a tactical sensor to increase range performance and improve size, weight, and power; test ultra small and low cost semi-active laser seeker technology for improved flexibility and use on a variety of missile platforms including aviation and long range fires missiles; integrate programmable laser proximity</p>	8.686	8.860	7.631

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
sensor components and filter algorithms that will maintain operation in the presence of obscurants; complete the development of advanced technologies for affordable phased array sensors that enable all-weather operation of missile seekers and fire control.				
Title: Missile Guidance, Navigation and Controls Technologies		6.237	6.745	6.809
<p>Description: This effort designs, fabricates and evaluates guidance, navigation, and control systems and software, as well as information and signal processing systems for rocket and missile applications. Goals of this effort include more affordable missile guidance; miniaturization of guidance electronics; maintaining performance in global positioning system denied environments; improved image processing; improved missile power systems; improved communication with ground and other systems; technologies to track and respond to swarms of incoming and outgoing munitions; and electrical connections embedded in missile structures.</p> <p>FY 2013 Accomplishments: Evaluated and demonstrated the image gyro navigation solution for image based navigation; continued design of an enhanced miniaturized image stabilization and tracker hardware module; evaluated reduced size, weight, and power inertial navigation systems with increased accuracy and guidance technologies to reduce reliance on global positioning system for missiles; and continued to design and develop structural electronics in missile subsystems and apply to the missile as a whole.</p> <p>FY 2014 Plans: Continue the design, development, integration and evaluation of high-precision inertial components and systems that allow faster/higher-accuracy positional alignment of far target location systems, and missile navigation in environments of high dynamic-maneuvers as well as environments where reliance on the Global Positioning System (GPS) cannot be assured; develop and evaluate emerging low-cost terrain/stellar navigation technologies (including algorithms) for application to precision long-range stand-off fires that have the capability to operate in an environment where reliance on the GPS is not assured; design, and evaluate second-iteration embedded structural electronics that enable smaller, lower-cost airframe designs.</p> <p>FY 2015 Plans: Will develop, integrate and evaluate navigation technologies and algorithms capable of providing accuracy in GPS available and GPS denied/challenged environments to include: vision-aided, enhanced navigation-grade gyros, accelerometers, unique inertial systems and GPS Anti-Jam /Anti-Spoofing systems; continue to develop, integrate and demonstrate state-of-the-art integration techniques for COTS inertial sensors representing low cost, high accuracy navigation systems for extremely dynamic missile environments; develop, integrate, and demonstrate inertial technologies aimed at reducing size, weight, power and cost, while increasing accuracy.</p>				
Title: Missile Sustainment, Simulations, Launchers, and Fire Control Systems		5.149	3.398	3.085

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort designs and evaluates advanced health monitoring technologies to increase missile useful life; advanced simulations to increase performance and reduce size, weight, and cost in missile systems; launchers to deliver effects from the air and ground platforms; and fire control systems for area protection and air defense.</p> <p>FY 2013 Accomplishments: Continued development of integrated missile design tool for system-level analysis; designed, evaluated, and demonstrated next generation of health monitoring technologies for current fielded applications and future missile system needs; analyzed advanced interfaces between launcher and weapon to provide more targeting information to the missile; designed and demonstrated small signature, slow air target classification algorithms for fire control radars; and integrated and demonstrated a state-of-the-art, affordable active electronically steered aperture architecture with enhanced target range and classification into a radar test bed.</p> <p>FY 2014 Plans: Develop application-ready missile health monitoring technologies for shelf-life sensing of high-payoff components that improves the quality and quantity of missile health source data, reduces missile sustainment costs, and increases readiness; further develop the Non Cooperative Target combat identification algorithms and integrate into air defense radars; evaluate and quantify performance of Electronic Steered Arrays for air defense radars.</p> <p>FY 2015 Plans: Will develop phased array radar technology for fire control systems and supporting thermal management, to include small, low-cost, lightweight designs using commercially-available components and commercial processes with integrated thermal structures to enable effective power levels; further develop target identification algorithms for integration with radar systems to increase targeting fidelity. Continue development of health monitoring unit to improve user interface to assess health of missile systems; optimize health monitoring units for reduced cost, power, and volume and operation in dynamic vibration environments using micro-electromechanical system.</p>			
<p>Title: Missile Propulsion, Structures, Lethality, and Aerodynamic Technology</p> <p>Description: This effort designs, fabricates, evaluates, and demonstrates missile enabling technologies including: advanced missile propulsion with reduced launch signatures; increased lethality and range of lethality options; improved structural integrity of light weight missile cases; and increased understanding of missile aerodynamic interactions.</p> <p>FY 2013 Accomplishments: Formulated, synthesized, and evaluated higher performance energetic materials for minimum smoke missile propulsion while improving insensitive munitions performance; designed, fabricated, and evaluated lightweight thermal barriers for next generation extended range propulsion systems; evaluated and simulated the integration of first iteration variable effects warhead in a missile system form factor; evaluated energetic technologies to enable effects against electronic devices; continued design, fabrication,</p>	5.235	5.158	5.754

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>and evaluation of composite structural components for missile systems and their launchers; continued to design simulations to evaluate high speed missile aerodynamics and separation effects of missiles on weaponized unmanned aircraft.</p> <p>FY 2014 Plans: Fully characterize the most promising minimum-signature propellants with enhanced cold temperature strain capability that can be used in operational-environment temperature extremes encountered by unmanned aviation systems; based on the testing in FY13, conduct static tests of advanced thermal barriers for pulsed-motors; design novel ignition systems that reduce propulsion system ignition delay and increase the energy release efficiency; continue rocket motor survivability/reliability assessments and prediction modeling; evaluate high performance compact warhead designs in collaboration with the Armaments Research, Development, and Engineering Center.</p> <p>FY 2015 Plans: Will test novel propulsion structures to increase missile range and decrease time of flight of minimum signature propulsion systems; develop vibration-induced material degradation models of propulsion systems for stockpile reliability models to extend missile life; develop new methodologies that accurately characterize base flow predictions for complex aft bodies to improve aerodynamic predictability; continue modeling and analysis to determine the vulnerability of UAVs to fragment impact and blast effects to enable the design of counter UAS missiles; continue to evaluate high performance compact warhead designs in collaboration with the Armaments Research, Development, and Engineering Center.</p>			
<p>Title: Multi-Role Missile Technology</p> <p>Description: This effort evaluates critical technology and designs component for future affordable rockets and missiles to provide overwhelming defeat of conventional and asymmetrical threats in all environments. Successful technologies are matured and demonstrated in PE 0603313A Project 263.</p> <p>FY 2013 Accomplishments: Performed system and component level trade studies to design a long range missile; designed and evaluated modular components for a lightweight missile system with multiple configurations launched from manned and unmanned aircraft, and refined the design of the lightweight air launched missile based on evaluation of critical components and began integration for a system-level demonstration; and designed and evaluated guidance and tracking algorithms as well as sensor technology to support attack of a large array of targets.</p> <p>FY 2014 Plans: Continue identification of critical component technology for next-generation air defense and long-range fires systems, conduct component performance trade studies and begin the component designs, conduct initial laboratory evaluations of the component technologies, and finalize an integrated system architecture; update the all-digital simulation to reflect new navigation component technology designs and propulsion energy management technologies for long-range stand-off missiles; complete evaluation of component designs for lightweight multi-role (air-to-ground/air-to-air) missiles that can be integrated onto all sizes of unmanned</p>	7.651	11.039	8.106

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
aviation systems as well as manned rotary wing platforms; perform laboratory testing to determine feasibility to support attack of a larger target set. FY 2015 Plans: Will utilize data fusion to incorporate new navigation technology components into missile navigation algorithms, evaluate propulsion energy management technologies, and perform trade studies of new payload technologies for long-range missiles; conduct component performance trade studies; continue laboratory testing of component designs for lightweight multi-role modular missiles that can be integrated onto various sizes of unmanned aviation systems as well as manned rotary wing platforms; investigate alternate component technologies for seeker and guidance electronic unit design cost reduction and with no performance degradation; evaluate and assess new alternate lightweight/high strength materials to increase weapon survivability and reduce soldier weight burden.				
Title: Large Long Range Future Fires Description: This effort evaluates and develops technologies and performs necessary trade studies to provide the key components for maturation and demonstration for a large long range future fires missile in PE 0603313A Project 263. FY 2014 Plans: Develop a simulation and conduct analyses of large long-range fires propulsion system requirements; develop candidate propulsion system designs and perform trade studies to distinguish the most promising technologies; develop detailed propulsion system design(s) of the most promising technology. FY 2015 Plans: Will continue to update propulsion models and conduct analyses of large long-range fires propulsion system requirements; design, fabricate, and perform initial testing of propulsion sub-systems that will enable Large Long Range Future Fires capability.		-	5.000	3.000
Title: Micro Inertial Navigation Sensor for Networked Javelin Command Launch Unit (CLU) with External Far Target Locator (FTL) Description: This effort focuses on the design, fabrication, and evaluation of reduced size, weight, and power advanced inertial sensor technology for use in highly-accurate robust targeting by a man-portable system. FY 2014 Plans: Finalize initial design of a small, light weight, low power navigation sensor developed for robust man-portable close-combat targeting performance with on-the-move capabilities (both targeting and navigation) to include operation in environments where reliance on the Global Positioning System cannot be assured. (This work was initiated in FY 13 under the Smaller, Lighter, Cheaper Tactical Missile technologies effort.)		-	2.000	-
Title: Counter Unmanned Aerial Systems and Counter Cruise Missile		-	2.850	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) 214 / Missile Technology
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort evaluates and develops technologies and performs necessary trade studies to provide the key components for maturation and demonstration of counter unmanned aerial systems and counter cruise missile systems in PE 0603313A Project 263 & 704.</p> <p>FY 2014 Plans: Identify, characterize, and test effects of lethality mechanisms against potential UAS threats. Develop models based on results to predict effectiveness of lethal mechanisms against UAS. Evaluate other components, such as power sources, tracker algorithms, and fire control for counter UAS mission.</p> <p>FY 2015 Plans: Will evaluate and analyze component technologies to support the counter UAS mission and expand efforts to include tactical level air threats with 360 degree coverage. Begin component level modeling and simulation and evaluate system architecture concepts.</p>			
Accomplishments/Planned Programs Subtotals	43.277	51.500	46.194

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / MISSILE TECHNOLOGY	Project (Number/Name) G05 / MISSILE TECHNOLOGY INITIATIVES (CA)
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	-	-	8.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item.

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

	FY 2013	FY 2014	FY 2015
Title: Program Increase	-	8.000	-
Description: This is a Congressional Interest Item.			
FY 2014 Plans: This is a Congressional Interest Item.			
Accomplishments/Planned Programs 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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research	R-1 Program Element (Number/Name) PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	23.140	26.148	28.528	-	28.528	29.641	29.015	29.439	29.999	-	-
042: High Energy Laser Technology	-	23.140	26.148	28.528	-	28.528	29.641	29.015	29.439	29.999	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This program element (PE) investigates enabling technologies for High Energy Laser (HEL) weapons. Project 042 develops component technologies such as efficient, high energy, solid state lasers; advanced beam control components; and lethality / effectiveness measurements that enable better models and simulations for future HEL weapon designs.

Work in this project is related to, and fully complements, efforts in PE 0601101A (In-House Laboratory Independent Research), PE 0602120A (Sensors and Electronic Survivability) Project EM8, PE 0603004A (Weapons and Munitions Advanced Technology) Project L96 and Air Force PE 0602890F (HEL Research).

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

Work is performed by the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT), in Huntsville, AL, the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC) in Huntsville, AL, and the High Energy Laser Systems Test Facility, at White Sands Missile Range, NM.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	25.999	26.162	28.376	-	28.376
Current President's Budget	23.140	26.148	28.528	-	28.528
Total Adjustments	-2.859	-0.014	0.152	-	0.152
• Congressional General Reductions	-0.034	-0.014			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.733	-			
• Adjustments to Budget Years	-	-	0.152	-	0.152

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army		Date: March 2014			
Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>		PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>			
• Sequestration	-2.092	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>	Project (Number/Name) 042 / <i>High Energy Laser Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>042: High Energy Laser Technology</i>	-	23.140	26.148	28.528	-	28.528	29.641	29.015	29.439	29.999	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates and develops advanced technologies for High Energy Laser (HEL) weapon systems to enable more efficient lasers with greater power output. This includes technologies to support development of alternate laser sources, precision optical pointing and tracking components, adaptive optics to overcome laser degradation due to atmospheric effects, and thermal management systems to remove excess heat. In addition, this effort conducts laser lethality demonstrations and analysis against a variety of targets and investigates the impact of low-cost laser countermeasures. Solid State Laser (SSL) efforts continue to leverage other funds provided by the HEL Joint Technology Office (JTO), the Air Force, and the Navy to develop multiple technical approaches that reduce program risk and maintain competition.

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

Work is performed by the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT), in Huntsville, AL, the U.S. Aviation and Missile Research, Development, and Engineering Center (AMRDEC) in Huntsville, AL, and the HELSTF at White Sands Missile Range, NM.

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

	FY 2013	FY 2014	FY 2015
Title: Solid State Laser (SSL) Effects	7.016	7.978	5.807
Description: This effort provides the underlying data required to support system engineering designs, lethality analysis, and modeling and simulation (M&S) tools for laser weapon systems. Beginning in FY13, this effort includes the operation of the Solid State Laser Testbed (SSLT), a 100kW class laser testbed located at the HELSTF for conducting SSL effects experiments in an open air environment. Beginning in FY13, multiple SSLT related project tasks were reorganized and are now captured in this planned program.			
FY 2013 Accomplishments: Continued to conduct static and dynamic experiments using the SSLT infrastructure to investigate SSL performance against RAM, UAS, and other selected targets; and used data from experiments to validate M&S codes to predict SSL weapon system effectiveness in operational scenarios.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>	Project (Number/Name) 042 / <i>High Energy Laser Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Return SSLT laser and clean room to fully operational standards to complete transfer of SSLT operations and maintenance responsibility to White Sands Missile Range (WSMR) HELSTF; continue static and dynamic experiments to investigate performance of the SSLT against Man Portable Air Defense Systems (MANPADS) and use data collected from experiments to refine and validate M&S codes to predict SSL weapon system effectiveness against MANPADS.</p> <p>FY 2015 Plans: Will upgrade SSLT lethality data collection capability to collect better represented lethality data to improve lethality models and better predict integrated high energy laser demonstration performance; use lethality data to improve laser weapon system battle management capability against RAM and UAS targets; begin collecting lethality data on targets to support planning for the upcoming High Energy Laser Mobile Demonstrator (HEL MD) 50kW class demonstration, modeling, and effects simulation analysis; continue validation and analysis of atmospheric effects on the propagation of a 1.06 micron solid state laser.</p>				
<p>Title: Advanced Beam Control Component Development</p> <p>Description: This effort investigates technologies to enable lighter, more agile beam control systems that are robust enough to be used in Army ground platforms. This work is done in collaboration with the HEL JTO and other Services. Beginning in FY13, support activities were redistributed across all planned programs rather than solely captured in this activity.</p> <p>FY 2013 Accomplishments: Continued to mature components of a light weight beam director, including a shared aperture system and beam control algorithms to support the ability to precisely point a HEL through a beam control system.</p> <p>FY 2014 Plans: Demonstrate performance of an off-axis light weight beam director and use data to update and validate models for component maturity; complete development of the aperture sharing element of the light weight beam director and demonstrate the jitter performance and track stability required for a mobile HEL weapon system; begin the integration of an Adaptive Optics (AO) system that will allow for improved beam propagation.</p> <p>FY 2015 Plans: Will begin joint advanced beam control effort with the Air Force and the HEL JTO to develop beam control component technology that is capable of meeting desired performance requirements; continue development of an All Weather Tracker with the goal to be able to track RAM and UAS targets in adverse weather to augment the tracking and aim point maintenance of a High Energy Laser Weapon System; complete analysis and subscale experiments using segmented mirrors to demonstrate improved ability to correct wavefront errors in a high energy laser.</p>		0.769	1.267	4.063
<p>Title: High Efficiency Laser Development</p>		14.733	15.667	16.965

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>	Project (Number/Name) 042 / <i>High Energy Laser Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Description: This effort develops component technologies that lead to increased SSL wall-plug efficiencies, which will lead to reductions in size and weight for multiple subsystems that greatly improve the ability to integrate SSL systems onto mobile Army weapon platforms. This work is done in collaboration with the HEL JTO and other Services. Selected laser design will be fabricated and integrated with the High Energy Laser Mobile Demonstrator (HEL MD) developed in 0603006A, Project L96.</p> <p>FY 2013 Accomplishments: In concert with the HEL JTO and the other services, evaluated and selected one or more high efficiency laser approaches to mature the design, determined interface specifications, purchased hardware items, and began assembly of a 25-50kW class robust electric laser that is compatible with the mobile beam control system and vehicle payload weight and volume constraints; conducted experiments as components mature to validate performance and efficiency specifications; evaluated high efficiency laser technology approaches for ruggedness, reliability, and affordability; and investigated methods for using high efficiency lasers against sensors.</p> <p>FY 2014 Plans: Complete environmental testing on fiber laser subcomponents to support the rugged 50kW efficient laser critical design and conduct subscale experiments and analysis to ensure it will be compatible with the HEL MD ruggedness, reliability, and affordability factors; complete high efficient laser component design requirements and risk reduction testing of the rugged fiber laser amplifier, fiber array holder, and the Multi-Layer Dielectric (MLD) grating and holder; complete the rugged fiber laser component development and begin the purchase of long lead items for laser fabrication, such as high efficient laser diode pumps, efficient high power ytterbium doped fibers, and laser control electronics; and complete the design and fabrication of the rugged, high power beam combination optical element.</p> <p>FY 2015 Plans: Will complete critical design review on efficient high power rugged laser for future integration into HEL MD; purchase long lead items, including the multi-dielectric grating, 112 channel fiber array holder, polarization-maintaining high power fibers, fiber coupled pump diodes, fiber isolators and pump combiner, and narrow line-width seed sources; complete design and spectral beam combiner component risk reduction experiments to support scaling up to 100kW; begin initial subcomponent integration; conduct improved laser thermal management risk reduction experiments and verify performance of two-phase cooling approach to improve magazine depth; complete fabrication of one double-density Fiber Laser Module (FLM) and two additional fiber laser modules to support the manufacture readiness review; complete maintenance concept plan for the high power rugged laser line replaceable units.</p>				
Title: HEL Research and Development and Concepts Analysis Laboratories		0.622	1.236	1.693

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602307A / <i>ADVANCED WEAPONS TECHNOLOGY</i>	Project (Number/Name) 042 / <i>High Energy Laser Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort focuses on developing in-house expertise through SSL assessments and other SMDC/ARSTRAT technical core competencies starting in FY15.</p> <p>FY 2013 Accomplishments: Conducted experiments using Adaptive Optics (AO) components to develop and validate algorithms for correction of atmospheric distortions to improve effective range.</p> <p>FY 2014 Plans: Complete the analysis of an Adaptive Optics (AO) system and transition the hardware and algorithms to the light weight beam director effort for integrated tactical performance assessments; begin performance demonstrations using hardware and algorithms for correcting laser propagation in deep turbulence; begin development of an all weather tracker that is compatible with a laser weapon system.</p> <p>FY 2015 Plans: Will complete Adaptive Optics (AO) performance demonstrations of advance AO algorithms for transition to the HEL MD AO system; purchase pump diodes and scaled electric/Radio Frequency discharge sources and begin diode pump gas laser scaling experiments; develop models of space environment effects on small spacecraft; perform orbital assessments of nanosatellite spacecraft and constellation concepts; and investigate concepts in support of space, missile, rocket, and mortar defense.</p>			
Accomplishments/Planned Programs Subtotals	23.140	26.148	28.528

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	21.075	24.051	27.435	-	27.435	28.059	28.486	30.138	31.564	-	-
C90: <i>Advanced Distributed Simulation</i>	-	15.373	17.557	20.942	-	20.942	21.187	21.334	24.670	24.991	-	-
D02: <i>Modeling & Simulation For Training And Design</i>	-	5.702	6.494	6.493	-	6.493	6.872	7.152	5.468	6.573	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decreases attributed to Congressional General Reductions (-35 thousand); SBIR/STTR transfers (-545 thousand); and Sequestration reductions (-1.852 million)
FY15 increases for Soldier system architecture and autonomy research.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and designs enabling technologies to create effective training capabilities for the Warfighter and supports the underpinning technologies and understanding to establish architecture standards and interfaces necessary for realizing the Army vision of creating a realistic synthetic "electronic battlefield" environment for use across the spectrum of doctrine, organization, training, leader development, materiel, personnel, and facilities (DOTLM-PF). Project C90 focuses on advancing component technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by refining technologies for advanced distributed interactive simulation. Project D02 further develops concepts for immersive training and learning environments with the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California.

Work in this PE complements and is fully coordinated with PE 0601104A (University and Industry Research Centers), PE 0602785A (Manpower/Personnel/Training Technology), PE 0602786A (Clothing & Equipment Technology), PE 0602787A (Medical Technology), PE 0603001A (Future Warrior Technology Integration), PE 0603007A (Manpower, Personnel and Training Advance Technology), PE 0603015A (Next Generation Training & Simulation Systems) and PE 0603710A (Night Vision Advanced Technology).

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

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	23.507	24.063	24.237	-	24.237
Current President's Budget	21.075	24.051	27.435	-	27.435
Total Adjustments	-2.432	-0.012	3.198	-	3.198
• Congressional General Reductions	-0.035	-0.012			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.545	-			
• Adjustments to Budget Years	-	-	3.198	-	3.198
• Other Adjustments 1	-1.852	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) C90 / <i>Advanced Distributed Simulation</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
C90: <i>Advanced Distributed Simulation</i>	-	15.373	17.557	20.942	-	20.942	21.187	21.334	24.670	24.991	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project investigates and designs enabling technologies for advancing distributed simulation and training (live, virtual and constructive) environments. This includes networking of models representing complex human behavior, complex data interchange between simulations, synthetic natural environments, medical training simulations, ground platform training, adaptive tutoring for individuals and teams, and collaborative training. The project researches the ability to create a virtual representation of combined arms environments, with the Warfighter-in-the-loop that constructive (event driven) simulations cannot simulate.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Live, Virtual, Constructive (LVC) Simulations	5.908	6.708	8.191
Description: This effort develops and investigates Live, Virtual and Constructive (LVC) training technologies (tools and methods) to inform an interactive, seamless training environment. Live training refers to personnel and systems performing an exercise mission on real terrain; virtual training refers to personnel using simulators; and constructive training refers to computer based models representing real world behaviors that introduce a wider control of virtual forces. Developed methods and technologies are transitioned to PE 0603015A/Project S29.			
FY 2013 Accomplishments: Investigated component level technologies to support advanced dynamic synthetic natural environments to include: advanced handheld environments, underground structures and cross domain interactions; matured rapid generation, scaling of appearance			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) C90 / <i>Advanced Distributed Simulation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>and behaviors for realistic, culturally-specific virtual humans able to interact with other virtual humans and trainees within local/distributed simulations and conduct experiments on the next generation collaborative training environments.</p> <p>FY 2014 Plans: Explore technologies and methods to provide Soldiers with an adaptive learning environment, tailored to the individual Soldier; conduct assessments of a prototype training development environment that will deliver training content to various software environments on different hardware platforms, including mobile devices; conduct assessments on common processes and technologies for LVC to ease the difficulty and expense of using LVC distributed simulation for Joint and Coalition Warfare training; and design components in laboratory for real-time, physics-based terrain that replicates the operational environment and is distributed to support collective training for use in mobile devices and embedded systems.</p> <p>FY 2015 Plans: Will develop the architecture for the Soldier-Centered Army Learning Environment (SCALE); investigate the next generation simulation architectures and environments for the integration and execution of LVC simulations to be employed by joint and coalition warfare forces during collective training and mission rehearsal exercises; complete and implement component designs of natural and man-made synthetic terrain effects such as craters, building rubble, etc.; and assess the training effectiveness of the attained levels of realism and immersion. The SCALE architecture will integrate mobile and social media technologies to enhance the training effectiveness of individual Soldiers. The architecture development will be consistent with the Army Learning Model (ALM).</p>			
<p>Title: Modeling and Simulation Training Technologies</p> <p>Description: This effort investigates future simulation and training technologies across a variety of domains, requirements, and applications. It will include new technologies that can be applied to military domains such as live and medical training. Included in this effort will be the development of new medical training simulations to train medical personnel across all levels of care and the development of live training technology that can be applied across all military levels and training environments. The effort will address the training effectiveness of the simulation and training technologies being researched and how they will contribute to the overall effectiveness of new training capabilities.</p> <p>FY 2013 Accomplishments: Assessed weapon orientation measurement software and hardware for use in future unmanned system demonstrations; conducted applied research and assess realism of live tissue replacement technologies, as well as three dimensional (3-D) visualization and enhanced representations of virtual humans to include more robust physiological and anatomical representations for future medical training.</p> <p>FY 2014 Plans:</p>	3.981	4.512	6.532

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) C90 / <i>Advanced Distributed Simulation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Research enabling technologies for medical training combining appropriate fidelity, physiology, movement, and tissue (silicon vs. simulated biological structures), integrated and dissipating smells, sensors, varying pathologies, and fluids using an open source, platform agnostic methodology; and design hybrid position-navigation sensor to simulate electronic bullet to replace laser based system for live fire training.</p> <p>FY 2015 Plans: Will continue next generation Multiple Integrated Laser Engagement System (MILES) research in support of a live training program of record for home station and combat training center supporting Force-on-Force (FOF) training for Brigade Combat Teams (BCTs), battalions, companies, platoons, squads, crews and individuals; and research, measure, and characterize real human and simulated human tissue to derive performance requirements for future simulated tissue; research embedded and external sensors to autonomously measure student performance inside and outside of the body; and investigate advanced 3-D visualization technologies and measure the impact on anatomical cognition for medical training.</p>			
<p>Title: Collaborative and Immersive Environment Technologies</p> <p>Description: This effort investigates adaptive tutoring and immersive learning environments with social simulations to conduct kinetic and non-kinetic training for individuals and teams.</p> <p>FY 2013 Accomplishments: Conducted assessments to support trainee modeling, classification of trainee state and machine-based selection of instructional strategies; investigated methods for a computer-based intelligent tutor capable of assessing the cognitive state of trainees, and adapting instruction to optimize individual and team performance across a variety of dismounted Soldier training tasks; and developed wrap-around immersive environment leveraging commercial technology; and conducted world-wide challenge on emerging virtual environment technologies and evaluated critical elements necessary for specific types of virtual training.</p> <p>FY 2014 Plans: Conduct research to develop best practices for authoring computer-based tutoring systems (CBTS), managing instruction provided by CBTS, and assessed learning gains (e.g., knowledge and skill acquisition, retention and accelerated learning); research learner modeling and instructional strategy/tactics selection by autonomous CBTS to reduce the cost to develop, deliver, and assess self-regulated training/tutoring for individuals and teams required under the ALM for 2015; and capture research results in the Generalized Intelligent Framework for Tutoring (GIFT) to promote standards and reuse; and conduct efficacy studies on virtual world and game based learning techniques for a blended learning approach to kinetic and non-kinetic training as well as human-unmanned systems teaming.</p> <p>FY 2015 Plans: Will conduct research to develop best practices for automatically authoring, assessing, managing instruction, and deploying CBTS; design and develop domain models (e.g., content, human interaction, and assessment standards); determine effectiveness</p>	5.484	6.337	5.219

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) C90 / <i>Advanced Distributed Simulation</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
for CBTS technologies; develop techniques and identify technologies that will lower the skills required to author CBTS (per ALM); continue to incorporate research results in GIFT tutoring framework to enhance overall training effectiveness; conduct follow-on efficacy studies on virtual world and game-based learning techniques for a blended learning approach to conduct kinetic and non-kinetic training.				
<p>Title: Soldier System Architecture</p> <p>Description: Research and develop a simulation architecture to represent the Soldier as a System considering physiological effects, cognitive load, and Soldier culture in the context of Soldier-materiel interactions supporting training effectiveness, experimentation, and materiel development. The architecture will advance computational strategies to enable the integration and interaction of new and existing Soldier models into a seamless Soldier as a System simulation. This effort is coordinated with and complements PE 0602785/project 790, PE 0602786/project H98, PE 0602787/project 869, PE 0603001/J50, and PE 0603710/project K70.</p> <p>FY 2015 Plans: Will research and design a simulation architecture that supports the development of a Soldier as a System simulation; develop novel simulation solutions to link and synchronize models of human and system components; and establish groundwork for implementing echelons of metrics to create trade space data for analyzing factors to include Soldier individual and team performance, system effectiveness, training requirements, and cost.</p>		-	-	0.500
<p>Title: Future Autonomy – Optimizing Training Strategies</p> <p>Description: This effort will research and develop simulation architectures, tools, and models that can represent current and future semi and fully autonomous systems. The architecture, tools and models will enable the evaluation of the training impacts (i.e., cognitive, physiological, and team coordination) of future autonomous systems and technologies on individual, crew, and unit tasks. The training demands of systems that are increasingly complex, intelligent, and self-adaptive far exceed those of legacy systems that require training of primarily procedural tasks. This is compounded by parallel increases in autonomy and responsibility at lower echelons.</p> <p>FY 2015 Plans: Will research and develop simulation architectures that can represent current and future autonomous systems. The architectures will incorporate current autonomous system attributes that will enable the evaluation of their effects on individual and unit training.</p>		-	-	0.500
Accomplishments/Planned Programs Subtotals		15.373	17.557	20.942
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) C90 / <i>Advanced Distributed Simulation</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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) D02 / <i>Modeling & Simulation For Training And Design</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>D02: Modeling & Simulation For Training And Design</i>	-	5.702	6.494	6.493	-	6.493	6.872	7.152	5.468	6.573	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This effort transitions basic research into applied research. This project investigates and designs training applications to enable the Army to train any time and any place. Efforts include designing virtual humans that embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech. Techniques and methods are assessed for integrating different sensory cues into virtual environments that result in enhanced training and leader development. The project leverages the capabilities of industry and the research and development community through the synthesis of creativity and technology, including work at the Army Research Institute and the Army Research Laboratory.

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

Developed technologies and techniques are transitioned for maturation and demonstration to PE 0603015A/project S28.

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Immersive Technology Environments	2.846	3.244	3.242
Description: Conduct applied research that enables responsive and reconfigurable environments that immerse human senses such as sight, sound, and touch in mixed reality environments to include physical elements providing touch and feel to simulate objects such as obstacles and walls.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) D02 / <i>Modeling & Simulation For Training And Design</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Collaborated with the U.S. Army Medical Department (AMEDD) Center and School at Ft. Sam Houston to investigate potential application of developed virtual worlds to support the therapy of veterans and active duty Soldiers Post-Traumatic Stress Disorder (PTSD).</p> <p>FY 2014 Plans: Conduct studies to better understand how humans both perceive and interact with virtual environments; develop technologies for improved, low-cost immersive displays to reduce cost of training equipment and reduce the physical footprint needed for training facilities; and enhance small team training, providing improved small unit leadership and capabilities using virtual environments.</p> <p>FY 2015 Plans: Will research techniques for human spatial perception within virtual environment; investigate the effect of display configurations on social responses to virtual humans to increase immersive effects; and investigate outfitting displays with audio transducers and methodologies using psycho-acoustical effects to increase the ability to localize to increase immersion and effectiveness during interactions with virtual humans.</p>				
<p>Title: Immersive Technology Techniques</p> <p>Description: This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments and therefore creating enhanced realism.</p> <p>FY 2013 Accomplishments: Created training toolkits based on assimilation of actual experiences available for Army use; improved data structures and methods (algorithms and software) for integration of scanned facial data into the Virtual Human architecture for more human-like representations and design tools for annotating transcripts with semantic and speech information to assist future social cultural training technologies.</p> <p>FY 2014 Plans: Determine how computer agents may be used to track a Soldier's career learning experiences and be used to provide training feedback and career guidance; finalize the development of a tool that automatically detects poorly synthesized segments of speech for the purpose of improving synthesized speech and dialogue for virtual humans; and finalize and implement model that automatically adapts the dialogue intent recognition to each user.</p> <p>FY 2015 Plans: Will research and evaluate situational authoring tools designed to enable non-technical users to create content for inclusion into intelligent tutoring systems; investigate new animation and natural language techniques for the development of web-based virtual humans to support on-line immersive learning environments; and explore techniques to rapidly recreate training scenario content.</p>		2.856	3.250	3.251
Accomplishments/Planned Programs Subtotals		5.702	6.494	6.493

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602308A / <i>Advanced Concepts and Simulation</i>	Project (Number/Name) D02 / <i>Modeling & Simulation For Training And Design</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-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	62.267	64.555	72.883	-	72.883	69.342	70.127	68.882	67.830	-	-
C05: <i>Armor Applied Research</i>	-	25.350	27.023	31.414	-	31.414	29.467	28.617	26.304	25.494	-	-
H77: <i>National Automotive Center</i>	-	14.695	15.031	15.640	-	15.640	15.853	16.027	16.308	16.421	-	-
H91: <i>Ground Vehicle Technology</i>	-	22.222	22.501	25.829	-	25.829	24.022	25.483	26.270	25.915	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decrease is attributed to for Congressional General reductions (-141 thousand); SBIR/STTR transfers -958 thousand); and Sequestration reductions (-5.696 million)

A. Mission Description and Budget Item Justification

This program element (PE) researches, designs, and evaluates combat and tactical vehicle automotive technologies that enable the Army to have a lighter, more survivable, more mobile and more deployable force. Project C05 investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability modeling and simulation (M&S), hit avoidance, kill avoidance, safety, sensors, instrumentation and survivability packaging concepts to achieve superior survivability/protection for Soldiers and military ground vehicles. Project H77 funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry, or "dual use", technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Project H91 designs, matures, and evaluates a variety of innovative and enabling technologies in the areas of electrical power, thermal management, propulsion, mobility, power for advanced survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, autonomy-enabled systems, and other component technologies to enhance the mobility, power and energy and reduce the logistic chain of combat and tactical vehicles.

Work in this PE is related to, and fully coordinated with, 0602105A (Materials Technology), 0602618A (Ballistics Technology, Robotics Technology), 0602705A (Electronics and Electronic Devices), 0602716A (Human Factors Engineering Technology), 0603005A (Combat Vehicle and Automotive Advanced Technology), 0603125A (Combating Terrorism – Technology Development), 0603734 (Military Engineering Advanced Technology), and 0708045A (Manufacturing Technology).

Work in this PE is coordinated with the U.S. Marine Corps, the Naval Surface Warfare Center, and other ground vehicle developers within the Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation.

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 Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	69.062	64.589	72.309	-	72.309
Current President's Budget	62.267	64.555	72.883	-	72.883
Total Adjustments	-6.795	-0.034	0.574	-	0.574
• Congressional General Reductions	-0.141	-0.034			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.958	-			
• Adjustments to Budget Years	-	-	0.574	-	0.574
• Sequestration	-5.696	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) C05 / <i>Armor Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
C05: <i>Armor Applied Research</i>	-	25.350	27.023	31.414	-	31.414	29.467	28.617	26.304	25.494	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability modeling and simulation (M&S), improved situational awareness, hit avoidance, kill avoidance, safety, sensors for blast, crash and rollovers, instrumentation and survivability packaging concepts to achieve superior survivability/protection for Soldiers and ground combat and tactical vehicles. Survivability/protection technologies are being investigated to meet anticipated ground combat and tactical vehicle survivability objectives. Additionally, this project focuses on analysis, modeling, and characterization of potential survivability solutions that could protect against existing and emerging threats. This analysis is used to aid in the identification of technologies to enter maturation and development in PE 0603005A, project 221.

This project supports Army science and technology efforts in the Ground portfolio.

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

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC) Warren, MI and is fully coordinated with work at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD and at Communications-Electronics Research, Development and Engineering Center (CERDEC), Aberdeen Proving Ground, MD and Fort Belvoir, VA.

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

	FY 2013	FY 2014	FY 2015
Title: Advanced Armor Development:	8.353	11.444	15.250
Description: The objective of this effort is to design, integrate and validate performance of advanced armor systems to defeat single and multiple chemical and kinetic energy (CE and KE) emerging threats for combat and tactical vehicles. These systems include base armor (small arms / medium caliber opaque B-kits and transparent), applique armor (passive / reactive / active multi-threat C-kits) and multifunctional armor (embedded antennas & health monitoring devices).			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) C05 / <i>Armor Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Developed a high-performance lightweight armor recipe by conducting risk mitigation and system level multi-hit ballistic validation evaluation; conducted health monitoring into armor recipe and design; created techniques and procedures for integration of advanced armors.</p> <p>FY 2014 Plans: Provide initial characterization of next generation advanced light weight combat vehicle armors for identification of future maturation risk; conduct initial performance and cost trade analysis on the integration of advanced armor technologies; and perform environmental and ballistic testing on vehicle size armor coupons for system level integration.</p> <p>FY 2015 Plans: Will continue characterization of next generation advanced light weight combat and tactical vehicle armors; will perform environmental and ballistic testing, along with modeling and simulation integration analysis for combat and tactical objective threat based laminate and encapsulated kinetic energy armor systems (B Kits); will perform risk mitigation and integration analysis for combat vehicle threat based passive, reactive and electromagnetic chemical energy armor systems (C Kits); will explore adaptive armor applicability and related platform integration techniques to reduce armor weights while increasing protection levels.</p>				
<p>Title: Blast Mitigation:</p> <p>Description: This effort designs, fabricates and evaluates advanced survivability and protection capabilities, tools and technologies to improve protection against vehicle mines, improvised explosive devices (IEDs) and other underbody threats and crash events. This effort also designs and evaluates technologies purposed for protecting the occupant such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious research and development of blast-mitigating technologies. Blast and crash mitigation technologies are further investigated and matured in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, sensors for active technologies and performance evaluation, modeling and simulation (M&S), experimentation and instrumentation. This effort supports the Occupant Centric Platform (OCP) program.</p> <p>FY 2013 Accomplishments: Leveraged defense, automotive and medical communities to research innovative occupant protection technologies such as restraints, hull structure designs, seats, and crash event simulation tools; refined finite-element M&S tools for quicker assessment of occupant protection technologies; developed a Multi-Axis Blast Simulator (MABS) for rapid component-level testing; matured and evaluated occupant protection technologies in such areas as exterior protection technologies, interior protection technologies, sensor technologies and instrumentation technologies; Created 3D CAD models of the OCP Demonstrator to further refine and validate the design through M&S; created standards for occupant protection against underbody blasts and crashes to capture and document the best practices of occupant protection.</p> <p>FY 2014 Plans:</p>		12.098	11.141	9.284

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) C05 / <i>Armor Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Further research innovative approaches and improve occupant protection capabilities in mitigating underbody blast, crash and rollover injuries in areas such as seats, restraints, protective trim, hull structures, and energy absorbing materials and approaches; refine and employ modeling and simulation (M&S) tools for assessing occupant protection technologies; develop laboratory tools to better assess integrated components, sub-system and system level responses for protection of Soldiers in underbody blast, crash and rollover events; leverage and expand on defense, automotive and medical community efforts for improving vehicle exterior, interior and sensor capabilities; continue incorporating lessons learned into occupant protection standards and guidelines; and advance instrumentation capabilities such as anthropometric test devices and blast data collection for research.</p> <p>FY 2015 Plans: Will research and conduct experiments to evaluate the use of advanced passive and active approaches to mitigate the effects of underbody blast threats in areas such as seats, restraints, energy absorbing materials and active blast countermeasures; will conduct tests to evaluate the integration of exterior and interior blast mitigation solutions onto the OCP demonstrators, vehicle systems, test assets and/or sub-systems; will verify and validate occupant centric design guidelines/standards, M&S tools, test procedures, laboratory processes, experimentation capabilities; will research means to allow mechanical countermeasure tactics or products to be more effective; support testing of new instrumentation capabilities being developed by other programs such as WIAMAN Generation 1 blast dummy.</p>				
<p>Title: Synergistic Vehicle Protection Technologies:</p> <p>Description: This effort investigates and integrates advanced synergistic survivability technologies and simulation tools to provide enhanced protection for ground vehicles while minimizing overall system burdens. Synergistic survivability technologies such as, armor and active protection, offer the potential of non-linear survivability improvements. The modular approach facilitates trade-offs between protection, payload, performance, cost drivers and performance of vulnerability assessments throughout the life cycle of a system. Provides quantifiable metrics for development of requirements and evaluation of concept feasibility in the development of survivable combat systems. This effort supports the OCP program.</p> <p>FY 2013 Accomplishments: Synergized vehicle survivability technologies to optimize protection during multi-threat, multi-aspect engagements; designed and evaluated assessment methodologies for quantifying and mitigating post-engagement damage and crew casualties from effects such as fire and blast; provided enhanced capabilities to support combat modeling such as COMBAT XXI by providing rapid vehicle/weapon interaction modeling.</p> <p>FY 2014 Plans: Provide rapid organization and assessment of threat/countermeasure interaction reducing the overall burden on systems; design and develop modeling and simulation capability to optimize vehicle protection; design modeling capabilities to represent blast</p>		4.899	4.438	3.873

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
technologies for tradeoff analysis; provide quick reaction capability to quantify platform baseline survivability and prioritize enhancements. FY 2015 Plans: The effort will provide enhanced capabilities for protected mobility and survivability optimization to support combat modeling, and assessment of technologies that provide enhanced protection with minimum increase in system burdens; will provide enhanced assessment methodologies for quantifying and mitigating post-engagement damage and crew casualties from effects such as blast and fire; and will provide enhanced assessment methodologies for mobility and survivability on protected mobility.				
Title: Improved Situational Awareness for Ground Platforms Description: This effort investigates situational awareness (SA) technologies and architectures to improve occupant and vehicle survivability through increased situational awareness (SA) in all conditions and environments to include degraded visual environments (DVE) for ground vehicles. This effort also investigates and analyzes electronic architectures to enable the efficient integration of DVE systems such as intra-vehicle data and video networks, SA input/output devices, and associated software architectures and interfaces. This effort coordinates with PEs 0603005A, 0602709A, and 0603710A. FY 2015 Plans: The effort will conduct initial investigation of video and data architectures that enable the efficient integration of degraded visual environment (DVE) situational awareness (SA) technologies. This effort will also conduct feasibility analysis, trade studies and interface definitions of DVE SA technologies from aviation and commercial applications onto ground combat and tactical vehicles utilizing advanced vehicle digital architectures.		-	-	3.007
Accomplishments/Planned Programs Subtotals		25.350	27.023	31.414
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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>				Project (Number/Name) H77 / <i>National Automotive Center</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H77: <i>National Automotive Center</i>	-	14.695	15.031	15.640	-	15.640	15.853	16.027	16.308	16.421	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry (dual use) technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Primary thrusts for this activity include advanced power and energy technologies for tactical and non-tactical ground vehicles, electric infrastructure and alternative energy for installations and bases, vehicle networking and connectivity to maximize overlap between commercial and military requirements. Active outreach to industry, academia and other government agencies develops new thrust areas for this project to maximize shared commercial and government investment.

This project supports Army science and technology efforts in the Ground portfolio.

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Power, Energy and Mobility:	4.494	4.081	4.238
Description: This effort investigates dual use power, energy, and mobility technologies leveraging commercial and academic investment to military application. This effort focuses on technologies such as light weight composite materials, electrification of engine accessories, alternative fuels, hybrid vehicle architectures, and compact electrical power generation in order to maximize common investment to meet Army ground vehicle requirements. This work is done in conjunction with PEs 0603005A and 0603125A.			
FY 2013 Accomplishments: Continued the development and integration of dual use power, energy and weight reducing components such as lightweight composites, electrification of engine accessories and compact electrical power generation into non-tactical vehicles for fuel consumption and mobility improvement; conducted operational assessments of advanced propulsion vehicles on military			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H77 / <i>National Automotive Center</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
installations; pursued dual use automotive technology collaborations with other government agencies, industry and university partners. FY 2014 Plans: Continue to partner with other government agencies such as the Department of Energy (DOE) through cooperative alliances such as the Advanced Vehicle Power Technology Alliance (AVPTA); continue to support the transition of technology to/from industry and government; leverage both industry and government facilities for evaluation, integration and testing; develop new manufacturing processes and material technologies to reduce platform weight through lightweight composite materials and novel material joining; continue to pursue collaborations with industry and university partners to develop dual use, energy efficient, automotive technologies. FY 2015 Plans: In collaboration with the Department of Transportation, will leverage activities in the active safety and autonomy areas to exploit efficient fuel vehicle operation over military platforms and duty cycles. Will initiate next generation of joint activities under the AVPTA vehicle efficiency alliance with the Department of Energy. Will initiate modeling and simulation of advanced vehicle technologies with DOE Alliance activities. Will investigate energy efficient lubrication potential to produce a significant savings in overall fuel efficiency for our fleets. This work will be coordinated with PE 0603125A.				
Title: Dual Use Technologies: Description: This effort investigates, researches and evaluates ground vehicle technologies with both military and commercial applications such as renewable energy technologies, electrical power management between vehicles and the grid, alternative fuels, and advanced vehicle networking and communication (telematics). This effort maximizes commercial technology investment for military applications in line with the National Automotive Center's Charter. Collaborations with industry, universities and other government agencies on standards writing for joint applications will facilitate this activity. This work is done in conjunction with PE 0603005A. FY 2013 Accomplishments: Pursued, identified and leveraged dual use technology opportunities to benefit both commercial industry and military application through active partnering and outreach; matured vehicle-to-grid and grid-to-vehicle technology and standards; emphasized the use of renewable energy sources to solve military energy problems for base applications; continued to support the transition of distributed power generation hardware to PM Mobile Electric Power and other materiel developers; pursued vehicle based telematics (vehicle networking and communication) solutions in support of Homeland Defense. FY 2014 Plans: Continue to identify, pursue, and leverage dual use technical opportunities with both military and industry application through active partnering with industry/academia/other government agencies as well as other consortiums/forums/alliances and		10.201	10.950	11.402

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H77 / <i>National Automotive Center</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>associations such as the Hybrid, Electric and Advanced Truck Users Forum; continue to focus on technologies that will help solve vehicle and installation energy problems; continue University applied research in areas including off-road vehicle dynamics and controls, soldier/vehicle interaction modeling, high-performance/lightweight structures and materials, alternative propulsion systems, advanced thermal management, and vehicle system design optimization for reliability and robustness.</p> <p>FY 2015 Plans: Will continue to partner with the Department of Transportation to leverage both traditional crash worthiness as well as active safety and autonomous driving. Other areas of collaborative research will include component safety, human interface and distracted driving technologies. Continue to leverage the commercial automotive and trucking research and development centers at the OEM and tier suppliers to bring reliable, affordable technology solutions to our military ground vehicle fleet.</p>			
Accomplishments/Planned Programs Subtotals	14.695	15.031	15.640

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H91 / <i>Ground Vehicle Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H91: <i>Ground Vehicle Technology</i>	-	22.222	22.501	25.829	-	25.829	24.022	25.483	26.270	25.915	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, autonomy-enabled systems, and other component technologies for application to combat and tactical vehicles.

This project supports Army science and technology efforts in the Ground portfolio.

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

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan. Efforts in this project are closely coordinated with the Army Research Laboratory (ARL), the Defense Advanced Research Projects Agency (DARPA), the U.S. Army Engineer Research, Development, and Engineering Center, Edgewood Chemical Biological Center, and the Army Medical Department.

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

	FY 2013	FY 2014	FY 2015
Title: Pulse Power:	0.997	0.961	3.369
<p>Description: This effort focuses on growing compact, high frequency/high energy/high power density components and devices for several advanced electric-based survivability and lethality weapon systems. Technologies include direct current (DC) to DC chargers, high energy batteries, pulse chargers, high density capacitors, and solid state switches. This effort is coordinated with PEs 0603005A and 0602705A.</p> <p>FY 2013 Accomplishments: Investigated silicon carbide (SiC) and fast discharge high energy density capacitors based components for electro-mechanical armor to protect ground vehicles from the next generation threats at reduced platform weight.</p> <p>FY 2014 Plans:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Perform component development of advanced electrified armor components, and directed energy systems components related to survivability and lethality including high voltage solid state devices and high energy density capacitors and continue component development to decrease space, volume and thermal requirements while increasing performance.</p> <p>FY 2015 Plans: Will fabricate electrified armor and pulse power components for validation at the subsystem level against MILSTD810G test procedures, thermal, rain and salt testing, shock/vibration and performance testing. Will conduct road testing and soldier in the loop testing with electrified armors for safety and performance validation.</p>				
<p>Title: Propulsion and Thermal Systems:</p> <p>Description: This effort researches, designs and evaluates high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), increased electrical power generation needs (onboard communications, surveillance and exportable power), improved fuel economy (fuel cost & range), enhanced mobility (survivability), and reduced cooling system burden (size, heat rejection). This effort also researches and matures thermal management technologies and systems including heat energy recovery, propulsion and cabin thermal management sub-systems to utilize waste heat energy and meet objective power and mobility requirements on all ground vehicles. Lastly, this effort maximizes efficiencies within propulsion and thermal systems to reduce burden on the vehicle while providing the same or greater performance capability. This effort is coordinated with PE 063005A.</p> <p>FY 2013 Accomplishments: Conducted combat and tactical powertrain simulation and component designs; investigated novel high power density, low heat rejection, fuel efficient engine technologies to address increasing combat vehicle weights and thermal burden issues; assessed waste heat recovery feasibility from the engine compartment and innovative thermoelectric generator designs to achieve greater conversion to onboard electricity.</p> <p>FY 2014 Plans: Investigate and create concepts for a high power density low heat rejection, fuel efficient engine technology that is scalable and modular for combat and tactical vehicles to address increasing vehicle weights, commonality and thermal burden issues and develop an advanced fan design to provide for a more efficient cooling capability for the engine to increase the overall system capability.</p> <p>FY 2015 Plans: Will investigate waste heat recovery applications for military vehicles to increase system efficiencies. Will investigate grill designs for greater cooling capability. Will design and fabricate a high power density, low heat rejection, fuel efficient engine technology</p>		4.313	3.056	4.465

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H91 / <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
that is scalable and modular for combat and tactical vehicles to address increasing vehicle weights, commonality and thermal burden issues that are not available in commercial-off-the-shelf engines specific to military applications.				
<p>Title: Power Management Technologies:</p> <p>Description: This effort investigates power management technologies, software, and implementation approaches. Technologies include Alternating Current (A/C) to Direct Current (DC) inverters, DC-DC converters, solid state circuit protection, power distribution, and automated control of complete power systems. Special emphasis has been placed on developing high temperature capable power electronics, leading to the use of Silicon Carbide (SiC) in the above technologies. This effort coordinates with PE 0603005A, Projects 497 and 441.</p> <p>FY 2013 Accomplishments: Developed a common vehicle power management control architecture as well as wrote and evaluated power control software, designed high voltage power electronics with high operating temperatures to be further matured in PE 0603005A, project 497. These technologies optimized power distribution and minimize thermal burdens on the vehicle as demands for greater electrical power continue to increase.</p> <p>FY 2014 Plans: Design and develop Silicon Carbide-based power electronics for power conversion, distribution, and control in order to implement the next generation, open, non-proprietary electrical power architecture for military ground vehicles and merge power management efforts from FY12 with architectural developments in FY12 and FY13 in order to be ready to demonstrate in FY15 the fuel savings (at least 10% on a 72-hour combat mission) power management brings when combined with an advanced electrical power architecture.</p> <p>FY 2015 Plans: Will test Silicon Carbide-based power electronics for power conversion, distribution, and control to implement the next generation, open, non-proprietary electrical power architecture for military ground vehicles. Will continue development of the power management algorithms and software for the next generation power architecture. Will demonstrate power management and advanced electrical power architecture fuel savings gains of at least 10% on a 72-hour combat mission. Will begin integration of the components for the next generation power architecture into a Systems Integration Lab to demonstrate SiC and automated power management.</p>		1.907	1.903	2.826
<p>Title: Power Electronics, Hybrid Electric and On-Board Vehicle Power (OBVP) Components:</p> <p>Description: This effort researches, designs and evaluates high temperature and efficient power generation components to provide increased electrical power and reduced thermal loads using high operating temperature switching devices and advanced electrical generation components such as integrated starter generators and integrated starter alternators. This effort also</p>		1.958	2.417	1.328

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>researches, designs and evaluates advanced control techniques for power generation components to make these systems more efficient, increase electrical power output and reduce thermal loads. This effort researches, develops and evaluates technologies to increase OBVP for vehicle systems such as advanced computing, sensors, survivability and communications systems that have driven electrical power demands on ground vehicle platforms beyond current generation capability.</p> <p>FY 2013 Accomplishments: Developed OBVP generation components; modeled and validated electric machines and power electronics hardware that met performance requirements for military ground vehicle electrical power needs.</p> <p>FY 2014 Plans: Investigate vehicle efficiency, space and weight impacts of OBVP generation in a system laboratory that includes the vehicle power pack and supporting auxiliary systems; compare OBVP system performance versus the performance of the conventional system; investigate the potential controls strategy enhancements of system operation where speed/power of auxiliary systems are easily manipulated; investigate vehicle level benefits (efficiency, space, weight, ambient temperature operating range) of high temperature power electronics versus traditional power electronics for power generation.</p> <p>FY 2015 Plans: Will investigate approaches to further electrify and control parasitic vehicle automotive loads and increase efficiency; will model and simulate tracked vehicle performance OBVP technologies integrated; will investigate approaches to implement mild hybrid (system that integrates electric machines to assist internal combustion engines for propulsion) capabilities on OBVP equipped vehicles; specifically intelligent engine start/stop strategy, architecture and controls to dramatically reduce engine idling.</p>				
<p>Title: Advanced Non-Primary Power Systems:</p> <p>Description: This effort researches, investigates, conducts experiments and validates Auxiliary Power Units (APUs) technologies such as modular/scalable engine based APUs, fuel cell reformer systems to convert JP-8 to hydrogen, sulfur tolerant JP-8 fuel cell APUs and novel engine based APUs for military ground vehicle and unmanned ground systems. This effort also determines inputs for APU interface control documents, as well as investigates solutions for reducing APU acoustic signature for silent operation during mounted surveillance missions. This effort investigates the use of small engines and JP-8 fuel cell systems for use as prime power solutions for unmanned ground systems.</p> <p>FY 2013 Accomplishments: Investigated modular/scalable small engine technologies, developed fuel injection strategies and validated their application for use as auxiliary power units for military ground vehicles and unmanned ground systems in order to reduce fuel consumption and meet the increasing power demands of military vehicles.</p> <p>FY 2014 Plans:</p>		2.958	3.113	3.052

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Investigate engine based 10 kW Auxiliary Power Unit (APU) oil consumption reduction technologies in order to decrease maintenance intervals and increase reliability; conduct experiments on acoustic treatments for engine based APUs; conduct sulfur tolerant JP-8 reformer experiments; and conduct initial assessment of fuel cell based APU solutions.</p> <p>FY 2015 Plans: Will investigate technologies that would enable a 20kW fuel cell APU; will begin initial experiments on increasing fuel cell components resistance to sulfur; will begin initial experiments of high power rotary engine APU designs; will begin investigating noise mitigation solutions for high power rotary engine APUs.</p>				
<p>Title: Elastomer Improvement Program:</p> <p>Description: This effort researches, formulates and tests new elastomer (rubber) compounds for vehicle track systems to increase track system durability, reduce track system failures and reduce Operations & Sustainment (O&S) costs related to premature track system failures.</p> <p>FY 2013 Accomplishments: Integrated advanced nano-composites into elastomer designs and formulations to increase durability and reduce flammability of materials. Fabricated and tested novel running gear elastomers designs to reduce maintenance and increase system durability. Performed laboratory testing of new compounds to validate the new materials/properties were exceeding the properties of existing materials.</p> <p>FY 2014 Plans: Expand integration of short fibers into elastomer compounds to augment durability and increase abrasion resistance; fabricate American Society for Testing and Materials (ASTM) samples and perform laboratory evaluation of short fiber infused elastomer coupons to determine material property improvements; and fabricate vehicle test articles and perform on vehicle testing to validate laboratory based improvements to material compound changes.</p> <p>FY 2015 Plans: Will perform analysis of previously tested short fiber materials; will optimize fiber orientation and validate through laboratory testing; will analyze combining short fiber material with novel other fillers to further reduce black carbon in the elastomer material; will perform laboratory testing of optimized compounds.</p>		0.995	0.989	0.662
<p>Title: Intelligent Systems Technology Research:</p> <p>Description: This effort investigates improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems such as maneuver and tactical behavior algorithms, driver assist techniques, autonomy kits, advanced navigation and planning, vehicle self-protection, local situational awareness, advanced perception,</p>		7.847	6.535	7.592

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H91 / <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>vehicle and pedestrian safety, active safety, and robotic command and control. This effort supports the Occupant Centric Platform program.</p> <p>FY 2013 Accomplishments: Expanded development of tactical behaviors utilizing common frameworks and control interfaces to provide drive-by-wire capability to the tactical wheeled fleet; extended this capability to the combat fleet, emphasizing combat-unique mission sets and payloads; investigated advanced sensors and control software; continued to advance autonomy and cognition to enable manned/unmanned collaboration and teaming; matured command and control software to enable single-operator control of multiple unmanned vehicles.</p> <p>FY 2014 Plans: Develop advance active safety systems to include controls, algorithms and associated hardware onto manned/unmanned wheeled vehicles; increase performance of perceptive sensors and planning algorithms and integrate on to robotic platforms for safe operations in dynamic environments; and refine tactical behaviors for mission execution on robotic platforms.</p> <p>FY 2015 Plans: Will extend the capabilities of active safety systems for military vehicles to reduce soldier injury due to vehicle accidents and rollovers; will advance capabilities for manned/unmanned teaming; will enhance command and control software to enable single-operator control of multiple unmanned systems; will refine algorithms, sensor fusion, dismounted behaviors, and soldier-robot interaction capabilities to enable mission planning and execution in dynamic environments; will further development of interoperability profiles and mission package integration; will develop capabilities for longer-duration/higher-tempo operations.</p>				
<p>Title: Energy Storage:</p> <p>Description: This effort investigates novel advanced ground vehicle energy storage devices such as advanced chemistry batteries and ultra capacitors for starting, lighting, and ignition and silent watch requirements for powering vehicle electronics and communications systems with main engine off. Develop and test energy storage devices to meet harsh military requirements that far exceed commercial requirements such as extreme temperature operation (-46 to +71C), ballistic shock and vibration, and electromagnetic interference (in accordance with MIL-SPEC 810G). Designs and develops advanced batteries to reduce battery volume and weight while improving battery energy and power densities within the same footprint and standardized form factor (6T) to enhance logistics.</p> <p>FY 2014 Plans:</p>		-	2.386	2.535

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / <i>Combat Vehicle and Automotive Technology</i>	Project (Number/Name) H91 / <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Conduct initial experiments to validate performance of novel materials (anode, cathode, electrolyte, and separators) for cell and battery module (series of cells in series or parallel) with improved energy density and power density in the same form factor as the existing batteries for extended silent watch durations.</p> <p>FY 2015 Plans: Will integrate novel battery materials (anode, cathode, electrolyte, and separators) into battery cells designed to fit into existing military battery form-factors (ex: 6T); will improve existing advanced 6T battery pack prototypes and designs by incorporating new cell technologies and refining their battery management systems, control algorithms, and physical construction for shock & vibration and Electro-Magnetic Interference (EMI); will improve 6T battery designs for manufacturability, commonality and cost reduction; will validate improved 6T designs against latest battery & vehicle safety and performance requirements.</p>				
<p>Title: Petroleum, Oil, and Lubricant (POL) Products:</p> <p>Description: This project focuses on creating and evaluating innovative petroleum, oil and lubricant (POL) products that reduce logistic burdens, maintenance requirements, and fuel consumption. Products will be developed in areas such as alternative fuels, fuel additives, lubricants, power train fluids, coolants, and petroleum, oil, and lubricant products to support new military technology requirements such as anti-lock brakes and semi-active suspension.</p> <p>FY 2013 Accomplishments: Initiated design and evaluation of POL products to meet new military technology requirements, such as anti-lock brakes and semi-active suspensions, while exceeding future and legacy equipment performance and technical requirements; began research and design of lubricants and fluids which promoted improved energy efficiencies, improved performance and improved longevity; characterized alternative fuels and fuel additives that improved performance and diversify energy sources; initiated research and evaluation of nanofluid technology that suspends nanoparticles in coolants and lubricants to improve thermal, friction, and wear properties.</p> <p>FY 2014 Plans: Identify candidate fuel efficient gear lubricants and hydraulic fluids to improve ground system performance and reduce logistics burden; evaluate new alternative fuels and fuel additives that may improve performance and diversify energy sources; and identify candidate POL products with high potential to meet new military technology requirements while ensuring legacy equipment performance and technical requirements are maintained.</p>		1.247	1.141	-
Accomplishments/Planned Programs Subtotals		22.222	22.501	25.829
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	55.113	75.263	85.597	-	85.597	93.967	88.749	90.980	91.977	-	-
H80: <i>Survivability And Lethality Technology</i>	-	55.113	68.263	85.597	-	85.597	93.967	88.749	90.980	91.977	-	-
HB1: <i>SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)</i>	-	-	7.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 decreases attributed to General Congressional reductions (-130 thousand); SBIR/STTR transfers (-733 thousand); and Sequestration Reductions (-4.847 million)
 FY 14 adjustment attributed to Congressional Add funding (7.0 million) and FFRDC reductions (-37 thousand)
 FY15 increases for Active Protection Technologies, Warrior Injury Assessment Manikin, Survivability/Lethality Analyses, and Disruptive Energetics.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and evaluates materials and technologies, and designs and develops methodologies and models required to enable enhanced lethality and survivability. Project H80 focuses on applied research of lightweight armors and protective structures for the Soldier and vehicles; kinetic energy active protection; crew and components protection from ballistic shock and mine-blast; insensitive propellants/munitions formulations; novel multi-function warhead concepts; affordable precision munitions design; and techniques, methodologies, and models to analyze combat effectiveness, and identify vulnerabilities of current and emerging technologies; and developing a demonstrator with associated methods and tools for injury prediction of vehicle occupants during under-body blast events.

Work in this PE makes extensive use of high performance computing and experimental validation and builds on research transitioned from PE 0601102A (Defense Research Sciences)/Project H42 (Materials and Mechanics) and Project H43 (Ballistics); and utilizes emerging materials from PE 0602105A (Materials Technology) and applies it to specific Army platforms and the individual Soldier applications.

The work in this PE complements and is fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602303A (Missile Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602716A (Human Factors Engineering), PE 0602786A (Warfighter Technology), PE 0603125A (Combating Terrorism-Technology Development), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), PE 0603313A (Missile and Rocket 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>
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Work in this PE is performed by the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	60.823	68.300	68.298	-	68.298
Current President's Budget	55.113	75.263	85.597	-	85.597
Total Adjustments	-5.710	6.963	17.299	-	17.299
• Congressional General Reductions	-0.130	-0.037			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	7.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.733	-			
• Adjustments to Budget Years	-	-	17.299	-	17.299
• Sequestration	-4.847	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / BALLISTICS TECHNOLOGY	Project (Number/Name) H80 / Survivability And Lethality Technology
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H80: <i>Survivability And Lethality Technology</i>	-	55.113	68.263	85.597	-	85.597	93.967	88.749	90.980	91.977	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project investigates, designs and develops materials, methods and models that provide Soldier protection by enhancing survivability and lethality. Specific technology and research thrusts include: lightweight armors and protective structures; crew and component protection from ballistic shock and/or mine-blast; insensitive high energy propellants/munitions to increase lethality and reduce propellant/munitions vulnerability to attack; novel kinetic energy (KE) penetrator concepts to maintain/improve lethality; novel multi-function warhead concepts to enable defeat of a full-spectrum of targets (anti-armor, bunker, helicopter, troops); and techniques, methodologies and models to analyze combat effectiveness and identify vulnerabilities of current and emerging technologies; and developing a demonstrator and associated methods and analysis tools for injury prediction (due to underbody blast).

This project sustains Army science and technology efforts supporting the Ground, Lethality and Soldier portfolios.

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Structural Armor	6.478	-	-
Description: This effort conducts applied research to design advanced lightweight structural armor technologies, such as ceramic, metallic, transparent, and electromagnetic, for transition to current and future tactical as well as combat vehicle designers. The goal is to provide designs that reduce weight while improving ballistic protection and affording multifunctional capabilities.			
FY 2013 Accomplishments: Optimized weight and validated FY12 encapsulated and laminated ceramic armor technologies for future vehicle platforms; and used high performance computing (HPC) modeling and simulation tools coupled with experiments to validate emerging passive			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>	Project (Number/Name) H80 / <i>Survivability And Lethality Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
material concepts and investigated threat defeat mechanisms that provide higher mass efficiency against more aggressive KE threats expected to proliferate during the next decade. In FY14 this work moved to Multi-Threat Armor Formulation and Designs.				
<p>Title: Mine Blast Protection</p> <p>Description: This effort investigates and designs tools, techniques, and technologies for protection against mine/improvised explosive device (IED) blast threats, ballistic shock mitigation, and fuel/ammunition fires to enable survivability of current and future platforms and the dismounted Soldier.</p> <p>FY 2013 Accomplishments: Conducted characterization and model development of vehicular hull structural welds while providing further refinement of soil models for incorporation into simulations of full scale blast events; and continued investigations of novel energy absorbing seat materials, restraints and structural designs with refined simulations for system design optimization by U.S. Army Tank and Automotive Research, Development and Engineering Center (TARDEC) in PE 0603005A. In FY14 this work moved to Underbody Blast & Occupant Protection.</p>		5.209	-	-
<p>Title: Underbody Blast & Occupant Protection</p> <p>Description: This effort investigates and designs tools, techniques, and technologies for protection against mine/IED blast threats, ballistic shock mitigation, and fuel/ammunition fires to enable survivability of current and future platforms.</p> <p>FY 2014 Plans: Introduce advanced modeling tools developed under the Ballistic and Blast Loading Highly Scalable Software Institute to develop strongly hardened hull designs; and mature long-stroke technology and multi-directional seating mechanisms to further enhance interior protection along with an appropriate sensor suite for pre-activation of active seat or exterior hull mechanisms.</p> <p>FY 2015 Plans: Will continue to develop experimental and modeling approaches to identify relevant physical parameters affecting the loading from buried blast and penetrator threats; develop experimental tools to track complex occupant motion during a blast event and validate associated numerical models; and develop and validate momentum transfer concepts to absorb energy from underbody threats through a combination of materials development and structural design research.</p>		-	6.188	6.750
<p>Title: Low Cost Hyper-Accuracy Munition Technologies</p> <p>Description: This effort designs advanced components/subsystems to enable a broad spectrum of future affordable direct and indirect fire precision munitions. The focus is on a multidisciplinary approach to munition systems design by coupling physics-based models of interior ballistics, launch dynamics, flight mechanics, and high-gravitational force guidance, navigation, and</p>		3.706	4.788	3.148

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>	Project (Number/Name) H80 / <i>Survivability And Lethality Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>control (GN&C) technologies. The goal is smaller, cheaper and lighter munition components enabling low-collateral-damage precision munitions for future asymmetric operations in military operations on urban terrain (MOUT).</p> <p>FY 2013 Accomplishments: Experimentally validated highly maneuverable direct and indirect fire munitions concepts to extend range and increase terminal effects by continuing applied research of components for novel actuation concepts, low cost guidance technologies, smart structures; and developed models to computationally support munitions designs.</p> <p>FY 2014 Plans: Implement new optimal terminal homing guidance laws and flight control algorithms in simulation code; conduct parametric studies across a range of attack angles to quantify resulting control effectiveness to more cost effectively and accurately hit targets; and perform lab, wind tunnel and soft launch experiments to investigate lifting surface control mechanisms and lateral & axial thrusters especially at high angles of attack.</p> <p>FY 2015 Plans: Will advance individual component guidance technologies and simulation capability by evaluating, at bench level, candidate actuator technologies, guided spin-stabilized munition technologies, and flow control technologies; and assess concepts using multiple technologies for guided munitions in global positioning system (GPS) denied environments.</p>			
<p>Title: Disruptive Energetics and Propulsion Technologies</p> <p>Description: This effort investigates, evaluates, selects, and models propulsion and energetic materials and technologies to validate novel energetic materials concepts (such as nano-structural and insensitive) that exploit managed energy release required for improving the effectiveness and reducing the vulnerability of future gun/missile systems and warheads. This effort builds on disruptive energetic materials discovery efforts in PE 0601102A (Defense Research Sciences)/project H43 (Ballistics) to synthesize new materials with energy content up to ten times that of Research Department Explosive (RDX).</p> <p>FY 2013 Accomplishments: Employed validated multi-scale models to conceive new energetic material compounds; designed and improved affordable propellant coatings to manage temperature sensitivity and enhance insensitive munitions qualities; and developed and applied advanced, reacting-flow, multiphase, computational fluid dynamics methods incorporating advanced bi-propellant (liquids and solids) chemistry for future missile applications.</p> <p>FY 2014 Plans: Synthesize two new energetic compounds (binder and explosive) that exhibit increased energy compared to current carbon, hydrogen, nitrogen and oxygen (CHNO) compounds; experimentally quantify their performance with a small scale technique that</p>	5.629	6.475	10.177

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>cost effectively requires only grams (compared to current kilogram technique); and evaluate propellant improvements for small arms ammunition.</p> <p>FY 2015 Plans: Will explore and exploit innovative methods for efficient synthesis and scale-up of disruptive energetic materials; develop novel energetic ingredients using chemical and high pressure synthesis methods; use these ingredients in new formulations for transition to weapons applications with significantly improved performance; develop multi-phase explosive and initiation concepts to maximize energy transfer to target; develop and validate numerical model of muzzle flow field in small caliber weapon systems to enable control of overpressure; and validate propulsion models and methods to enable 6 to 10 times solid propellant burn-rate/regression-rate enhancement using nitrate ester and novel propellant ingredients.</p>			
<p>Title: Lethal and Scalable Effects Technologies</p> <p>Description: This effort identifies and models preferred options to reduce energy/mass required to defeat emerging armor threats and to provide multi-purpose capabilities for revolutionary future lethality. In addition, this effort investigates technology options for scaling warhead lethality to enhance urban Warfighting capabilities including control of collateral damage.</p> <p>FY 2013 Accomplishments: Advanced FY12 scalable lethality concepts that defeat a range of threats with a single munition; and developed small and medium caliber penetrator technologies and concepts to improve the performance of armor-piercing rounds against heavy body armors, lightweight vehicle armors, and against high-obliquity urban targets.</p> <p>FY 2014 Plans: Conduct proof of principle experiments for man portable weapons that validate capability to perforate wall targets including double reinforced concrete and adobe; experimentally investigate and quantify performance improvements of chemical energy weapons when nano-crystalline materials (e.g., copper and tungsten) are used; conceptualize variations in novel penetrator deployment schemes and conduct laboratory experiments to understand how deployment variations affect lethality performance; and incorporate an optimized multi-component/jacketed shearing composite penetrator into a large caliber cartridge to examine its lethality.</p> <p>FY 2015 Plans: Will develop small caliber soldier-portable mechanisms to defeat combatants in high-risk urban scenarios; validate robust kinetic energy penetrator concept with reduced mass while maintaining armor defeat capabilities to reduce life-cycle costs and enable defeat of future threats; and validate modeling and simulation capabilities to assess novel lethality concepts.</p>	3.328	4.012	6.238
<p>Title: Survivability/Lethality Analyses</p>	8.700	10.041	12.566

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort devises state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats against future weapon systems.</p> <p>FY 2013 Accomplishments: Improved vulnerability analysis methodologies for injury criteria and injury assessment to address crew protection and survivability for mine blast threats; and prepared for FY14 validation and verification of the Modular Unix-based Vulnerability Estimation Suite (MUVES) 3 ballistic vulnerability and lethality code.</p> <p>FY 2014 Plans: Develop new methodologies to characterize Personnel Protective Equipment armor back face deformation and assess the associated injury incapacitation probabilities for soldiers; and perform improvements to tools, techniques, and methodologies for ballistic survivability/lethality analysis to ensure analysis tools are relevant and credible for developmental and modernized Army systems; and conduct validation and verification of the MUVES 3 ballistic vulnerability and lethality code.</p> <p>FY 2015 Plans: Will develop new methodologies to characterize behind helmet blunt trauma and assess the associated injury incapacitation probabilities for soldiers; develop predictive ammunition vulnerability methodologies (vulnerability to unintended ammunition detonation due to incoming round); perform improvements to tools, techniques, and methodologies for ballistic survivability/lethality analysis to ensure analysis tools are relevant and credible for developmental and modernized Army systems; and conduct validation and verification of ballistic vulnerability and lethality codes.</p>			
<p>Title: Multi-Threat Armor Formulations and Designs</p> <p>Description: This effort devises and matures multi-threat hybrid armor technologies incorporating both active and passive mechanisms for ground vehicle systems that are effective against future conventional weapons and evolving improvised threats.</p> <p>FY 2013 Accomplishments: Determined physics mechanisms to explore potential efficiencies against very large improvised threats and investigate fusion of best mechanisms with known technologies for conventional threat defeat; validated and exercised algorithms that capture the multi-physics aspects of the determined mechanisms and begin transition to U.S. Army TARDEC (PE 0602601A/Project C05) technologies for defeat of very large improvised threats; and began development of high-resolution anatomic computational model for the human legs and spine that accurately predicts critical injury mechanisms that may result from vehicular underbelly blast and other accelerative loading utilizing emerging data from the anthropomorphic Test Device (Warrior Injury Assessment Manikin, WIAMan) development effort.</p> <p>FY 2014 Plans:</p>	15.814	18.071	20.975

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Develop ceramic laminate technology, large improvised threat protection, second generation multi-threat protection and support transition to the U.S. Army TARDEC (PE 0602601A/project C05); and use modeling and simulation coupled with experimentation to explore encapsulated ceramic mechanisms capable of defeating more advanced KE threats and begin exploration and concept development of novel adaptive protection.</p> <p>FY 2015 Plans: Will continue to investigate ceramic laminate characteristics to identify/gain iterative improvements for protection during future threat/armor engagement processes; investigate concepts for defeat of very large shaped charge threats, including developing an understanding of how various defeat mechanisms interact as threat size increases; explore novel explosive reactive armor mechanisms for defeat of advanced threats; develop new approaches for advanced kinetic energy (KE) multi-hit defeat for vehicle sides and front; validate protection capabilities against both explosively formed penetrators (EFPs) and rocket propelled grenades (RPGs) by utilizing multiple defeat mechanisms in a single system; develop new mechanisms to enable defeat of both KE and chemical energy (CE) threats in a single system; and support transitions to the U.S. Army TARDEC (PE 0602601A/project C05 and PE 0603005A/project 441).</p>			
<p>Title: Ballistic and Blast Protection for Dismounted Soldiers</p> <p>Description: This effort develops unique physics based models to understand the deflection and stress wave interactions with the human during the complex target interactions between threats and personal protective equipment (PPE). Use of this knowledge framework to develop low technology readiness level (TRL) PPE concepts that are informed by the human effects during impact and blast events.</p> <p>FY 2014 Plans: Develop techniques for understanding the response of biologic materials at high rates of loading that cause severe deformation and failure; and explore low TRL concepts for PPE that are based on computational simulations of the interaction of humans with the dynamic threat/PPE impact.</p> <p>FY 2015 Plans: Will develop an objective blunt trauma test methodology for helmets using a combination of experimental and modeling approaches, exploring relationships to injury mechanisms; and explore the use of covers and surface coatings on ceramic performance for monolithic and flexible body armor concepts.</p>	-	3.108	3.259
<p>Title: Penetrator Lethality Applied Research</p> <p>Description: This effort evaluates effects of velocity and novel penetrator designs for future lethality applications across the spectrum of targets to include vehicles, buildings, and personnel.</p> <p>FY 2013 Accomplishments:</p>	6.249	3.847	-

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Determined penetration efficiency of full scale novel penetrators; performed modeling and simulation to define a guided projectile with novel lethal mechanisms and conducted experiments that validate concept projectile(s) can withstand launch environment; conducted lethality analysis (probability of kill given a hit) of novel concepts across the velocity spectrum; and investigated light weight composite sabot technology for rifled barreled guns.</p> <p>FY 2014 Plans: Conduct lethality analysis (probability of kill given a target hit) across the velocity spectrum for novel penetrator concepts; conceptualize variations in novel penetrator deployment schemes and conduct laboratory experiments to understand how deployment variations affect lethality performance; and incorporate an optimized multi-component/jacketed shearing composite penetrator into a large caliber cartridge to examine its lethality.</p>			
<p>Title: Soldier Lethality Technologies</p> <p>Description: This effort focuses on development of advanced lethal mechanisms, improved accuracy approaches, and leverages state-of-the-art materials to enable a single small arms cartridge for defeat of hard and soft targets and enable the defeat of combatants in defilade out to 2km.</p> <p>FY 2014 Plans: Investigate alternate approaches to increase long range precision and improve probability of incapacitation for sniper and small arms applications.</p> <p>FY 2015 Plans: Will pursue novel concepts to enable significant increases in impact velocities, reduced muzzle pressures, and increased accuracy in small caliber systems; and develop understanding of alternate approaches to achieve long range precision for 50 caliber man-portable systems.</p>	-	2.994	3.484
<p>Title: Warrior Injury Assessment Manikin (WIAMan)</p> <p>Description: This work develops an improved demonstrator blast test manikin, data acquisition system, and injury prediction methods and tools that incorporate new medical research and which provides an improved capability to measure and predict skeletal injuries for vehicle occupants during under-body blast events. (Prior to FY14, this effort was described under the Survivability/Lethality Analyses.)</p> <p>FY 2014 Plans: Complete technical data package for the design concept for a first generation, WIAMan demonstrator; begin fabrication of the first generation WIAMan demonstrator and initiate manufacturing and component testing; develop new methods for injury</p>	-	5.239	10.500

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>	Project (Number/Name) H80 / <i>Survivability And Lethality Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
prediction and spin-out knowledge to benefit on-going Live Fire Test & Evaluation programs; and define concept for WIAMan data acquisition system. FY 2015 Plans: Will initiate validation and verification testing of the first generation WIAMan demonstrator; design and initiate development of the WIAMan data acquisition system; transfer knowledge and tools for use in Live Fire Test & Evaluation and other under-body blast survivability efforts; and conduct research to establish human tolerance to the under-body blast loading environment and development of human injury probability curves; and transfer of responsibilities and funding (PE 0602787A/project 869) from U.S. Army Medical Research and Materiel Command (MRMC) to U.S. ARL effective FY15.			
Title: Vulnerability Assessment of Technologies Description: This effort focuses on independently reviewing developmental technologies in the context of current and emerging threats, identifying tradeoffs that may not have been considered by the technologies' proponents, developing risk reduction and mitigation strategies and promoting the development of technologies that are "threat ready" when they evolve into a formal program of record or are fast-tracked to the field. State-of-the-art vulnerability assessment methodology and tools will be applied across a broad spectrum of threats in order to determine vulnerabilities. This effort includes investigating, designing and developing methods and tools and the oversight and coordination required to execute this research across the Army enterprise. This work complements and is be coordinated with PE 63125A/project DF5. FY 2014 Plans: Design and conduct experiments on developmental communications technologies (Multiple-Input and Multiple-Output (MIMO), Dynamic Spectrum Access, and Ultra-Wideband) to identify potential technology vulnerabilities through brute force and smart jamming approaches, spoofing, malicious code, and device discovery exploitation; determine mitigation options to address demonstrated technology vulnerabilities. FY 2015 Plans: Will select developmental (current and emerging) technologies; identify spectrum of threats for technologies identified and select high-priority threats for investigation; design, develop and mature assessment methods and tools; design and conduct experiments that will demonstrate technology vulnerabilities; and identify mitigation strategies for any vulnerabilities discovered. Technology selection will be influenced by highest priority/highest potential payoff technologies taking in to account intelligence research, such as that performed at the National Ground Intelligence Center (e.g. high priority threat/capabilities, threat horizon, characterization of contested environment, etc.); and design assessments with environments and factors that may be used to demonstrate vulnerabilities (electronic warfare, cyber security, survivability, lethality and system of systems). Candidates and technologies to investigate include Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and Network Modernization, Active Protection Systems, unmanned ground vehicle/unmanned aerial	-	3.500	4.500

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>	Project (Number/Name) H80 / <i>Survivability And Lethality Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
vehicle technologies, hostile fire detection technologies, digital radio frequency memory (DRFM) for countermeasures/counter-countermeasures, or optics technologies that might benefit from reduction of optical augmentation.			
<p>Title: Active Protection Modeling and Technologies</p> <p>Description: This effort supports the development of Active Protection System (APS) technologies and common architecture to reduce vehicle weight while significantly increasing protection against current and emerging advanced threats by reducing reliance on armor through other means such as sensing, warning, and active countermeasures. The APS common architecture will provide adaptable APS solutions that can be integrated across Army vehicle platforms as required. This research includes the development of new modeling and simulation capabilities along with supporting experimental and theoretical approaches to enable active protective systems. This effort includes integrated information (e.g., battlefield geography, threat launch detection and tracking) and intelligence to inform protection optimization, requiring collaboration across multiple Army organizations. This effort complements and is coordinated with Program Elements, PE 0602601A/project C05, PE 0603004A/project 232, PE 0603005A/project 221, PE 0603270A/project K16, and PE 0603313A/project 263.</p> <p>FY 2015 Plans: Will explore threat independent hybrid/adaptive mechanisms; develop and validate initial computational model to examine interactions of sensors and defeat mechanisms against ballistic threats; and develop active protection concepts, including counter measures, threat warning capabilities, and dynamic threat maps.</p>	-	-	4.000
Accomplishments/Planned Programs Subtotals	55.113	68.263	85.597

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602618A / <i>BALLISTICS TECHNOLOGY</i>	Project (Number/Name) HB1 / <i>SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
HB1: <i>SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)</i>	-	-	7.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

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

	FY 2013	FY 2014	FY 2015
Title: Program Increase	-	7.000	-
Description: This is a Congressional Interest Item			
FY 2014 Plans: Program Increase			
Accomplishments/Planned Programs Subtotals	-	7.000	-

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602622A / <i>Chemical, Smoke and Equipment Defeating Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	4.010	4.487	3.971	-	3.971	3.894	3.946	4.016	4.043	-	-
552: <i>Smoke/Novel Effect Mun</i>	-	4.010	4.487	3.971	-	3.971	3.894	3.946	4.016	4.043	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and evaluates obscurant technologies to increase personnel and platform survivability and develop and validate forensic analysis methods for military and homemade explosive devices, including their precursors and residue. Project 552 pursues research in materials science as well as dissemination methodologies, mechanisms, technologies, and techniques to enable forensic analysis of explosive signatures.

Work in this PE is related to, and fully coordinated with, PE 0603004A, project L97 (Smoke and Obscurants Advanced Technology) and PE 0603606A, project 608 (Countermines & Barrier Development).

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

This work is performed by the Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	4.465	4.490	3.968	-	3.968
Current President's Budget	4.010	4.487	3.971	-	3.971
Total Adjustments	-0.455	-0.003	0.003	-	0.003
• Congressional General Reductions	-0.007	-0.003			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.094	-			
• Adjustments to Budget Years	-	-	0.003	-	0.003
• Sequestration	-0.354	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602622A / <i>Chemical, Smoke and Equipment Defeating Technology</i>				Project (Number/Name) 552 / <i>Smoke/Novel Effect Mun</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
552: <i>Smoke/Novel Effect Mun</i>	-	4.010	4.487	3.971	-	3.971	3.894	3.946	4.016	4.043	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates and evaluates obscurant technologies that degrade threat force surveillance sensors and defeat the enemy's target acquisition devices, missile guidance, and directed energy weapons. This project focuses on advanced infra-red (IR) and multi-spectral obscurant materials that provide effective, affordable, and efficient screening of deployed forces, while being safe and environmentally acceptable. Additionally, it researches and investigates forensic analysis technology in explosives and explosives-related chemical signatures, and develops and validates field sampling and forensics methods for use in a forward-deployed laboratory.

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

Work in this PE is related to, and fully coordinated with, PE 0603004A/project L97 (Smoke and Obscurants Advanced Technology) and PE 0603606A/project 608 (Countermines & Barrier Development).

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Advanced Obscurants	1.159	1.451	1.453
Description: This effort investigates new materials and compounds to enable safe, effective screening of personnel and equipment.			
FY 2013 Accomplishments: Began small scale synthesis of spectrally selective materials and conduct characterization.			
FY 2014 Plans: Investigate spectrally selective obscuration concepts to provide Warfighter with a new one-way smoke capability; investigate microwave obscurant formulations to defeat future electronic warfare (EW) threats.			
FY 2015 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602622A / <i>Chemical, Smoke and Equipment Defeating Technology</i>	Project (Number/Name) 552 / <i>Smoke/Novel Effect Mun</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will continue to investigate spectrally selective materials and new microwave obscurant materials.				
<p>Title: Obscurant Enabling Technology</p> <p>Description: This effort investigates distribution technologies for various obscurants.</p> <p>FY 2013 Accomplishments: Conducted dissemination studies of new low hazard visual obscurants.</p> <p>FY 2014 Plans: Continue dissemination studies of new low hazard visual obscurants for grenade applications; conduct novel modeling analysis of new low hazard obscurants for mortar/artillery applications dissemination studies.</p> <p>FY 2015 Plans: Will continue to study dissemination of new low hazard visual obscurants for grenade applications. Will initiate explosive dissemination technology studies. Will initiate efforts to investigate vulnerability of various technologies to obscurant/target defeat effects. Will identify technologies of interest; conduct initial analysis with the intent of evaluating/assessing effects.</p>		1.056	1.050	1.052
<p>Title: Forensic Analysis of Explosives</p> <p>Description: This effort investigates forensics analytical methods for military explosives, homemade explosives (HME), HME precursors, and residue analysis for attribution.</p> <p>FY 2013 Accomplishments: Developed analytical and forensic protocols for homemade explosive threats in order to expand and enhance capabilities at Tier II theater analytical laboratories (mobile and semi permanent); demonstrated integrated biometric and chemical sensing for attribution using Raman chemical imaging.</p> <p>FY 2014 Plans: Develop analytical methods for forensic analysis of explosives with the objective of assigning attribution to include collection, preparation, instrumental analysis and advanced statistical techniques; provide solutions for analytical problems encountered by expeditionary laboratories, particularly for the analysis of explosives (Toxic Industrial Compounds (TICs), and Materials(TIMs), agricultural chemicals and emerging needs and threats) in a variety of sample matrices.</p> <p>FY 2015 Plans: Will investigate linkages of spectroscopic signatures developed in FY12 with compositional analysis of explosives using analytical protocols developed in FY13-14 in order to improve the attribution power of optical systems.</p>		1.795	1.986	1.466
Accomplishments/Planned Programs Subtotals		4.010	4.487	3.971

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602622A / <i>Chemical, Smoke and Equipment Defeating Technology</i>	Project (Number/Name) 552 / <i>Smoke/Novel Effect Mun</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-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602623A / <i>JOINT SERVICE SMALL ARMS PROGRAM</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	6.378	7.814	6.853	-	6.853	5.527	5.581	5.644	5.600	-	-
H21: <i>Jt Svc Sa Prog (JSSAP)</i>	-	6.378	7.814	6.853	-	6.853	5.527	5.581	5.644	5.600	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY15 funding realigned to support higher priority efforts.

A. Mission Description and Budget Item Justification

This program element (PE) investigates designs and evaluates individual and crew-served weapon technologies that enhance the fighting capabilities and survivability of the dismounted Warfighter in support of all the Services. All work is done under the Joint Service Small Arms Program (JSSAP) (Project H21) and are based upon the Joint Service Small Arms Master Plan (JSSAMP) and the Joint Capabilities Integration Development System's Small Arms Analyses.

Work in this PE is related to, and fully coordinated with, efforts in PE 0601102A (Defense Research Sciences), PE 0602624A (Weapons and Munitions Technology), PE 0603607A (Joint Service Small Arms Program), and PE 0603827A (Soldier Systems-Advanced Development).

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

This program is managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ in collaboration with the Army Research Laboratory (ARL) at Aberdeen proving Ground, MD.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	7.169	7.818	8.969	-	8.969
Current President's Budget	6.378	7.814	6.853	-	6.853
Total Adjustments	-0.791	-0.004	-2.116	-	-2.116
• Congressional General Reductions	-0.011	-0.004			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.050	-			
• SBIR/STTR Transfer	-0.169	-			
• Adjustments to Budget Years	-	-	-2.116	-	-2.116

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army Date: March 2014

Appropriation/Budget Activity	R-1 Program Element (Number/Name)
2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	PE 0602623A / <i>JOINT SERVICE SMALL ARMS PROGRAM</i>

• Sequestration	-0.561 - - - -
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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602623A / JOINT SERVICE SMALL ARMS PROGRAM	Project (Number/Name) H21 / Jt Svc Sa Prog (JSSAP)
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H21: Jt Svc Sa Prog (JSSAP)	-	6.378	7.814	6.853	-	6.853	5.527	5.581	5.644	5.600	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates designs and evaluates individual and crew-served weapon component technologies that enable increased lethality for survivability of the dismounted Warfighter in all the Services. All efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP) and the Joint Capabilities Integration Development System's Small Arms Analyses.

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

Work in this project is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology) and PE 0603607A (Joint Service Small Arms Program) and PE 0602786A (Warfighter Technology).

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Advanced Small Unit (Squad) Small Arms Technology Concepts	3.382	3.750	2.015
Description: This effort was originally titled JSSAP Mini Grand Challenge. It addresses future small arms technology investments including new materials, high power energy sources, miniaturization techniques, and reduction of weapon moving components.			
FY 2013 Accomplishments: Investigate new small arm concepts and systems proposed to enable Small Unit operations; fund research to decrease time to complete mission objective and double the maximum effective range of current individual and crew served small arm systems as defined by the Small Arms Capabilities Based Assessment; analyze new concepts through modeling and simulation.			
FY 2014 Plans: Continue to design and conduct experiments of a universal projectile concept to validate modeling and simulation of projectile aerodynamics, launch survivability and suitability to military environments; investigate gun barrel stabilization technologies to validate effectiveness of maximum range increases.			
FY 2015 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602623A / JOINT SERVICE SMALL ARMS PROGRAM	Project (Number/Name) H21 / Jt Svc Sa Prog (JSSAP)		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will validate advanced armor piercing ammunition technology designs that achieve TRL 5 and prepare transition documentation for Project Manager Maneuver Ammunition Systems (PM MAS); will mature weapon advanced stabilization concept for 6.3 transition.				
<p>Title: Small Arms Material and Process Technology</p> <p>Description: This effort addresses state of the art material substrates and surface coatings to improve reliability, reduce maintenance and improve weapon diagnostics through embedded technology.</p> <p>FY 2013 Accomplishments: Investigated available state-of-the-art coatings materials and processes and the potential synergistic effects to weapon applications; designed and conducted experiments at component level to determine validity of technology to small arms applications; used modeling and simulation to validate analytical predictions; formulated concept and application studies.</p> <p>FY 2014 Plans: Develop and analyze custom phosphors for providing day/night capable tracer material; validate phosphor characteristics (excitation and emission energies) to enhance focus light back to the shooter; mature coatings for corrosion resistant applications on ammunition and weapons; conduct experiments through suppressor development designs to decrease peak temperatures and increase reliability.</p> <p>FY 2015 Plans: Will experiment with selected phosphors properties that provide one-way luminescence capability for 5.56mm 7.62mm caliber ammunition; will mature suppressor designs to decrease flash and acoustic detection; will validate adaptive solid lubricants to decrease required weapon maintenance.</p>		2.996	4.064	2.518
<p>Title: Advanced Future Small Arms Concept Exploration</p> <p>Description: This effort address the investigation and maturation of enabling technologies transitioned from Basic Research (6.1) efforts in the areas of ballistics, energetics, future weapon and fire control sensors in order to extend individual soldier engagement ranges and maintain equal lethality overmatch; optimize caliber performance to match mission sets.</p> <p>FY 2015 Plans: Will mature advanced small arms kinetic ammunition designs; design and develop new small caliber weapons component technologies to obtain increased range and accuracy, decreased weight, improved target acquisition and engagement while reducing weapons recoil and suppressing weapon signature; investigate futuristic small arms weapon systems proposed by the West Point Futures Studies and generate technology development plans, trade-off analysis, and concept designs.</p>		-	-	2.320
Accomplishments/Planned Programs Subtotals		6.378	7.814	6.853

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602623A / JOINT SERVICE SMALL ARMS PROGRAM	Project (Number/Name) H21 / Jt Svc Sa Prog (JSSAP)
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	46.097	52.778	38.069	-	38.069	42.686	49.902	49.000	57.578	-	-
H18: <i>Weapons & Munitions Technologies</i>	-	16.281	13.194	18.792	-	18.792	21.127	22.277	21.998	25.581	-	-
H19: <i>Asymmetric & Counter Measure Technologies</i>	-	7.562	9.044	6.988	-	6.988	7.302	7.933	8.046	11.454	-	-
H1A: <i>WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE</i>	-	11.567	15.000	-	-	-	-	-	-	-	-	-
H28: <i>Warheads/ Energetics Technologies</i>	-	10.687	15.540	12.289	-	12.289	14.257	19.692	18.956	20.543	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 resource adjustments attributed to Congressional Add funding (15.000 million); Congressional General Reductions (-88 thousand); SBIR/STTR transfers (-620 thousand); and Sequestration Reductions (-3.413 million)

A. Mission Description and Budget Item Justification

This program element (PE) investigates, designs and evaluates enabling technologies to develop lethal and nonlethal weapons and munitions with increased performance and the potential for lower weight, reduced size, and improved affordability. Project H18 focuses on weapons and munitions development. Project 19 researches technologies to maintain the lethality of US weapons as well as directed energy (DE) capabilities and subsystems to support the weaponization of high power microwave (HPM), and short pulse lasers. Project H28 evaluates munition components such as fuzes, power, warheads with tailorable effects, and insensitive munition compliant energetic materials.

Work in this PE is related to, and fully coordinated with, PE 0602303A (Aviation Advanced Technology), 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603008A (Electronic Warfare Advanced Technology).

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

Work in this PE is primarily performed by the Armament Research, Development, and Engineering Center (ARDEC) at Picatinny Arsenal, NJ, in cooperation with the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD; the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>
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Belvoir, VA; the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	35.218	37.798	40.431	-	40.431
Current President's Budget	46.097	52.778	38.069	-	38.069
Total Adjustments	10.879	14.980	-2.362	-	-2.362
• Congressional General Reductions	-0.088	-0.020			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	15.000	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.620	-			
• Adjustments to Budget Years	-	-	-2.362	-	-2.362
• Sequestration	-3.413	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H18: <i>Weapons & Munitions Technologies</i>	-	16.281	13.194	18.792	-	18.792	21.127	22.277	21.998	25.581	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project designs, investigates, and evaluates component technologies to enable affordable precision munitions as well as provide increased lethality and performance with reduced logistics and advanced direct/indirect fire capabilities.

This project sustains Army science and technology efforts supporting the Ground and Lethality portfolios.

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

Work in this project is performed by the Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ in collaboration with a the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL; and the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA.

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

	FY 2013	FY 2014	FY 2015
Title: Novel Propulsion Technology for the Future	3.958	3.521	3.614
Description: This effort explores propellant technologies such as powder coextrusion and grain coatings, while retaining insensitive properties, for employment in gun launch environments as well as directional thrusters including those that deliver a broad spectrum of effects. It also conducts experiments with these propellants to increase the range of artillery and mortar rocket assisted projectiles.			
FY 2013 Accomplishments: Investigated new propulsion ingredients for scale up of formulations to provide extended range; designed, fabricated and evaluated new charge systems using coextrusion of multiple materials as well as coatings for burn rate modification.			
FY 2014 Plans: Conduct experiments on rocket propulsion systems concepts to extend the range of 155mm artillery and 120mm mortar; determine ballistic applications for co-extruded propellants; leverage advancements in combustible cartridge case technologies to improve projectile propulsion; design and develop optimal propellant configurations for specific applicable systems; develop			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>120mm mortar propellant for 120mm systems for improved range and cost; develop and optimize advanced propellant for 81mm extended range system compliant with automated direct/indirect fire mortar (ADIM).</p> <p>FY 2015 Plans: Will conduct initial experiments on non ammonium perchlorate propellant formulations for rocket assisted projectile indirect fire solutions; will design and develop propellant technologies for next generation artillery and tank applications; will scale up materials for advanced propellants, igniters and combustible materials for propellant charges.</p>				
<p>Title: Advanced Weapons Technology</p> <p>Description: This effort investigates innovative weapon technologies such as recoil energy mitigation, affordable precision, extended range/guided technologies, and advanced propelling for future medium caliber direct fire systems that could provide similar or greater lethality than current systems.</p> <p>FY 2013 Accomplishments: Continued to mature hydrogen propellant ignition and remote automated gun firing in medium caliber weapons for transition to advanced development; conducted additional small scale research into multiple novel weapon system candidate technologies; developed precision technologies for extended/guided range applications.</p> <p>FY 2014 Plans: Mature most promising weapon technologies to enable swarming munitions that provide highly lethal target tailorable effects such as advanced miniature fuze and power systems and munition architectures for synergistic effects; evaluate for transition to advanced development; conduct additional small scale research into multiple novel weapon system candidate technologies, including fire control decision support services, and enhanced sniper technologies for improved precision at extended ranges.</p> <p>FY 2015 Plans: Will investigate multiple promising innovative weapon technologies that could provide greater lethality; will develop weapon technologies that incorporate emerging materials (e.g. nanotechnology, additive manufacturing); will develop weapon, munition and fire control technologies that support advanced forms of engagement, such as collaborative munitions.</p>		3.118	2.291	2.174
<p>Title: Fire Control Target Recognition</p> <p>Description: This effort designs and develops networked fire control hardware and software that can be integrated with existing command and control architectures.</p> <p>FY 2013 Accomplishments:</p>		2.256	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Designed and investigated target data and weapon effects for improved mission planning; designed and investigated weapon placement coordination; designed weapons and effects database; investigated small unit fire control hardware; conducted experiments to validate design efforts.				
Title: Line-of-Sight (LOS) Course Correction Munition Technology Description: This effort investigates and evaluates technologies such as small thrusters fired to the side of the round to correct trajectory and to improve precision and lower collateral damage in munitions. FY 2013 Accomplishments: Integrated line-of-sight (LOS) course correction subsystem for ballistic testing; measured both structure and function of LOS course correction subsystem integrated into surrogate munition for performance and success.		2.747	-	-
Title: Precision Munition Technologies Description: This effort designs and investigates scalable and modular enabling technologies such as novel decelerators, advanced explosive detonators, and advanced control actuators for gun-launched munitions. FY 2013 Accomplishments: Investigated sensor targeting algorithm solutions for all-weather operations (to include experiments with semi-active laser sensors and other suitable options); investigated and matured affordable control actuation system components; conducted high-g survivability experiments.		4.202	-	-
Title: Novel Penetrator Designs Description: This effort provides novel direct fire capabilities against advanced heavy armor threats by investigating several projectile configurations and non depleted uranium (DU) materials to achieve flight stability and effectiveness against new armored targets. FY 2014 Plans: Optimize components for better function and launch survival; design and modify non-DU kinetic energy (NexGen KE) functional projectile leading to the tech demo		-	1.691	-
Title: Extended Range Projectile Technology Description: This effort develops various methods of low cost extended range technologies for 60mm through 120mm mortar. Target acquisition will improve with the incorporation of semi-active laser (SAL), video and GPS Guidance, Navigation and Control (GNC) state of the art technologies. The warfighter/Command & Control on a PDA and/or computer will be able to see beyond line-of-sight targets and change directions of projectiles while in flight.		-	0.997	0.991

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>FY 2014 Plans: Mature component technologies such as aerodynamic shapes, tail fins, lift surfaces, improved propellant and base bleed for 60mm through 120mm mortar projectiles; conduct experiments for directing the projectile onto target at ranges beyond 500 meters; validate and mature electronic components for insertion into projectiles.</p> <p>FY 2015 Plans: Will mature and validate the improved aerodynamic shapes, propellant, guidance/navigation and control, auto pilot and low pressure gas technologies, into 60mm/120mm mortar projectiles with a goal of up to a 75% increase in range with guidance; will conduct an experimental flight of a guide to hit projectile at 75% increased range.</p>				
<p>Title: Affordable Precision Technologies</p> <p>Description: This effort investigates technologies that provide affordable precision capabilities for projectiles fired into GPS denied environments.</p> <p>FY 2014 Plans: Conduct experiments to validate the concept of utilizing commercial-off-the-shelf (COTS) inertial sensors for guided munition applications; determine the feasibility of applying arrayed sensor concepts to gun launched munitions in order to determine position within navigation grade accuracies; validate target recognition algorithms adapted for use with the imaging modalities selected.</p> <p>FY 2015 Plans: Will validate inertial sensor array design and processing algorithms developed: will conduct various experiments with the long-wave/near-IR imagers used for terminal guidance in GPS denied environments. Nature of the experiments will be to collect real time imagery data for the purpose of navigation algorithm development. This effort is being conducted in collaboration with AMRDEC through the ATR Working Group and with the Army Research Laboratory (ARL) through a technology transition agreement. This effort will spin out component technologies that will be evaluated and matured in the fully coordinated effort of the same name in PE/Project 0603004A/232.</p>		-	1.695	3.282
<p>Title: Enabling Printed Explosives, Power Sources & Electronics for Munitions</p> <p>Description: This effort develops and accelerates the state-of-the-art in materials printing, direct write, flexible electronics, and conformal systems for the warfighter.</p> <p>FY 2014 Plans:</p>		-	0.704	0.700

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Develop Printed Electronics, Energetics, Materials, & Sensors (PEEMS) technologies for armament applications; investigate ink development, device fabrication, and testing of printed electronics for current and future armament system; determine the utility of PEEMS technologies for munitions fuzing, sensing, security, and logistics.</p> <p>FY 2015 Plans: Will investigate, design, develop and validate printed electronics, energetics, and power sources for Munitions and other armament applications; will mature materials and printing techniques to add capabilities to munitions and fuze systems, while reducing the size, weight, and cost of conventional electronics; will conduct experiments to determine applicability of printing techniques for antennas, sensors, electrical components, and other components printed onto windscreens, radomes, munitions, and weapon systems. This effort is being conducted in collaboration with CERDEC, AMRDEC and the Army Research Laboratory (ARL) through both the integrated project team and technical working groups.</p>				
<p>Title: Air Dropped Guided Munition Technology</p> <p>Description: This effort develops and integrates component technologies that enable the precision delivery and function of an 81mm mortar to defeat moving targets of opportunity in complex terrain.</p> <p>FY 2014 Plans: Mature designs and analyze integration of Proximity Fuze system, with a wrap around antenna, and semi active laser seeker components, designed and developed to fit the volume and form factor of low cost and light weight air drop 60-81mm munitions.</p>		-	1.295	-
<p>Title: Extended Range Indirect Fire Weapon Technology</p> <p>Description: This effort initially investigates and determines the viability of candidate extended range indirect fire weapon technologies that facilitate hyper-velocity launch and result in ranges beyond 60km. The effort subsequently addresses the component level technological gaps.</p> <p>FY 2014 Plans: Identify candidate technologies that can be used to facilitate hyper-velocity launch; investigate viability of candidate technologies; develop concepts utilizing the most promising technologies; identify the subcomponent technological gaps that need to be addressed early.</p> <p>FY 2015 Plans: Will mature the concepts of an extended range armament system; will continue the investigation of unconventional materials and processes to allow a new system to have no significant weight increase compared to existing systems; will develop a detailed</p>		-	1.000	1.021

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H18 / <i>Weapons & Munitions Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
design of a lightweight armament system for use in extended range weapons that addresses the current Army capability gaps with minimal system impact.				
<p>Title: Force Protection Technologies</p> <p>Description: This effort accelerates the development of disruptive technologies that enable transformational protection capabilities protection for vital assets, forces and civilian populations, increasing safety, decreasing collateral damage and minimizing fratricide.</p> <p>FY 2015 Plans: Will investigate and develop armament technologies to provide protection to vital National assets including vehicles, facilities, weapons, and personnel; will develop precision weapons, munitions and fire control technologies to reduce collateral damage to non-combatants; will develop armament technologies that provide greater standoff distance between incoming threats and vital assets.</p>		-	-	3.010
<p>Title: Long Range Gun Technology Development</p> <p>Description: This effort investigates and develops candidate extended range artillery weapon system and projectile technologies that increase the range by 100% with increased precision.</p> <p>FY 2015 Plans: Will investigate candidate projectile and weapon systems technologies that provide extended range by leveraging novel materials, innovative propulsion technologies and advanced design concepts.</p>		-	-	2.000
<p>Title: Fuze and Power Technologies for Munitions</p> <p>Description: This effort investigates and develops innovative fuze and power technologies for enhanced environmental and target sensing/classification, warhead initiation schemes and advanced fuze setting to provide enhanced lethality combined effects on targets and advanced initiation schemes for the next generation munitions.</p> <p>FY 2015 Plans: Will identify candidate technologies that can be used to facilitate advanced high-g target sensing/classification that are miniaturized, integrated and packaged into existing fuze form factors which are currently not available for advanced munitions; new miniaturized safe and arm architectures that can enable the next generation of enhanced lethality; and advanced fuze setting for size and weight reduction through advanced electronic packaging schemes and efficient setting technologies; will</p>		-	-	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
investigate viability of candidate technologies; will develop initial concepts and determine feasibility to known technological gaps. Through collaboration with ARL will seek innovative miniaturized munitions power source candidate technologies.			
Accomplishments/Planned Programs Subtotals	16.281	13.194	18.792

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / Weapons and Munitions Technology	Project (Number/Name) H19 / Asymmetric & Counter Measure Technologies
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H19: <i>Asymmetric & Counter Measure Technologies</i>	-	7.562	9.044	6.988	-	6.988	7.302	7.933	8.046	11.454	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project designs and develops technologies to support asymmetric countermeasures such as radio frequency and ultra-short pulse directed energy and efforts to maintain the lethality and overmatch of US weapons. Work in this project is related to, and fully coordinated with, efforts in projects H18 and H28 (also in PE 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0603004A (Weapons and Munitions Advanced Technology).

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.

This work is performed by the Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Novel Battlefield Effectors	0.779	1.208	1.603
Description: This effort investigates unique weapon and munitions enabling technologies to achieve tunable effects on targets and that are capable of providing a full range of effects from non-lethal to highly lethal via a single weapon or munition.			
FY 2013 Accomplishments: Continue to investigate most promising effector technologies and evaluate for transition to advanced development; conduct additional research into multiple novel battlefield effector candidate technologies.			
FY 2014 Plans: Continue to investigate additional new and promising effector technologies and evaluate them for transition to advanced development; conduct experiments to enable size, weight, power and cost (SWaP-C) reduction of solid state active denial technologies to allow for handheld applications and for use on the design of other novel battlefield effector candidate technologies.			
FY 2015 Plans: Will develop most promising effector technologies for transition to advanced development; will investigate size, weight, power and cost benefits of those technologies; will explore the use of non-traditional technologies in new applications.			
Title: Active Denial Technologies	1.716	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H19 / <i>Asymmetric & Counter Measure Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Description: This effort develops non-lethal, counter-personnel directed energy (DE) technology that can repel personnel up to 100 meters.</p> <p>FY 2013 Accomplishments: Completed integration and conduct experiments of the solid state active denial technology system to achieve the desired range of 100 meters.</p>				
<p>Title: Counter Countermeasure (CCM) Technologies for weapons and munitions</p> <p>Description: This effort investigates guidance signal reduction, inertial measurement unit, and antenna design technologies to enable continued effectiveness of US weapon systems against enemy countermeasures including Active Protection Systems (APS), Global Positioning System (GPS) jamming, and active seeker jamming.</p> <p>FY 2013 Accomplishments: Continued to investigate most promising CCM technologies and evaluate for transition to advanced development; conducted additional small scale research into multiple counter countermeasure candidate technologies; conducted various experiments to determine effectiveness against future threats.</p> <p>FY 2014 Plans: Design CCM systems to protect against known vulnerabilities and evaluate for transition to advanced development; investigate multiple counter countermeasure candidate technologies; explore susceptibilities and remediation techniques for armament systems; conduct various experiments to measure effects of directed energy and develop modeling and simulation to understanding underlying physics.</p> <p>FY 2015 Plans: Will develop most promising technologies that protect munitions and weapons technologies against emerging threat countermeasure technologies; will explore disruptive directed energy as a means of providing CCM; will investigate most promising CCM technologies for transition to advanced development.</p>		2.183	0.907	1.369
<p>Title: Novel Penetrator Designs</p> <p>Description: This effort provides novel direct fire capabilities against advanced heavy armor threats by investigating several projectile configurations and non depleted uranium materials to achieve flight stability and effectiveness against new armored targets</p> <p>FY 2013 Accomplishments:</p>		2.884	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H19 / <i>Asymmetric & Counter Measure Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Down selected to one penetrator design based on FY12 penetrator experiments and integrate into projectile cartridge for functional testing; executed a ballistic test to validate range and penetration requirements that support system performance and lethality goals.				
<p>Title: Enhanced Fire Control for Indirect Fires</p> <p>Description: This effort evaluates the applicability and integration of state-of-the-art acquisition and engagement technologies, sensors and methodologies to enhance fire control capability, and therefore weapon effectiveness, at various ranges and under battlefield conditions. It investigates components and architectures that will reduce size, weight, power and cost (SWAP-C), and increase commonality and operation across direct and indirect fire control systems.</p> <p>FY 2014 Plans: Utilize systems engineering to investigate the state-of-the-art of optics, microprocessors and target recognition/classification algorithms based on market surveys of private industry/academia/other government agencies' sensor technologies; establish, develop and mature the associated fire control system requirements and performance goals; generate and evaluate concepts for software and hardware architectures for optimal fire control system performance and size, weight and power considerations.</p> <p>FY 2015 Plans: Will develop novel methods and algorithms for improved ballistics, for data and image processing, and for sensing battlefield, weapon and target environment; will investigate small, accurate, survivable weapon orientation sensors, technologies and compensation methodologies to improve the weapon pointing; will refine concepts for hardware and software architectures for optimum physical and functional integration, increased commonality, lower weight, and faster engagement times.</p>		-	2.009	2.011
<p>Title: Recoil Reduction Disruptive Technologies</p> <p>Description: This effort investigates technologies to reduce recoil momentum and energy waste for integration onto lighter vehicle platforms for increased mobility, using rarefaction wave gun and supporting technologies.</p> <p>FY 2014 Plans: Investigate fundamental means of radical recoil reduction to enable large caliber weapons to be lightweight and integrated to lightweight manned and unmanned vehicles; fund research into rarefaction wave gun and supporting technologies for use in supersonic up to hypervelocity launchers.</p>		-	2.002	-
<p>Title: Improvised Explosive Device (IED) Neutralization Technologies</p> <p>Description: This effort investigates multiple radio frequency (RF) functions to neutralize IEDs utilizing a common set of hardware and software, on a ground vehicle. It develops novel RF waveforms to neutralize a broad spectrum of IEDs and their electronic triggering devices. Results to transition to explosive hazard predonation system effort in PE 0603004A/Project 232 in FY2014/15.</p>		-	2.014	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H19 / <i>Asymmetric & Counter Measure Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>FY 2014 Plans: Mature existing IED neutralization systems; conduct research to include the development of IED neutralization waveforms utilizing a modular exciter architecture, and development of a beam steering directional antenna to focus high power RF towards predicted threat zones to neutralize the IED; validate the increased performance of a convoy / route clearance based IED neutralization system by interfacing with IED detection sensor systems.</p>				
<p>Title: Integrated Decision Enhancing Capabilities for Fire Control Description: This effort develops target database and target management capability for company and below operations</p>		-	0.904	-
<p>FY 2014 Plans: Develop software for integration and collaboration of remote weapon station for lethal/non lethal effects; develop software for the processing and integration of sensor/target information; develop LOS/BLOS fires capability for company and below within program of record architecture.</p>				
<p>Title: High Powered Radio Frequency Description: The use of High Power Radio Frequency (RF) has been demonstrated to provide desired target effects against various targets; however such systems are still too large and consume too much power to make them tactically useful for Army applications. This effort will focus on addressing the Size, Weight, Power and Cost (SWAP - C) of High Power RF systems and their components so as to allow tactically useful systems.</p>		-	-	2.005
<p>FY 2015 Plans: Will focus on reducing antenna size for high power RF transmission; will investigate high dielectric constant composites (nano-dielectrics) to produce 60-80% size reduction in antenna array elements; develop the antenna array elements to transmit known RF waveforms (frequency, pulse width, and amplitude) to cause a desired target effect of interest.</p>				
Accomplishments/Planned Programs Subtotals		7.562	9.044	6.988
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 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H19 / <i>Asymmetric & Counter Measure Technologies</i>

E. Performance Metrics N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / Weapons and Munitions Technology	Project (Number/Name) H1A / WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H1A: WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	-	11.567	15.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Weapons and Munitions Technology applied research.

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

	FY 2013	FY 2014	FY 2015
Title: Program Increase	11.567	15.000	-
Description: This is a Congressional Interest Item			
FY 2013 Accomplishments: Investigated, designed and evaluated enabling technology to develop lethal and nonlethal weapons and munitions with increased performance and the potential for lower weight, reduced size, and improved affordability.			
FY 2014 Plans: Investigate, design and evaluate enabling technology to develop lethal and nonlethal weapons and munitions with increased performance and the potential for lower weight, reduced size, and improved affordability.			
Accomplishments/Planned Programs Subtotals	11.567	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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / Weapons and Munitions Technology	Project (Number/Name) H28 / Warheads/ Energetics Technologies
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H28: Warheads/ Energetics Technologies	-	10.687	15.540	12.289	-	12.289	14.257	19.692	18.956	20.543	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates and designs enabling warhead and energetic technologies such as novel warhead architectures, new propellant techniques, and high-density explosives to produce smaller, lighter, more effective, multi-role warheads.

This project sustains Army science and technology efforts supporting the Ground and Lethality portfolios.

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

This work is performed by the U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ in collaboration with the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

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

	FY 2013	FY 2014	FY 2015
Title: Scalable Warhead Technology	4.143	4.176	4.395
Description: This effort designs scalable and adaptive explosives and reactive materials technology for either gun or missile-launched weapons and munitions that can deliver a broad spectrum of effects with reduced collateral damage.			
FY 2013 Accomplishments: Designed and tested brassboard designs for shaped charge and explosively formed penetrator (EFP) with scaled up lethality; determined through modeling and simulation the range of lethal to less than lethal effects for scalable warheads.			
FY 2014 Plans: Design and conduct experiments for spin compensated shaped charges, enhanced fragmentation and multiple explosively formed penetrator (MEFP) warheads; investigate scalable technologies as they relate to lethal to less than lethal effects; develop designs for non-axisymmetric EFP warheads.			
FY 2015 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H28 / <i>Warheads/ Energetics Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will mature designs and conduct experiments in the area of spin compensated shaped charges, enhanced fragmentation, directional lethality and multiple explosively formed penetrator (MEFP) warheads; will validate scalable technologies as they relate to lethal to less than lethal effects.				
<p>Title: Energetic Materials and Warheads</p> <p>Description: This effort designs energetic materials with controlled energy release for precision munition and counter-munition applications.</p> <p>FY 2013 Accomplishments: Continued to investigate most promising technologies like structural energetics, solventless propellants, and nanoinsensitive nitramines and evaluate them for transition to advanced development; conducted additional small scale research into multiple energetic materials and warheads candidate technologies for medium and large cal ammunition.</p> <p>FY 2014 Plans: Continue to investigate most promising technologies such as disruptive energetics, micro-thrusters and tailorable propellants, highly effective miniature lethal mechanisms, and nano insensitive nitramines; also conduct evaluation for transition into novel swarming munitions, advanced warheads, medium and large cal ammunition; seek new applications based on measured performance.</p>		1.919	2.893	-
<p>Title: Insensitive Munitions Multi-Scale Reactive Modeling (IM-MSRM)</p> <p>Description: The IM-MSRM effort designs and investigates new M&S tools for the design and development of insensitive munitions.</p> <p>FY 2013 Accomplishments: Continued to investigate and develop atom level computer code modifications to create material models; developed mixed mode (blast/fragmentation) analytical capability and detonation shock dynamics to improve the representations of physics and chemistry in explosives and provide more accurate supercomputer design tools for the U.S. insensitive munitions design community.</p>		0.689	-	-
<p>Title: Explosives Research</p> <p>Description: This effort develops high energy/high performance, multi-purpose insensitive munitions (IM) explosives.</p> <p>FY 2013 Accomplishments:</p>		3.936	3.996	4.064

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H28 / <i>Warheads/ Energetics Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Began optimization and scale-up of promising ingredients formulations and tailored explosives for mixed-mode and combined effects; conducted baseline design and testing of novel components as well as structures based on nano-energetics, energetic fibers and reactive alloys, explosive inks, multipoint initiation.</p> <p>FY 2014 Plans: Determine most promising compounds to enable tailored energy release and combined effects; investigate and characterize new insensitive energetic ingredients; design and develop novel concepts for explosive initiation and formulation; scale up and test Nano energetic materials in TRL-4-5 experiments; develop nano-enhanced melt pour ingredients for reduced sensitivity and cost.</p> <p>FY 2015 Plans: Will formulate and process combined effects and high efficiency explosives; will validate affordable new energetic binders for enhanced blast formulations; will investigate new synthetic processes to enable low-cost, high energy solid crystal explosive ingredients; will mature processing techniques for nano-enhanced organic energetics formulations; will conduct experiments on electrically-induced tailored energy release for proof of chemistry-based variable warhead fragmentation and the possibility of an on/off energetic capability. This effort is being conducted in collaboration with the Army Research Laboratory (ARL) through both the integrated project team and technical working groups.</p>				
<p>Title: Material Development for Water Purification</p> <p>Description: This effort originated from a material development for armament systems and was found to have a dual use application. The effort (also known as Adaptive Armament Reactive Interface Domains/AARID) is intended to provide a capability to enhance contingency basing water efficiency via recycling with secondary contributions to reduction of waste and power. Lesser focus advantages are on sustainment, greater logistics flexibility, and reduced Warfighter threat from supply convoys.</p> <p>FY 2014 Plans: Investigate cycle time and water flow, determining rate of reaction for decontamination, validate the coating to lend itself useful for robustness of current filters, and design and develop laboratory systems for conducting experiments.</p> <p>FY 2015 Plans: Will design and develop a method to collect real time data to determine flow rates and validate water purity; will conduct experiments to compare coated filters to uncoated filters to determine the benefits of the coating in purifying water.</p>		-	0.495	0.248
<p>Title: Explosives Safety for Automated Base Camp Planning</p> <p>Description: This effort determines data interoperability requirements between explosive safety and base camp planning software tools; designs an integrated tool that increases explosive safety for base camps by managing the risk due to interaction between changes in Net Explosive Weight, geography, facilities and force structure. In FY 2014 this effort supports the Demonstration of Force Protection for Basing.</p>		-	0.300	0.497

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / <i>Weapons and Munitions Technology</i>	Project (Number/Name) H28 / <i>Warheads/ Energetics Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p><i>FY 2014 Plans:</i> Determine data interoperability requirements of explosives safety, risk assessment, and base camp planning tools leading to the development of the design architecture for an automated comprehensive base camp planning software suite.</p> <p><i>FY 2015 Plans:</i> Will develop and evaluate ammunition explosives safety planning and management modules within the base camp planner design architecture. This task is fully coordinated with the effort of the same name in PE/Project 0603001A/543.</p>				
<p><i>Title:</i> Tunable Pyrotechnics</p> <p><i>Description:</i> This effort develops smoke and flare countermeasure for passive protection for ground and air combat platforms, and hand held signals for illumination and signaling. This will increase warfighter and aircraft survivability.</p> <p><i>FY 2014 Plans:</i> Investigate ultraviolet countermeasure (UVCM) flare reformulation with modeling & simulation and validate in scale up experiments; develop and validate laser beam rider countermeasure (LBRCM) designs with functional experiments; design & develop image seeking countermeasure (ISCM) flare configurations;. mature and validate white illumination hand held signal designs.</p> <p><i>FY 2015 Plans:</i> Will assess formulations and functional concepts for dazzler, cloud and seeker countermeasures; will conduct experiments on dazzler flares and prepare for flight tests; will conduct experiments on cloud countermeasures; will analyze dazzler and cloud countermeasure performance using experiment and simulation results for application to multiple aircraft and aspect angles; will identify threats and develop concepts for seeker countermeasure.</p>		-	3.680	3.085
Accomplishments/Planned Programs Subtotals		10.687	15.540	12.289
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research	R-1 Program Element (Number/Name) PE 0602705A / ELECTRONICS AND ELECTRONIC DEVICES
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	85.099	58.990	56.435	-	56.435	55.672	57.292	55.553	56.231	-	-
EM4: Electric Component Technologies (CA)	-	27.573	-	-	-	-	-	-	-	-	-	-
EM8: High Power And Energy Component Technology	-	14.438	14.920	13.182	-	13.182	12.232	12.761	12.968	13.020	-	-
H11: Tactical And Component Power Technology	-	9.851	11.685	11.769	-	11.769	11.895	11.980	9.686	9.656	-	-
H17: Flexible Display Center	-	5.915	2.702	0.571	-	0.571	1.145	1.017	1.031	1.082	-	-
H94: Elec & Electronic Dev	-	27.322	29.683	30.913	-	30.913	30.400	31.534	31.868	32.473	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 adjustments attributed to Congressional Adds (33.0 million); Congressional General Reductions (-172 thousand); SBIR/STTR transfers (-864 thousand); and Sequestration Reductions (7.165 million)

A. Mission Description and Budget Item Justification

This program element (PE) designs and evaluates, power components, frequency control and timing devices, high power microwave devices, display technologies; and electronic components. The applied research on these technologies enable the ability to perform precision deep fires against critical mobile and fixed targets; investigate all-weather, day or night, theater air defense against advanced enemy missiles and aircraft; as well as investigate enhanced communications and target acquisition through support of capabilities such as autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communications, automatic target recognition, foliage-penetrating radar, and combat identification. Project EM8 designs and evaluates high-power, microwave, electronic components and technologies. Project H11 designs, fabricates and evaluates advanced portable power technologies (batteries, fuel cells, hybrids, engines, chargers, and power management). Project H17 designs and evaluates flexible displays in conjunction with the Flexible Display Center. Project H94 researches and evaluates electronic component technologies such as photonics, micro electromechanical systems, imaging laser radar, magnetic materials, ferroelectrics, microwave and millimeter-wave components, and electromechanical systems.

Work in this PE complements and is fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602709A (Night Vision Technology), PE 0602782A (Command, Control, Communications Technology), PE 0602783A (Computer and Software Technology), PE 0603001A (Warfighter Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>
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The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work is performed by the Army Research Laboratory, Adelphi, MD, and the Army Communications-Electronics Research, Development, and Engineering Center, Aberdeen Proving Ground, MD.

B. Program Change Summary (\$ in Millions)	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015 Base</u>	<u>FY 2015 OCO</u>	<u>FY 2015 Total</u>
Previous President's Budget	60.300	59.021	56.711	-	56.711
Current President's Budget	85.099	58.990	56.435	-	56.435
Total Adjustments	24.799	-0.031	-0.276	-	-0.276
• Congressional General Reductions	-0.172	-0.031			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	33.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.864	-			
• Adjustments to Budget Years	-	-	-0.276	-	-0.276
• Sequestration	-7.165	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / ELECTRONICS AND ELECTRONIC DEVICES	Project (Number/Name) EM4 / Electric Component Technologies (CA)
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
EM4: <i>Electric Component Technologies (CA)</i>	-	27.573	-	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Electronic Component applied research.

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

	FY 2013	FY 2014	FY 2015
<p>Title: Silicon Carbide Research</p> <p>Description: This is a Congressional Interest Item.</p> <p>FY 2013 Accomplishments: Silicon Carbide Research</p>	10.863	-	-
<p>Title: Energy Efficiency</p> <p>Description: This is a Congressional Interest Item</p> <p>FY 2013 Accomplishments: Researched 3-D Printing Technology of Thermoelectric Materials for Multi-Function Applications; Environmental Control Unit Thermal Improvement Program; Flexible Electronics Research; Thermophotovoltaic Power Sources; High energy efficient electro-active materials for higher rate higher energy density energy storage; Lightweight, conformal Soldier-worn power sources</p>	16.710	-	-
Accomplishments/Planned Programs Subtotals	27.573	-	-

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 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) EM4 / <i>Electric Component Technologies (CA)</i>

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

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / ELECTRONICS AND ELECTRONIC DEVICES	Project (Number/Name) EM8 / High Power And Energy Component Technology
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
EM8: <i>High Power And Energy Component Technology</i>	-	14.438	14.920	13.182	-	13.182	12.232	12.761	12.968	13.020	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project provides for the research, development, and evaluation of high-power electronic components, materials, and related technologies. These technologies have application in compact and efficient power conversion, conditioning, and management sub-systems; energy storage and conversion devices; radio frequency (RF)/microwave and solid-state laser directed energy weapons (DEW); and traditional and non-traditional RF and laser electronic attack. All project elements are coordinated with and, as appropriate, leveraged by DEW and power/energy programs in the Air Force, Navy, High Energy Laser Joint Technology Office, Defense Threat Reduction Agency, national labs, university consortia, and relevant industry and foreign partners. The products of this research are required by developers of Army (DoD) systems to evolve traditional (mechanical-based) sub-systems such as geared transmissions, plate armor, and kinetic projectiles to electrically-based ones. These products will provide the Soldier enhanced survivability and lethality through increased power management and energy savings as well as new fighting capabilities offered only by electrical power.

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

The work in this project is coordinated with the U.S. Army Tank and Automotive Research, Development, and Engineering Center (TARDEC); Armaments Research, Development, and Engineering Center (ARDEC); the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC); and the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC). These efforts were previously funded in PE 0602120A (Sensors and Electronic Survivability).

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 on this project is performed by the U.S. Army Research Laboratory (ARL), Adelphi, MD.

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

	FY 2013	FY 2014	FY 2015
Title: High Power and Energy Technologies	1.120	1.128	1.187
Description: Research and evaluate electronic materials, structures, and components that will enable the realization of higher energy density and efficiency required by future Army systems such as electromagnetic armor, directed energy weapons, power grid protection, and other pulsed-power systems. Special emphasis is on components operating at high voltages - greater than (>) 10 kilovolts (kV).			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) EM8 / <i>High Power And Energy Component Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Investigated and conducted experiments with FY12 advanced wide band gap materials, such as silicon carbide (SiC), operation at e20kV with emphasis on high voltage packaging based on the results of FY12's >10 kV SiC component research; and identified and assessed wide band-gap semiconductors (such as aluminum nitride) that allow higher voltage (>25kV) operation for expanded power control in survivability and lethality applications.</p> <p><i>FY 2014 Plans:</i> Investigate and develop advanced wide band gap materials and devices, for operation at and above 20kV to support survivability, lethality systems, and high voltage micro-grid application requirements; evaluate high voltage packaging needs and identify packaging research; and initiate research into wide band-gap semiconductors identified in FY13.</p> <p><i>FY 2015 Plans:</i> Will investigate and develop advanced wide band gap materials and devices, for operation at and above 20kV to support survivability, lethality systems, and high voltage microgrid application requirements; research and evaluate high voltage packaging needs; and continue research into wide band-gap semiconductors identified initiated in FY14.</p>			
<p><i>Title:</i> High Energy Laser Technology</p> <p><i>Description:</i> Research novel solid-state laser concepts, architectures, and components with the goal of providing technology to Army directed energy weapon developers. Exploit breakthroughs in laser technology, material development and photonics basic research to meet the stringent weight/volume requirements for platforms. Applied research will be conducted in close collaboration with domestic and foreign material vendors, university researchers, as well as major laser diode manufacturers.</p> <p><i>FY 2013 Accomplishments:</i> Investigated solid-state laser thermal management based on composite design of the gain elements (materials that are stimulated to produce laser light) with optically transparent heat sinking material in order to further increase beam power while preserving high beam quality.</p> <p><i>FY 2014 Plans:</i> Experimentally validate feasibility of a fiber laser which could provide significantly improved thermal management in order to achieve advanced power scalability (>10X) with good beam quality; and scale chirped diode laser seed technique to obtain multi kW power output from a 1060 nm fiber amplifier.</p> <p><i>FY 2015 Plans:</i> Will investigate techniques for power scaling continuous wave (CW) and pulsed mid-wave infrared (IR) sources for IR countermeasure (IRCM) applications; and explore laser materials with enhanced thermal conductivity that will provide superior</p>	2.213	2.544	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) EM8 / <i>High Power And Energy Component Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
ability to meet stringent Army size, weight, and power (SWAP) requirements for counter radar-absorbing material (RAM) applications.				
<p>Title: Directed Energy/Electromagnetic Environments (EME) Technologies</p> <p>Description: Investigate and evaluate emerging technologies related to DE technology, electronic warfare (EW) survivability/ lethality, operations in the EME, and supporting high power components with the goal of enhancing the survivability/lethality of Army platforms.</p> <p>FY 2013 Accomplishments: Investigated the susceptibility of a variety of Improvised Explosive Device (IED) targets in order to determine the vulnerability of these threats as well as design neutralization strategies; designed and developed an initial neutralization sub-component that is a part of a integrated radio frequency based detection, location and IED neutralization technology for future counter IED devices; and investigated the effect of Digital Radio Frequency Memory (DRFM) technology (one of the top concerns in EW across the DoD) on U.S. sensors and receivers and transitioned data to ARDEC, CERDEC, U.S. Army Test and Evaluation Command (ATEC), and program managers as appropriate.</p> <p>FY 2014 Plans: Characterize the susceptibility of emerging IED threats to identify their unique susceptibilities/vulnerabilities. Design neutralization waveforms and techniques based on their vulnerabilities; and develop and evaluate smart RF waveforms to create countermeasures to affect electronic devices.</p> <p>FY 2015 Plans: Will determine the susceptibility of emerging threat electronics (to include those related to IEDs) to electronic attack; characterize parameters for use in the development of neutralization waveforms and techniques; investigate DRFM technology and its effects on jamming/counter-jamming applications; and develop cognitive RF architecture and baseline hardware and algorithms for sensing and exploiting electromagnetic environment.</p>		2.277	2.386	2.396
<p>Title: Electronic Components and Materials Research</p> <p>Description: Investigate, and evaluate compact, high-efficiency, high-temperature, high-power component technologies (such as semiconductor, magnetic, and dielectric devices) for hybrid-electric propulsion, electric power generation and conversion, and smart/micro-grid power distribution. Research addresses current and future Army-unique performance and operational requirements.</p> <p>FY 2013 Accomplishments:</p>		4.334	4.335	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) EM8 / <i>High Power And Energy Component Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Investigated advanced wide band gap modules developed in FY12 for use in vehicle and micro-grid applications that potentially provided improved fault tolerant operation and efficiency; and conducted applied research on next-generation wide band-gap materials and devices to provide high temperature, voltage, and current conversion for micro-grid applications.</p> <p>FY 2014 Plans: Investigate advanced control and diagnostic methods intended for power switches to improve fault tolerance and efficiency; conduct applied research on next-generation materials and fabrication methods for passives and wide band-gap materials and devices and develop switching components to provide power conversion components for micro-grid applications.</p> <p>FY 2015 Plans: Will investigate both gallium nitride (GaN) and silicon carbide (SiC) based electronic components for device reliability and characterize these materials; investigate advanced control and diagnostic methods for power switches to improve fault tolerance and efficiency; conduct applied research on next-generation materials and fabrication methods for compact power switching components that provide high voltage, high current, and/or high frequency operation; and investigate and develop advanced power semiconductor devices and modules, for operation at above 20kV and at high currents.</p>				
<p>Title: Power System Components Integration and Control Research</p> <p>Description: Research and evaluate the configuration of electronic components and control strategies required to achieve high-power density and high efficiency power utilization in current and future platform sub-systems, vehicle, and micro-grid (installation) applications to include the operation of military-specific power distribution topologies at the system and circuit levels.</p> <p>FY 2013 Accomplishments: Conducted applied research in designing advanced control techniques, such as smart switches, to provide more efficient, robust, and reliable power delivery for vehicle power applications; and conducted investigations at the system and circuit levels to evaluate micro-grid topology effectiveness.</p> <p>FY 2014 Plans: Conduct applied research in intelligent controls and diagnostics for power conversion modules and circuits to provide more efficient, robust, and reliable power delivery and conversion for vehicle and micro-grid power applications; research intelligent control methodologies for micro-grids and other power distribution systems; and investigate bidirectional power conversion circuits for platform and micro-grids.</p> <p>FY 2015 Plans: Will conduct applied research in power management, intelligent controls, and diagnostics for power conversion modules and circuits to provide more efficient, robust, and reliable power delivery and conversion for vehicle and micro-grid power applications; investigate advanced behavior based Tactical Energy Network control and prediction techniques; and research distributed control</p>		3.550	3.787	4.599

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) EM8 / <i>High Power And Energy Component Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
strategies to enable more robust and failure resistant grids (e.g. utilize swarm (hive or colony) control, where each member of the swarm represents a specific piece of equipment).				
<p>Title: Pulsed-Power Components and Systems Research</p> <p>Description: Investigate, and evaluate emerging technologies such as energy storage capacitors, high voltage converters, and high rate-of-current-rise semiconductor switches, explosive based pulse generators, that improve the reliability and efficiency of pulsed-power components for applications such as electromagnetic armor, electronic fuze initiators, and electronic protection systems.</p> <p>FY 2013 Accomplishments: Experimentally characterized and validated the FY12 silicon carbide (SiC) switch and other components in an electromagnetic armor demonstration system in support of efforts in PE 062618/project H80 and with TARDEC in PE 063005/project 441; and designed novel compact high power devices, modules, converters and passive components utilizing emerging wideband gap materials that provide enhanced power density for survivability systems with reduced space and weight.</p> <p>FY 2014 Plans: Analyze semiconductor switch and component operation under extreme currents and voltages; experimentally characterize and validate improved FY13 SiC switches and other components for electromagnetic armor systems; and develop enhanced power dense power conversion hardware to reduce size and weight for platform survivability efforts through the implementation of novel materials, circuits and module designs.</p>		0.944	0.740	-
Accomplishments/Planned Programs Subtotals		14.438	14.920	13.182
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H11 / <i>Tactical And Component Power Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H11: <i>Tactical And Component Power Technology</i>	-	9.851	11.685	11.769	-	11.769	11.895	11.980	9.686	9.656	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project identifies, advances, and enhances emerging power generation, energy storage, and power management components and software. This project researches advancements in enabling small unit & Soldier power management, decision making, and distribution. This project also researches power sources that are smaller and more fuel-efficient, advanced cooling systems that enable tactical sustainability and survivability.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Soldier/Squad and Innovative Enablers portfolios. Work in this Project complements and is fully coordinated with efforts in PE 0603001A (Warfighter Advanced Technology).

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Soldier Power Technologies (formerly Soldier Hybrid Power and Smart Chargers)	6.197	7.721	7.529
Description: This effort designs, fabricates and validates Soldier-borne hybrid power sources, batteries, rapid battery chargers, and power management software, devices and techniques in order to decrease Soldier load and power burden, increase power capabilities such as extending battery run-time, and decrease battery sizes and costs.			
FY 2013 Accomplishments: Fabricated higher rate lithium (Li) ion conducting membranes and air electrode catalysts for advanced Li/Air disposable battery; validated bio-inspired cathode coatings for rechargeable lithium ion cells to improve and exhibit battery safety characteristics and cell performance in a representative environment; further enhanced rechargeable Li/Air battery to achieve and exhibit greater cell energy density in laboratory environment; validated a rechargeable Soldier hybrid power source (external combustion or fuel cell) with greater energy density and extended run time in a laboratory environment; optimized electro-catalyst and alkaline membrane electrolyte performance with different fuels; improved sulfur tolerant catalysts to promote longer system life.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H11 / <i>Tactical And Component Power Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Investigate very high energy density lighter weight Soldier hybrid power sources including wearable conformal Li/Air disposable batteries; increase power density of Li/Air by designing, fabricating and assessing carbon nano-based air electrodes; investigate highly conducting, robust, lower cost lithium ion conducting membranes to further reduce weight and cost of Soldier batteries; investigate renewable multi-fueled Soldier portable power sources and aluminum hydride (high energy density) based fuel cells with extended run time, higher energy density and higher fuel to energy conversion efficiency; assess Soldier wireless power and energy harvesting concepts to reduce electrical wiring and connectors, achieve greater power transmission efficiencies and reduce energy logistics for extended missions; investigate processes, techniques and hardware for safe wireless power distribution for Soldier borne equipment and wireless charging of Soldier borne batteries.</p> <p>FY 2015 Plans: Will mature very high energy density hybrid power sources as a wearable conformal power source; design a smart Soldier power grid capable of integrating energy storage and power generation devices with smart power management and distribution with little to no user interaction; mature internal components to facilitate a renewable multi-fueled Soldier portable power source; investigate a system to integrate wireless power and energy harvesting technologies into the smart Soldier power grid to reduce cabling and connectors; continue to investigate techniques to increase wireless power transfer efficiency and distance; conduct experiments on novel energy harvesting components to increase efficiency and reduce weight of carried power sources.</p>				
<p>Title: Energy Informed Operations (formerly Silent Mobile Power)</p> <p>Description: This effort investigates power generation materials, components and systems to increase energy output, reduced weight and noise, while increasing fuel and cost efficiency in mobile power generation sources. Products are silent mobile power components and materials, waste-heat recovery components and systems, transitional power sources in the 500 watts (W) to 2 kilowatts (kW) range, towable generator sets up to 100 kW and renewable energy components and power management systems up to 5 kW.</p> <p>FY 2013 Accomplishments: Fabricated and validated advanced logistic fueled 250 to 1000 W mobile power generators with advanced sensors, power electronics/controls and advanced materials to achieve greater fuel-to-electric efficiency and increase component survivability through real time response to rapid changes in load, environment, and usage; designed and fabricated 3 to 5 kilowatt-hour military standard hybrid energy storage components to maximize fuel economy, extend mission times, reduce recharging and disposal burden of batteries, and support patrol base and command post applications; designed and fabricated integrated components and code software for power management of a smart power grid scalable from Brigade to installation power levels; fabricated and conducted experiments with smaller, lighter hybrid renewable (battery/engine/wind/solar) energy and co-generation equipment with improved fuel-to-electric efficiencies that provide environmental control (i.e., air conditioning) for Brigade tactical operations.</p> <p>FY 2014 Plans:</p>		3.654	3.964	4.240

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H11 / <i>Tactical And Component Power Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Investigate monitoring tools for Squad, Platoon and Brigade command post renewable energy power grids (300 W to 10 kW) to provide grid status to the commander; code intelligent power management protocols to increase reliability and efficiency of renewable energy integrated with fossil fuel generators; design and assess high energy density, efficient energy storage modules; investigate advanced harvesting of carbon dioxide (CO2) from exhaust to provide for autonomous power generation (fuel cells and external/internal combustion) and reduced fuel logistics; design alternative CO2 based co-generation capabilities for greater cooling capacity and reduced weight/size of environmental control units.</p> <p>FY 2015 Plans: Will develop intelligent power management architecture for mobile power generation grids to enable energy informed operations for integrated command, control, communications, computers, intelligence, surveillance and reconnaissance platforms; design a system of interconnected power grids of various voltages with multiple controllers using a master/slave control scheme capable of supporting ad-hoc connections and configuration; establish standards for renewable power generation and energy storage and incorporate into demonstration grid; establish power management protocols and policies for interfacing with mission systems; develop power planning tools and applications for monitoring and controlling grid status; develop advanced 2kW fuel efficient silent power generation systems with greater than 30% fuel to electric efficiencies.</p>			
Accomplishments/Planned Programs Subtotals	9.851	11.685	11.769

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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602705A / ELECTRONICS AND ELECTRONIC DEVICES				Project (Number/Name) H17 / Flexible Display Center			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H17: Flexible Display Center	-	5.915	2.702	0.571	-	0.571	1.145	1.017	1.031	1.082	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project fabricates and evaluates flexible display and electronic components emerging from the Army's Flexible Display Center (FDC) at the Arizona State University and materials and devices for flexible electronics developed at the Army Research Laboratory. This applied research on flexible display and electronic technologies makes them inherently rugged (no glass), light weight, conformal, potentially low cost, and low power. The resultant technology would enable enhanced and new capabilities across a broad spectrum of Army applications (such as hands-free/wrist mounted situational awareness devices, flexible X-Ray devices, large areas sensor, tagging, tracking, and soldier monitoring.)

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

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

Work in this project is executed by the U.S. Army Research Laboratory (ARL), Adelphi, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Flexible Display Center (FDC) and Flexible Electronics Development	5.915	2.702	0.571
Description: The Flexible Display Center is developing high resolution flexible reflective (electrophoretic) and emissive (organic light emitting diodes) displays and sensing arrays. The U.S. Army Research Laboratory is developing materials and devices and processes for flexible electronics for Army applications.			
FY 2013 Accomplishments: Continued to design full color light emitting displays and the related flexible electronics for soldier applications.			
FY 2014 Plans: Develop flexible electronic sensor devices for Army applications to include radiation sensors (visible to x-ray) and particle detection.			
FY 2015 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H17 / <i>Flexible Display Center</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Will develop printable sensor materials and devices that will enable new and enhanced capabilities in a areas such as flexible electronic large areas sensors, tagging, tracking, and soldier monitoring.			
Accomplishments/Planned Programs Subtotals	5.915	2.702	0.571

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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602705A / ELECTRONICS AND ELECTRONIC DEVICES				Project (Number/Name) H94 / Elec & Electronic Dev			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H94: Elec & Electronic Dev	-	27.322	29.683	30.913	-	30.913	30.400	31.534	31.868	32.473	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs and evaluates electronics and electronic components and devices for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) applications and battlefield power and energy applications. Significant areas of component research relevant to C4ISR include: antennas, millimeter wave components and imaging, micro- and nanotechnology, eye-safe laser radar (LADAR), vision and sensor protection, infrared imaging (IR), photonics, and prognostics and diagnostics. Areas of research relevant to power and energy include power and thermal management, micro-power generators and advanced batteries, fuel reformers, fuel cells for hybrid power sources, and photosynthetic routes to fuel and electricity.

This project supports Army science and technology efforts in the Command Control and Communications, Soldier, Ground and Air portfolios. Work in this project is fully coordinated with PE 0602709A (Night Vision Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Command, Control, Communications Advanced Technology), PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Adelphi, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Antennas and Millimeter Wave Imaging	3.400	4.574	3.439
Description: This effort designs evaluates and validates high performance antenna components and software for multifunction radar and communication systems. Research areas include scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability.			
FY 2013 Accomplishments:			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Developed low-profile antennas suitable for conformal and embedded platform applications; and developed and assessed millimeter wave and terahertz imaging devices and phenomenology for a wide range of applications such as low-visibility navigation and detection of concealed body-borne threats.</p> <p>FY 2014 Plans: Develop new terahertz detector for covert surveillance; continue millimeter wave antenna development; develop and evaluate carbon nanotube based antenna structures for potential integration into soldier uniforms; and design and develop antenna components to allow interoperability of and reduce interference between electronic warfare and communications functions on a single antenna system; and validate performance of antenna components in laboratory experiments.</p> <p>FY 2015 Plans: Will evaluate the performance of millimeter wave transceivers for covert communications and sensing; extend and modify microwave radar rain scattering models to frequencies above 200 GHz to support transmission of data through rain and dust; and develop and evaluate conformal antennas for non-standard vehicle, covert applications.</p>				
<p>Title: Advanced Micro and Nano Devices</p> <p>Description: This effort designs and evaluates micro and nanotechnology components for multifunctional and integrated radio frequency (RF) applications, microrobotics, integrated energetics, control sensor interfaces and sensors for improved battlefield awareness. Work being accomplished under PE 0601102A /project H47 compliments this effort.</p> <p>FY 2013 Accomplishments: Validated mechanical microcontroller for integrated control of electronically-scanned antennas; developed methods to extend autonomous jumping microrobot to multiple jumps > 5cm for increased mobility; designed and evaluated Microelectromechanical Systems (MEMS) based, low power rotational acceleration switch arrays for detection of potential traumatic brain injury-causing events; evaluated carbon based devices and developed circuits for future amplifiers and frequency doublers; and grew, characterized and fabricated graphene materials and structures for future high performance and low power Army electronic applications.</p> <p>FY 2014 Plans: Develop, synthesize and evaluate conformal and transparent graphene based electronics, and super-capacitors for high energy and power density; develop MEMS ultra high frequency (UHF) switchable filter module with variable bandwidth, center frequency tuning, and insertion loss <3 dB; investigate integration of MEMS and nano-energetics to enable directionality for jumping microrobots; develop piezoMEMS actuators for tethered flight and millimeter scale robotics; develop a digital interface between</p>		3.353	2.637	2.525

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>the MEMS acceleration switch arrays and the electronics to reduce power consumption; and investigate MEMS-based magnetic permeability sensing hardware for reading and writing non-erasable magnetic memory.</p> <p>FY 2015 Plans: Will develop and prototype MEMS technologies for enabling frequency agile RF systems, mm-scale robotic platforms, and novel MEMS and sensor fusion solutions for enabling position, navigation, and timing in global positioning system (GPS) denied environments; continue investigation of novel stacked two dimensional (2-D) electronic materials (e.g. graphene, moly-di-sulphide, boron nitride) for Army relevant high performance electronic devices such as flexible and transparent transistors, antennas, oscillators, and amplifiers; develop nanoscale energetic materials for micro-autonomous vehicle propulsion, technology protection, and fuze initiators; optimize magnetic tunnel junction interface with magnetic permeability bits to enhance memory density and read speed; develop MEMS acoustic vector intensity probes for target localization and wind mitigation; and develop intrusion detection algorithm to enhance communication link security.</p>				
<p>Title: Millimeter Wave Components and Architectures for Advanced Electronic Systems</p> <p>Description: This effort researches, designs and evaluates component materials, structures, devices, and the electromagnetic issues of millimeter wave (mmw) components and active devices. The goal is to develop components that can enable advanced systems that combine multiple RF functionalities.</p> <p>FY 2013 Accomplishments: Designed high density RF circuit with reduced size, weight and power (SWaP) for radar, communications, and electronic warfare applications; refined mmw power amplifier linearization design to optimize efficiency and output power for improved data throughput and reduced SWaP in satellite communications (SATCOM) applications; and designed, fabricated and experimentally validated radio receiver components that can sense, identify and exploit RF threat signatures for improved standoff threat signal identification.</p> <p>FY 2014 Plans: Investigate and evaluate RF component integration techniques; build and evaluate test antennas and amplifiers capable of receiving inherently weak wideband threat signatures; and design and fabricate a circuit that digitizes signals at mmw frequencies to enable architectures for SATCOM with smaller form factors.</p> <p>FY 2015 Plans: Will develop and test multi-function RF components capable of receiving weak signals and threat detection using a combination of advanced processing and hardware architectures; investigate novel thermal management techniques for heat removal in high power amplifiers; and develop and evaluate efficient, wideband, secured communications at mmw/terahertz frequencies.</p>		3.641	4.207	5.357
<p>Title: Imaging Laser Radar (LADAR) and Vision Protection</p>		2.196	2.715	2.749

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort develops and assesses eye-safe three dimensional (3-D) laser radar (LADAR) components and phenomenology for long-range reconnaissance and short-range unmanned ground and air vehicle applications. The effort also develops and evaluates materials for passive protection of electro-optic (EO) vision systems from lasers.</p> <p>FY 2013 Accomplishments: Assessed skin-based, long-range biometric identification phenomenology for uncooperative subjects; and completed assessment of LADAR on small-robotic platforms to validate perception performance under realistic conditions.</p> <p>FY 2014 Plans: Integrate and evaluate enhanced switching technology with an inorganic crystal-based optical switch for improving laser protection electro-optic shutters; develop and evaluate skin-based spectroscopic and advanced holographic technologies for the identification and verification of uncooperative subjects; and design and develop miniaturized components for high resolution active imaging systems (LADAR and holographic) for higher range and angular resolution.</p> <p>FY 2015 Plans: Will advance the development of fast EO shutters using inorganic crystal-based materials in conjunction with device tiling with the goal of increasing aperture size for non-focal plane vision protection from lasers; research new LADAR concepts to reduce hardware cost/complexity and multi-spectral illumination to detect explosive constituents and targets; and conduct field experimentation on novel hostile fire sensing component technology.</p>			
<p>Title: Photonics and Opto-Electronic devices</p> <p>Description: This effort investigates and evaluates novel photonic components and architectures to enable detection of hazardous substances for enhanced Soldier situational awareness and survivability. In addition, this effort develops and assesses the hybridization of opto-electronic (OE) devices with electronics for optical fuze applications.</p> <p>FY 2013 Accomplishments: Investigated active optical fuses to advance target detection device performance; evaluated laser spectroscopic phenomenology to determine inherent specificity and sensitivity for detection of hazardous or suspicious materials at several ranges; and examined trace detection capability of infrared photoacoustic spectroscopy for detecting energetic materials as well as electromagnetic signatures to enhance detection of hostile threats.</p> <p>FY 2014 Plans:</p>	1.901	2.316	1.287

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>

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

	FY 2013	FY 2014	FY 2015
<p>Measure the optical spectra of energetic and energetic related materials using ultra fast laser spectroscopy techniques and infrared photo-acoustic spectroscopy to identify explosive materials; and simulate, fabricate, and characterize advanced silicon photonic devices for improved sensing and processing.</p> <p>FY 2015 Plans: Will evaluate ultrafast laser spectroscopy techniques, especially multiplex Coherent Anti-Stokes Raman Scattering (CARS), to enable remote explosives detection; explore infrared photothermal technique used in conjunction with laser Doppler vibrometry for energetic-related material detection; and simulate and characterize advanced optical components in a threat detection device for active protection defeat of both kinetic energy and non-kinetic energy targets.</p>			
<p>Title: Power and Thermal Management for Small Systems</p> <p>Description: This effort investigates designs and fabricates MEMS based components to improve power generation and micro-cooling technology for both dismounted Soldier and future force applications.</p> <p>FY 2013 Accomplishments: Designed and evaluated compact thermal management components utilizing phase change materials to improve heat rejection capabilities, increase cooling capacity, and reduce volume; fabricated efficient high power density, multifunctional components and sub-systems for capturing, transforming, and delivering power to emerging microsystems; developed and experimentally validated combustion models for JP-8 and alternative fuels and integrate into the design of catalytic liquid fueled energy converters; and characterized catalysts for fuel conversion and fuel synthesis to identify mechanisms for efficient alternative fuels production.</p> <p>FY 2014 Plans: Establish models for package integrated thermal solutions to balance continuous and transient loads in electronic substrates; assess emerging thermoelectric materials and modules for power generation under the high temperature conditions required for efficient direct power generation or waste heat recovery; characterize catalysts for fuel conversion (JP-8 and alternative fuels) to build reaction models for efficient combustion design; investigate improved interconnects between solar cells with gallium nitride materials with advanced structures and interfacing to lower resistance and thereby improve efficiency of the modules; and investigate new 3D ultra-high density integration process that will enable disparate best-of-breed sensors and electronics to be integrated within a single package with minimal packaging overhead and interconnect losses.</p> <p>FY 2015 Plans: Will investigate heat management techniques for improving engine waste heat recovery; implement techniques for thermal interface measurements to evaluate heat transfer in novel materials; investigate thermoelectric, pyroelectric, and thermophotovoltaic power generation techniques and materials for applicability in direct power generation; will characterize advanced materials for improved fuel conversion efficiency and apply them toward developing improved reaction models;</p>	3.717	3.972	3.390

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
investigate improved techniques for wide bandgap material and device design for power supply and conversion systems; and develop improved models and measurement techniques for prediction of silicon carbide device performance and reliability for high power applications.				
<p>Title: Emerging Electronic Devices and Circuits</p> <p>Description: This effort investigates and evaluates emerging electronics such as analog, mixed signal, and millimeter wave. Efforts entail design, fabrication, and evaluation of electronic devices and integrated circuits for use in extreme environments necessary for Army applications</p> <p>FY 2013 Accomplishments: Assessed and evaluated digital source collectors for use in the areas of structural health, usage monitoring, and integrated prognosis; applied prognostics and diagnostics methodologies for built-in self test of RF integrated circuits; evaluated algorithms to assess current health and predict the remaining useful life of wide bandgap (WBG) RF power devices and circuits; and explored diagnostic sensing with non-traditional semiconductors that are potentially extremely low cost, very robust, and conformable.</p> <p>FY 2014 Plans: Develop and design devices and integrated circuits based upon leading edge group IV and III-V semiconducting materials and nanoelectronic approaches; and develop specialized approaches to accommodate extreme environment operation (built-in self-test, ultra-high power/high thermal stress, etc.).</p> <p>FY 2015 Plans: Will mature the design of devices and integrated circuits including built-in self test of high speed integrated circuits based upon leading edge group IV and III-V semiconducting materials; and investigate emerging electronics and prognostics and diagnostics strategies for microgrid energy & power applications.</p>		1.873	1.769	2.050
<p>Title: Advanced Infrared Technology (previously titled Infrared (IR) Imaging)</p> <p>Description: This effort designs and evaluates materials, components and focal plane arrays (FPA) for the next generation of Army's night vision systems, missile seekers, and general surveillance devices. Technologies investigated include mercury cadmium telluride (HgCdTe) on Silicon (Si), strained layer superlattices (SLS) and corrugated quantum well infrared photodetector (C-QWIP) detector arrays for both the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral regions with goals to increase the operating temperature and decrease the cost of focal plane arrays. Work accomplished under PE 0602709A/ project H95 and PE 0601120A/project 31B compliments this effort.</p> <p>FY 2013 Accomplishments:</p>		2.280	2.410	2.662

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Experimentally validated optimized HgCdTe devices on alternate substrates to provide a more sensitive large format and higher resolution LWIR and MWIR C-QWIP FPA; and designed voltage tunable two color C-QWIP FPAs that results in increased resolution and higher operating temperatures for more efficient operation and robust target detection.</p> <p>FY 2014 Plans: Model and exploit electromagnetic resonant effects to design and fabricate high quantum efficiency (up to 70%), large format, long wavelength, quantum well infrared photo-detector focal plane arrays with resolution up to 4 megapixel or higher; develop high quality scalable substrates with Cadmium (Zinc, Selenium) Telluride buffer layers on Silicon; and develop Mercury Cadmium (Telluride, Selenide) based infrared sensing materials and devices; and use thermal cycle annealing to reduce dislocations propagating in the active region, which currently limits operability.</p> <p>FY 2015 Plans: Will develop high quality scalable substrates with Cadmium (Zinc, Selenium) Telluride buffer layers on Silicon and develop HgCdTe material in collaboration with industrial partners; further study thermal cycle annealing (TCA) of HgCdTe IR detecting material to advance the development of low cost, dual-color, high performance night vision detectors; and develop and test high quantum efficiency, high definition resonator quantum well IR photodetector QWIP (R-QWIP) detectors for longwave/midwave infrared (LWIR/MWIR) imaging.</p>				
<p>Title: Power and Energy</p> <p>Description: This effort designs and evaluates chemistries, materials and components for advanced batteries, fuel reformers, and fuel cells. Potential applications include hybrid power sources, smart munitions, hybrid electric vehicles, and Soldier power applications. Investigate applicability of photosynthesis to provide fuel and electricity for Soldier power applications. Investigate silicon carbide (SiC) power module components to enable compact high efficiency, high temperature, and high power density converters for motor drive and pulse power applications.</p> <p>FY 2013 Accomplishments: Designed and evaluated thin film battery devices for munitions; evaluated advanced alkaline membranes and catalysts with improved efficiency for alkaline fuel cells; evaluated catalyzed lithium (Li)-air battery reactions for faster charging and high current discharge; investigated and evaluated processes for synthetically generating energy through photosynthesis; evaluated device physics reliability issues (i.e. material defects, interface impedances) of wide bandgap devices; and investigated and characterized high frequency operation of wide bandgap devices and for new device material implementation in vehicle motor drives and pulse power applications.</p> <p>FY 2014 Plans: Evaluate thin film thermal batteries; experimentally validate computational models of hydroxyl-ion transport in alkaline membranes for alkaline fuel cells; evaluate lithium/sulfur battery chemistry for grid energy storage, investigate solid electrolyte interphase</p>		4.961	5.083	3.954

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602705A / <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	Project (Number/Name) H94 / <i>Elec & Electronic Dev</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>formation on Si anodes for Li ion batteries; demonstrate production of hydrogen gas using photosynthetic methods for alternative energy applications; continue to evaluate and characterize material defects and interface impedances using a diode structure to improve the reliability of electronic power devices; and investigate and characterize high frequency operation of silicon carbide devices for new device material implementation in vehicle motor drives and pulse power applications.</p> <p>FY 2015 Plans: Will transition thin film thermal batteries to U S. Army Armament Research, Development and Engineering Center (ARDEC) for augmented munitions power; determine transport properties of anion exchange polymers for alkaline fuel cells; investigate components for sodium (Na) ion batteries, optimize electrolyte composition for Si anodes for Li ion batteries, develop three dimensional (3-D) strategies for photosynthetic production of hydrogen (H2) for alternative energy applications; and experimentally validate models developed through the multiscale modeling effort for batteries and fuel cells; will investigate gallium nitride (GaN) material based devices in addition to SiC based Metal Oxide Semiconductor Field Effect Transistors (MOSFETs) for reliability and operability characterization.</p>			
<p>Title: Sensor Protection Technologies</p> <p>Description: This research will develop technologies to specifically address laser threats at different frequencies (IR, UV, etc.) and at a variety of pulse widths (pico-second, femto-second). This research will develop technologies to protect Army radars by agile spectrum exploitation, reconfigurable, high speed switching technology and by investigating novel RF power limiters and switching devices to protect RF front ends in contested environments as well as from self-interference challenges where multiple RF systems are operating in close proximity.</p> <p>FY 2015 Plans: Will investigate non-linear EO materials and devices for use in a broad range of sensors, UV, MWIR, and LWIR against very short pulse (down to femto-second) laser threats; investigate materials and novel devices to delay the onset of thermal destruction of optics and optical structures from high energy lasers; improve laser protection by exploring fast EO shutters, using inorganic crystal-based materials, in conjunction with device tiling with the goal of providing increased protection for large aperture sensors; and investigate novel electronic materials to support fast switching devices and power dissipation techniques to protect RF front ends.</p>	-	-	2.000
<p>Title: Energy Harvesting</p> <p>Description: This research develops technologies to substantially reduce the number of batteries required to operate electronics needed to accomplish dismounted Soldier/Squad mission objectives, significantly reducing Soldier-borne load and reducing logistics requirements. Research will explore technologies to harvest electrical power by converting and storing energy via engineered structures and electronic bandgaps, MEMS-based microscale power conversion and heterogenous 3D assembly of</p>	-	-	1.500

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
MEMS with other devices to enable efficient distributed power conversion. Research explores novel paths to local fuel and energy production, including artificial photosynthesis to extract hydrogen and electricity directly from water and sunlight.			
<i>FY 2015 Plans:</i> Will explore novel thermal photo-voltage devices to achieve high efficiency conversion considering available microcombustors and wavelength-optimized semiconductor devices; investigate plasmonic and meta-materials for enhanced surface catalysis experiments for enhanced energy harvesting from battlefield scavenged resources; explore options for reducing parasitic losses for military thermoelectrics; and examine pyroelectric materials and models to determine suitability for energy harvesting.			
Accomplishments/Planned Programs Subtotals	27.322	29.683	30.913

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602709A / <i>NIGHT VISION TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	48.069	43.403	38.445	-	38.445	37.134	37.755	38.757	37.540	-	-
H95: <i>Night Vision And Electro-Optic Technology</i>	-	48.069	43.403	38.445	-	38.445	37.134	37.755	38.757	37.540	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decreases attributed to Congressional General Reductions (-101 thousand); SBIR/STTR transfers (-903 thousand); and Sequestration reductions (-4.171 million)

A. Mission Description and Budget Item Justification

This Program Element (PE) conducts applied research and investigates core night vision and electronic sensor components and software to improve the Army's capability to operate in all battlefield conditions. Technologies pursued in this PE have the potential to provide the Army with new, or enhanced, capabilities to detect and identify targets farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). Project H95 advances infrared (IR) Focal Plane Array (FPA) technologies, assesses and evaluates sensor materials, designs advanced multi-function lasers for designation and range finding, and develops modeling and simulation for validating advanced sensor technologies. In FY11 through FY16 the Army investment in advanced IR FPA technologies is augmented to ensure a world-wide technological and competitive IR sensor advantage for the United States.

Work in this PE is fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology) and PE 0603710A (Night Vision Advanced Technology).

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

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602709A / <i>NIGHT VISION TECHNOLOGY</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	53.244	43.426	38.199	-	38.199
Current President's Budget	48.069	43.403	38.445	-	38.445
Total Adjustments	-5.175	-0.023	0.246	-	0.246
• Congressional General Reductions	-0.101	-0.023			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.903	-			
• Adjustments to Budget Years	-	-	0.246	-	0.246
• Sequestration	-4.171	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H95: Night Vision And Electro-Optic Technology	-	48.069	43.403	38.445	-	38.445	37.134	37.755	38.757	37.540	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts applied research and develops component technologies that enable improved Reconnaissance, Surveillance, Target Acquisition (RSTA) and situational awareness (SA) at an affordable price. Component technologies include novel focal plane arrays (FPAs), processing and electronics improvements, and modeling and simulation to predict performance and to determine operational effectiveness. This research focuses on dual band infrared (IR) FPAs necessary to search, identify and track mobile targets in all day/night visibility and battlefield conditions and to improve standoff detection in ground-to-ground and air-to-ground operations. This project designs, fabricates and validates very large format IR FPAs needed for sensors to simultaneously provide wide area coverage and the high resolution for situational awareness, persistent surveillance and plume/gunflash detection. In addition this project develops multispectral and hyperspectral algorithms for on-chip hyperspectral functionality, which offer the ability to perform detection, identification and signature identification at extended ranges as well as the ability to detect targets in "deep hide". Reducing size, weight and power (SWaP) is a key research objective for all efforts. In FY11 through FY16 the Army investment in advanced IR FPA technologies is augmented to ensure a world-wide technological and competitive IR sensor advantage for the United States.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence	1.269	1.819	1.811
Description: This effort researches a Defense-wide virtual/distributed capability to interactively process both real and generated 3-Dimension multispectral scenes from sensor simulations. Automatic target recognition (ATR) and aided target recognition (AiTR) algorithms are evaluated against realistic operational scenarios in aided or fully autonomous reconnaissance, surveillance and target acquisition (RSTA) missions to include roadside threats/explosively formed projectiles.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Investigated and evaluated adaptable target tracking algorithms for their ability to perform target handoff/distribution from one sensor system to another without losing a target; investigated new processing techniques for developing target detection and tracking algorithms that will allow for less processing power for smaller processors in SWaP constrained platform environments.</p> <p>FY 2014 Plans: Investigate and evaluate target tracking algorithms through image based detection and confirmation processing to reduce false alarms and lost target tracks for persistent surveillance and airborne sensor systems; investigate signal processing and algorithms for threat detection and tracking that minimizes power consumption, enabling the use of smaller processors in SWaP constrained environments.</p> <p>FY 2015 Plans: Will investigate algorithmic correlation approaches to further reduce false alarms in image based detection and confirmation processing for vehicle systems; design and develop improved technology for multifunction display capability; continue to investigate signal processing and algorithms for threat detection and tracking that minimizes power consumption, enabling the use of reduced power processors in SWaP constrained environments.</p>				
<p>Title: Sensor Modeling and Simulation Technology</p> <p>Description: This effort investigates, verifies and validates engineering models, measurement techniques and realistic simulations concurrently with the development and transition of core sensor technologies. The goal of sensor modeling and simulation technology is to improve the fidelity and adaptability of in-house simulation capabilities for the purposes of 1) Warfighter training 2) sensor system analysis 3) identifying and addressing phenomenology associated with imaging technologies and 4) perception lab-based model target task calibration of imaging technologies.</p> <p>FY 2013 Accomplishments: Incorporated, researched and validated an integrated engineering sensor model that included the capability to predict the performance of multiple imaging systems such as multi-waveband image fusion, hyperspectral sensing, polarization sensing, active-passive image fusion (including laser radar), real-time image processing and models against stationary and moving targets or platforms; refined and completed development of a capability to more accurately assess combatant/non-combatant sensor performance criteria.</p> <p>FY 2014 Plans: Expand the engineering models, measurements and simulations to address new and emerging sensor capabilities, modalities and target threats; research and incorporate additions to the predictive engineering sensor performance model to include sub-pixel targets, cooperative sensors, measures of persistence and Three-Dimensional (3D) target rendering; provide calibrated, IR target signatures (human, IED, vehicles) to simulations used for sensor development, training and wargaming; develop and perform perception testing procedures to refine combatant/non-combatant sensor performance related to activity and motion and to</p>		4.983	5.223	5.222

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
document effects of 3D target rendering and displays on human decision; design, implement and publish laboratory measurement standards for new technologies including color/false color imaging, fused imaging across Electro-Optic/Infrared (EO/IR) bands and 3D displays. FY 2015 Plans: Will research and incorporate sensor performance model and measurement techniques to validate the optimal implementation of target and background signatures in simulation; compare laboratory and field measurements to determine if any errors are introduced by methodology; validate and measure imagery post processing algorithms and subsequent effects on human performance; research phenomenology and application of imaging sensor modalities across the waveband spectrum, to include 3D imaging and displays.				
Title: Advanced Multifunction Laser Technology Description: This effort investigates technology for a new class of multi-wavelength laser modules which will replace multiple laser systems and reduce the size, weight and cost of current devices such as laser designators, laser rangefinders (LRFs), pointers, markers, warning systems and illuminators. The goal is to achieve a single housing, electronics board, power supply and telescope for all applications to provide a drastic reduction in the SWaP of multi-function laser system, as well as reduction in the logistics inherent in deploying multiple systems. FY 2013 Accomplishments: Investigated and validated novel breadboard multi-wavelength laser modules for output energy, beam divergence and boresight over MIL-SPEC temperature range; increased the laser efficiency by optimizing the laser resonator configurations and increasing the laser diode pumping efficiency; improved operation over wide operating range; designed a brassboard laser with the goal of minimizing laser SWaP for applications such as designation/marketing, LRF and illumination. FY 2014 Plans: Investigate technology for a single source of multifunction, eye-safe fiber lasers operating in the Short Wave Infrared Band (SWIR, 1.5 to 2.0 microns); design a single laser for multiple applications in a compact package to perform laser range finding, day/night pointing, and 3D LIDAR imaging. FY 2015 Plans: Will design a multifunction SWIR laser breadboard that performs range finding, day-night pointing, and 3D Light Detection and Ranging (LIDAR); extend the laser operating wavelength to Long Wave Infrared (LWIR) by examining alternative laser technology including quantum cascade lasers; research methods for electronically tuning waveband throughout the LWIR band; research and improve laser diode drivers and associated electronics to improve efficiency and power consumption.		2.882	4.273	5.276
Title: High Performance Small Pixel Uncooled Focal Plane Array (FPA)		5.728	3.007	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort increases the working performance of both uncooled Longwave Infrared (LWIR) and Shortwave Infrared (SWIR) technologies. Through design and improved fabrication techniques this work increases detector resolution to high definition formats (LWIR-1920x1200 pixels, SWIR- 1280x720 pixels), improves sensitivity and image quality to increase recognition and identification ranges while reducing SWaP.</p> <p>FY 2013 Accomplishments: Improved the uncooled LWIR FPA design to include a second revision of the ROIC and pixel design to meet the performance goals of increased sensitivity and prevent image degradation; fabricated and evaluated multiple lots to validate performance; designed, fabricated and tested a brassboard camera system including support electronics to operate at higher frame rates.</p> <p>FY 2014 Plans: Complete full performance characterization of the HD 1920 x 1080 pixel uncooled LWIR FPA camera; fabricate the final lot of HD uncooled LWIR FPA and demonstrate in a camera for long range target identification; characterize a high performance uncooled hyperspectral SWIR FPA (1280 x 720 pixel) for detection of difficult targets in high cluttered background.</p>			
<p>Title: Advanced Structures for Cooled Infrared (IR) Sensors</p> <p>Description: This effort researches detector materials and substrates for infrared (IR) sensors. The emphasis is on reducing material defects and increasing the reliability by means of new ways to prepare and treat the substrates and new designs and methods of growing the structures. The goal is to develop cost effective components for high definition Army IR sensors.</p> <p>FY 2013 Accomplishments: Developed an advanced imprint technology to deposit small indium bumps suitable for high definition format FPAs; typified performance of emerging III-V and HgCdTe on alternate substrate FPAs; investigated novel techniques for steep sidewalled plasma etching and passivation thus enabling megapixel III-V and II-VI FPAs.</p> <p>FY 2014 Plans: Validate indium bump process for high definition format FPAs; research advanced steep sidewalled plasma etching for dual band structures for high definition FPAs, which will provide more pixels on target, increased resolution and higher quality images, thus enabling a reduction in defects.</p> <p>FY 2015 Plans: Will investigate new growth methods for improving the uniformity and reducing the cost of very LWIR (wavelength greater than 11 microns) III-V and II-VI materials; investigate new techniques for passivating LWIR III-V small pixel structures; mitigate effects</p>	3.374	4.763	5.762

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
of initial substrate condition and processing on resulting performance; design and validate read-out circuits appropriate for these FPAs.				
<p>Title: Digital Readout Integrated Circuit (ROIC)</p> <p>Description: This effort investigates and designs new Digital Readout Integrated Circuit (DROIC) technology (digital-in-pixel) enabling the affordable very large format and multiband IR FPAs. The digital-in-pixel results in increased signal storage available to collect incoming signal information from the scene, compared to traditional analog techniques. DROIC is an important component in reducing the overall IR sensor cost and SWaP by allowing much smaller FPA pitch. The increased storage improves dynamic range for targeting, situational awareness and persistent surveillance applications.</p> <p>FY 2013 Accomplishments: Fabricated and evaluated high definition, 1280x720 pixel, digital-in-pixel ROIC implementing innovative on-chip signal processing designs with 20 micron pitch unit cell; characterized performance to include dynamic range and signal/noise; conducted design review of ROIC for the 1280x720 FPA with reduced, 12 micron pitch, unit cell resulting in the reduction in overall infrared (IR) sensor cost and SWaP due to much smaller FPA pitch.</p> <p>FY 2014 Plans: Research and develop a high-definition, digital-in-pixel ROIC with on-chip signal processing for a 12 micron, 1280x720 pixel array; validate the DROIC performance (e.g. high dynamic range and low noise) using a well characterized 640x480, 20 micron pixel array.</p>		6.029	2.609	-
<p>Title: Enhanced IR Detector ("nBn") Technology</p> <p>Description: This effort investigates and improves a new barrier detector structure that makes midwave IR FPAs easier and more affordable to manufacture and allows operation at higher temperatures resulting in much more affordable sensor systems and also significant reductions in SWaP of system optics, housings and cryogenic coolers. In addition the barrier detector approach allows for very small pixel pitch (8 micron) enabling FPAs of very large format, 5000x5000 pixel, for persistent surveillance applications that were not possible prior to emergence of this barrier FPA technology.</p> <p>FY 2013 Accomplishments: Fabricated 2000x2500 pixel FPA with a 10 micron pitch implementing successes from design studies of a variety of potential manufacturing methodologies; evaluated resulting FPA structure and investigated techniques to increase yield by reducing defect formation; continued investigation of growth of semi-conductor material layers (nBn) on larger diameter (approximately 4-6 inches) GaSb and GaAs wafers.</p> <p>FY 2014 Plans:</p>		8.637	7.869	3.389

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Research and develop 2000x2500 8 micron pitch and 4000x4000 10 micron pitch FPAs, resulting in a higher resolution, smaller size array; validate resulting FPA structures and investigate techniques to increase yield by reducing defect formation; conduct comparison studies between single very-large-format versus multiple large-format FPAs by examining FPA pitch size, FPA format, butting issues and IR system interfaces and performance relationships; begin research on very small pitch (5-6 micron) ROIC and FPA designs.</p> <p>FY 2015 Plans: Will research and develop nBn large format FPAs (up to 3000x3000, 8-micron pitch) with a cutoff wavelength at or greater than 5 microns and operating at temperatures at or exceeding 130 Kelvin with a goal to achieve repeated performance comparable to indium antimonide; develop processing and hybridization for 8 micron pixel FPAs.</p>				
<p>Title: Strained Layer Superlattices (SLS) Technology</p> <p>Description: This effort investigates and improves III-V material (materials formed by a combination of elements from group III and V of the periodic table) thin film crystal growth of IR FPAs using a very flexible Strained Layer Superlattice (SLS) structure. This will allow high performance multi band infrared FPAs to be produced at much lower costs than the existing II-VI FPAs (Mercury Cadmium Telluride) and can leverage commercial product research and production lines, including cell phone chips, to improve uniformity related to performance.</p> <p>FY 2013 Accomplishments: Validated design of 1280x720 pixel with reduced pixel pitch, 12 micron, dual band MWIR/LWIR FPAs on alternate substrates; evaluated and fabricated these FPAs using analog ROICs; established new growth processes on alternative Gallium Arsenide (GaAs) substrates to reduce defects in the SLS FPA; correlated material performance of growth on GaSb versus GaAs allowing reduction in lattice mismatch defects which increases yield and reduces FPA costs.</p> <p>FY 2014 Plans: Fabricate 1280x720, 12 micron pitch, dual-band midwave/longwave infrared focal plane arrays on 4 inch GaSb and GaAs substrates; resolve the substrate flatness and detector passivation issues; begin material growth and assess the material quality on 6 inch GaSb and GaAs substrates.</p> <p>FY 2015 Plans: Will verify fabrication techniques for a 1280x720, 12 micron pitch, dual-band MWIR/LWIR FPA on analog readout integrated circuits with increased quantum efficiency and reduced noise equivalent differential temperature; hybridize 16 bit digital ROIC with characterized 640x480, 20 micron pitch LWIR FPA; extend cutoff wavelength device designs to 11.5 and 13.5 microns.</p>		9.941	5.369	4.141
<p>Title: Wide Field of View Displays and Processing for Head Mounted Display Systems</p>		5.226	5.303	5.912

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Description: This effort investigates and designs optical filters, objective lenses and personal display viewing optics that will enable ultra-low profile, lightweight sensors and virtual displays for both individual head mounted and vehicle based, multi-user vision systems using the latest developments in holograms for small package optics that can be readily reconfigured (i.e. ultra-small/light optical zoom). Additional work in this effort investigates image processing as part of the optical design strategy and designs novel approaches for color filtering image processing for low light sensors in order to provide a color low-light imaging capability to the US Warfighter. This effort is fully coordinated with PE 0603710A.</p> <p>FY 2013 Accomplishments: Investigated and designed state-of-the-art technology alternatives for large format waveguide based color heads-up displays; investigated and designed light weight waveguide head mounted displays; investigated and designed high definition, sparse color, low light image sensor/color filter architectures and color image processing algorithms. Validated operation of low latency/power color processing algorithms on dedicated processing hardware platform; performed laboratory based proof-of-concept validation of key performance metrics with clear path for SWaP scalability.</p> <p>FY 2014 Plans: Design waveguide optical components with multiple approaches including time domain switchable materials for head mounted and vehicle mounted applications; design and develop color low light solid state silicon focal plane to determine optimum color filter array spectral requirements, mature patterned interference filter coating technology for sub-10 micron pixel spacing and conduct experiments on tactical target low light color phenomenology.</p> <p>FY 2015 Plans: Will integrate waveguide optical components into head wearable form factors for limited data collections and Soldier perception testing; validate ability of large area waveguide virtual displays to provide the space stabilized display in scenes with jitter; fabricate and integrate color low light solid state silicon focal plane as a test platform; determine optimum color filter array spectral requirements; improve patterned interference filter coating technology for sub-10 micron pixel spacing; conduct experiments on tactical target low light color phenomenology.</p>				
<p>Title: Solid State Low Light Imaging</p> <p>Description: This effort develops true starlight and very low light sensing, solid state focal plane technology with reduced power and production cost for Soldier vision enhancement for deficient visibility conditions. The objective of this effort is an all solid state near-IR sensor for replacement of current Image Intensifier (I2) vacuum tube technology.</p> <p>FY 2014 Plans:</p>		-	3.168	4.872

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / NIGHT VISION TECHNOLOGY	Project (Number/Name) H95 / Night Vision And Electro-Optic Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Investigate and develop an all solid state low light imaging architecture with sensor, processor and display in a monolithic stacked design to replace analog vacuum tube based image intensifier; develop ultra-low dark current, high quantum efficiency silicon focal plane array fabrication processes in a US micro-electronic foundry. FY 2015 Plans: Will optimize pixel size and develop back-side illuminated silicon processes for near IR resolution comparable to current I2 technology; develop through silicon via processing capability for 3-dimensional stacking of small pixel silicon FPAs; investigate back-end processing techniques for stacking FPAs with electronics and displays; conduct design studies to determine image processing techniques required for low latency night imaging.				
Title: Sensing and Processing Description: This effort investigates processing and sensor fusion technology for low cost multi-modal sensors. Processing and sensor fusion technology will enable the capability to see through degraded visual environments and to improve situational awareness through automated recognition of personnel and obstacles. FY 2015 Plans: Will investigate incorporation of algorithms for improved situational awareness and mobility in degraded visual environments; develop low power processing techniques for improved imaging through degraded visual environments.		-	-	2.060
Accomplishments/Planned Programs Subtotals		48.069	43.403	38.445
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	28.875	30.563	25.939	-	25.939	25.251	26.677	26.842	27.180	-	-
H24: <i>Countermine Tech</i>	-	14.220	17.499	20.909	-	20.909	19.587	20.961	21.069	21.382	-	-
H35: <i>Camouflage & Counter-Recon Tech</i>	-	2.697	3.064	5.030	-	5.030	5.664	5.716	5.773	5.798	-	-
HB2: <i>COUNTERMINE COMPONENT TECHNOLOGY (CA)</i>	-	11.958	10.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 adjustments attributed to increases for Congressional Add funding (13.0 million); and SBIR/STTR transfers (-415 thousand); Congressional General reductions (-49 thousand); and Sequestration reductions (-2.5 million)
 FY 14 adjustments attributed to increase for Congressional Add funding (10.0 million) and FFRDC reductions (-11 thousand)
 FY15 increase for counter explosive hazard phenomenology.

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs, and evaluates technologies to improve countermine, signature management and counter-sensors capabilities. The focus is on sensor components, sub-components and software algorithms to improve detection of mines, explosive threats and directed energy; ballistic methods to defeat mines and explosive threats; and signature management technologies to reduce reconnaissance capabilities of the enemies. This PE also supports DoD's Center of Excellence for Unexploded Ordnance, which coordinates and standardizes land mine signature models, maintains a catalogue of mine signatures, supports the evaluation of mine detection sensors and algorithms, and working in conjunction with the US Army Engineer, Research and Development Center (ERDC), examines countermine phenomenology of surface and buried mines, and explosive threats. Project H24 advances state of the art Countermine technologies to accurately detect threats with a high probability, reduce false alarms, and enable an increased operational tempo. Project H35 evaluates and develops advanced signature management and deception techniques for masking friendly force capabilities and intentions.

Work in this PE is related to and fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602622A (Chemical, Smoke and Equipment Defeating Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602709A (Night Vision Technology), PE 0602784A (Military Engineering Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603606A (Landmine Warfare and Barrier Advanced 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>
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Work in this PE is performed by the U.S. Army Research, Development and Engineering Command (RDECOM)/Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate(NVESD), Fort Belvoir, VA.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	18.850	20.574	21.542	-	21.542
Current President's Budget	28.875	30.563	25.939	-	25.939
Total Adjustments	10.025	9.989	4.397	-	4.397
• Congressional General Reductions	-0.049	-0.011			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	13.000	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.415	-			
• Adjustments to Budget Years	-	-	4.397	-	4.397
• Sequestration	-2.511	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>				Project (Number/Name) H24 / <i>Countermine Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H24: <i>Countermine Tech</i>	-	14.220	17.499	20.909	-	20.909	19.587	20.961	21.069	21.382	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates, designs and evaluates new countermine components, sub-components and software algorithms for detection, discrimination and neutralization of individual mines, minefields and other explosive threats. The goal of this project is to accurately detect threats with a high probability, reduce false alarms and enable an increased operational tempo.

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

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

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

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

	FY 2013	FY 2014	FY 2015
<p>Title: Department of Defense Unexploded Ordnance (UXO) Center of Excellence (UXOCOEO)</p> <p>Description: The Army serves as executive agent of the Unexploded Ordnance (UXO) Center of Excellence (COE), which provides for the coordination of UXO activities across the Department of Defense (DoD) Army, Navy, Air Force and Marine Corps programs. The UXOCOEO serves as the focal point for research, development, testing and evaluation (RDT&E) for UXO detection, clearance technologies, remediation and sensor/signature/DOD program database development. Technologies investigated for mitigating UXO are oriented to land and underwater approaches.</p> <p>FY 2013 Accomplishments: Investigated various UXO detection sensors, performed field data collections against UXO surrogates and real targets in realistic background environments and updated the signature database.</p> <p>FY 2014 Plans: Research a high power laser neutralization source that enables safe standoff removal of wire obstacles while on the move.</p>	0.360	0.453	-
<p>Title: Standoff Sensors for Explosive Hazard Detection</p> <p>Description: This effort investigates all-terrain standoff detection using novel sensors and detection algorithms, including low grazing angle algorithms for forward looking Electro-Optic/Infrared (EO/IR) and RADAR sensors, to increase identification and</p>	7.065	7.559	5.409

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermining Systems</i>	Project (Number/Name) H24 / <i>Countermining Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>reduce false alarm rates (FAR) of explosive hazards. This effort also investigates new sensor phenomenologies to confirm buried threats at deeper depths (up to 1.5 meters deep) such as those from multispectral, low frequency electro-magnetic (EM), and low parity doppler interferometric sensors.</p> <p>FY 2013 Accomplishments: Designed and fabricated a multi-band ground penetrating radar (GPR) demonstrator integrating both downward looking and forward projecting antennas; began field data collections and evaluations using GPR demonstrator, based on the results, refined hardware and improved software target recognition algorithms to improve probability of detection and lower false alarm rates; investigated phenomenological standoff vibration technology in combination with the EM, electromagnetic interference (EMI) and EO based sensors for detection of shallow and more deeply buried explosive hazards; improved software to automatically adapt to available sensor inputs in real time.</p> <p>FY 2014 Plans: Validate designs of component antenna arrays and conduct experiments for a multi-band forward looking GPR demonstrator; investigate EO forward projecting laser radar (LADAR) to assist forward looking radar; develop advanced detection algorithms utilizing high resolution surface terrain information obtained from the integration with LADAR; conduct field data collections of standoff vibration technology in combination with the EM, EMI and EO based sensor for detection of shallow and more deeply buried explosive hazards; enhance visualization workstation software to incorporate available sensor inputs in real time.</p> <p>FY 2015 Plans: Will integrate dual band Forward Looking Ground Penetrating Radar (FLGPR) and EO/IR sensors on a brassboard demonstrator; conduct phenomenology studies to determine feasibility of fusion of multiple sensor modalities for improved detection; extend detection depth of low parity Doppler interferometer using seismic sources.</p>				
<p>Title: Chemically Specific Detection of Explosive Threats</p> <p>Description: This effort investigates emerging chemically-specific explosive hazards (to include Home Made Explosives (HMEs)) and detection technologies to address Warfighter needs. The effort will provide technologies for standoff detection and confirmation of emerging threats and production facilities and is complimentary to the work being accomplished under PE 0602622A/Project 552.</p> <p>FY 2013 Accomplishments: Investigated and validated emerging technologies capable of detecting explosive related threats including HME production facilities; conducted technical experiments in technologies for HME detection to include Ultraviolet (UV) laser-based Raman spectroscopy to exploit conventional and HME signatures in complex backgrounds and polymer-based sensors to exploit residues</p>		4.532	6.000	4.815

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>	Project (Number/Name) H24 / <i>Countermine Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>and vapors at ultra trace amounts; investigated and validated point confirmation technologies that exploit conventional and HME residues and vapors at ultra-trace amounts for classification and identification purposes.</p> <p>FY 2014 Plans: Investigate and validate standoff spectroscopic technologies capable of detecting explosive hazards and HME production facilities; conduct technical experiments using eye safe, low-SWaP, Quantum Cascade Laser (QCL) technology to effectively sample the residues for trace amounts of explosives for identification and standoff illumination for disturbed earth detection.</p> <p>FY 2015 Plans: Will improve algorithms and signal processing to maximize discrimination and reduce false alarms of explosive components; conduct data collections in various conditions to determine detection and identify capabilities against explosive compounds using quantum dots for close proximity sensing and QCLs for stand-off trace detection.</p>			
<p>Title: Dismounted Explosive Hazard Detection Technology</p> <p>Description: This effort investigates emerging technologies enabling the dismounted Soldier to detect explosive hazards. In addition to landmine threats, explosive hazards include: IEDs, HMEs, explosively formed penetrators (EFPs) and antitank/ antipersonnel landmines (metal and non-metallic). Emphasis will be on rate-of-advance, high detection probability and low false alarm rates. SWaP issues will be considered and studied to ensure solutions are viable for Soldier-portable applications. This effort investigates the processing and fusion of GPR and metal detector signals coupled with novel algorithms for increased real-time feedback on threat identification and sensor control.</p> <p>FY 2013 Accomplishments: Investigated emerging electromagnetically-based sensor technology and novel helmet-mounted electro-optical sensors; explored front-end physical and explosive materials sampling approaches oriented towards enhancing short-range standoff explosive hazard detection technologies as a component of a conceptual plug-and-play sensor suite for dismounted operations; leveraged emerging technologies, such as advanced ground penetrating radar antennas, hyperspectral imaging electro-optics, target polarization detection, compact metal detection with target identification, sensor position measurement techniques, explosives sensing materials and virtual display concepts, in combination as part of a portable handheld sensor suite for detection of a broad spectrum of explosive hazards.</p> <p>FY 2014 Plans: Optimize and validate emerging technologies such as advanced ground penetrating radar antennas; compact metal detectors with target identification; position measurement sensors and see-thru displays as part of a portable handheld sensor suite for detection of explosive hazards.</p> <p>FY 2015 Plans:</p>	2.263	3.487	5.495

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Will conduct laboratory data collections using GPR, wide bandwidth metal detectors, and position measurement sensors mounted in a handheld emulation platform to establish a correlated dataset; conduct experiments to determine highly accurate sensor position to improve display of sweep location and subsurface threats; develop near real-time detection and processing capability; conduct trade studies to determine the best combination of novel components and sensors for real-time detection and identification of buried explosive hazard threats using nuclear quadrupole resonance (NQR), GPR and frequency domain metal detectors.			
Title: Explosive Hazard Neutralization Technologies Description: This effort investigates emerging neutralization technologies and techniques to effectively neutralize explosive hazards (to include HMEs) to address Warfighter needs. FY 2015 Plans: Will investigate fiber laser based techniques for low or high-order neutralization of explosive threats at standoff ranges.	-	-	1.190
Title: Counter Explosive Hazard Phenomonology Description: This effort investigates potential long term solutions to the asymmetric explosive hazard threats. It leverages recent lessons learned to investigate new ideas and emerging technologies to counter explosive hazards through better understanding, detection, neutralization and mitigation of the threat. FY 2015 Plans: Will instigate a series of knowledge capture events with industry and academia; develop novel and innovative research efforts in counter-Improvised Explosive Device detection; begin analysis of research areas focusing on non-traditional approaches (such as crowd sourcing and novel sensors) identified as having high potential for significant breakthroughs.	-	-	4.000
Accomplishments/Planned Programs Subtotals	14.220	17.499	20.909

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>				Project (Number/Name) H35 / <i>Camouflage & Counter-Recon Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H35: <i>Camouflage & Counter-Recon Tech</i>	-	2.697	3.064	5.030	-	5.030	5.664	5.716	5.773	5.798	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates, designs and evaluates advanced signature management and deception techniques for masking friendly force capabilities and intentions. Technologies pursued under this effort reduce the cross section of sensor systems. Technologies such as decentered field lens, wavefront coding and spectral filtering and threat sensing algorithms are investigated along with next generation camouflage coatings and paints.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Camouflage and Counter-Reconnaissance Technology for Advanced Spectral Sensors	2.697	3.064	5.030
Description: This effort investigates and advances new techniques to reduce electro-optical (EO) susceptibility of sensors and camouflage. The two primary objectives are to reduce the optical cross section of currently fielded and emerging EO and infrared (IR) sensors and investigate technologies that will enable enhanced spectral signature reduction for next generation camouflage.			
FY 2013 Accomplishments: Leveraged previous funded efforts to design new approaches to reduce the optical cross section of emerging staring sensors, including large format arrays in the visible, near IR, shortwave IR, thermal and uncooled longwave IR (LWIR); conducted thermal signature studies for future development of IR signature reduction techniques, approaches included modified optics, computational imaging, polarization control and antireflection coatings. Investigated two sided camouflage netting for the Ultra Lightweight Camouflage and Netting System program; performed laboratory and field evaluations from FY12 developed prototypes and developed specifications for the next generation Army netting.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>	Project (Number/Name) H35 / <i>Camouflage & Counter-Recon Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Continue development of solutions to reduce optical cross section of large format (EO/IR) arrays; develop and investigate hardware/software, filters and coatings for currently fielded large format EO and uncooled IR sensors; camouflage effort focuses on implementation of thermal signature reduction coatings and methodologies suitable for nets and uniforms. <i>FY 2015 Plans:</i> Will investigate uncooled focal plane array vulnerabilities and exploitation against multiple laser threats; conduct initial studies into adaptive protection for LWIR sensors; incorporate large format array sensor protection solution into hardware/software demonstrators; evaluate multispectral camouflage to include thermal signature reduction technology.			
Accomplishments/Planned Programs Subtotals	2.697	3.064	5.030

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602712A / <i>Countermine Systems</i>	Project (Number/Name) HB2 / <i>COUNTERMINE COMPONENT TECHNOLOGY (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
HB2: <i>COUNTERMINE COMPONENT TECHNOLOGY (CA)</i>	-	11.958	10.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Countermine Systems applied research.

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

	FY 2013	FY 2014	FY 2015
<p>Title: Unexploded Ordinance and Landmine Detection Research</p> <p>Description: This is a Congressional Interest Item.</p> <p>FY 2013 Accomplishments: Investigated advanced sensor and component technologies for vehicular mounted explosive hazard detection, using fast response standoff sensors to increase rates of advance. Sensors exploited disturbed earth and explosive specific signatures while on-the-move. Investigated advanced technologies that enable low size, weight, and power sensors for Soldier portable, handheld, and dismounted explosive hazard detection for current and future unexploded ordnance (UXO) threats incorporating position sensing, augmented displays, wire detection, and advanced explosive specific sensors.</p> <p>FY 2014 Plans: This is a Congressional Interest Item.</p>	11.958	10.000	-
Accomplishments/Planned Programs Subtotals	11.958	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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602716A / <i>HUMAN FACTORS ENGINEERING TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	18.161	21.328	23.783	-	23.783	23.822	23.784	24.139	24.768	-	-
H70: <i>Human Fact Eng Sys Dev</i>	-	18.161	21.328	23.783	-	23.783	23.822	23.784	24.139	24.768	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY15 increases for Soldier sensory performance, training effectiveness and Soldier system architecture research.

A. Mission Description and Budget Item Justification

This program element (PE) conducts applied research on aspects of human factors engineering that impact the capabilities of individual and teams of Soldiers operating in complex, dynamic environments. The results of the research will enable maximizing the effectiveness of Soldiers and their equipment for mission success. The aspects of human factors that will be studied include sensing, perceptual and cognitive processes, ergonomics, biomechanics and the tools and methodologies required to manage interaction within these areas and within the Soldiers' combat environment. Project H70 research is focused on decision-making; human robotic interaction; crew station design; improving Soldier performance under stressful conditions such as time pressure, information overload, information uncertainty, fatigue, on-the-move and geographic dispersion; and enhancing human performance modeling tools.

Work in this project leverages basic research performed in PE 0601102A (Defense Research Sciences), and complements and is fully coordinated with PE 0602601A (Combat Vehicle and Automotive Advanced Technology), PE 0602786A (Warfighter Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0602784A (Military Engineering Technology), PE 0602783A (Computer and Software Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0602785 (Manpower/Personnel/Training Technology), PE 0603005A (Combat Vehicle and Automotive Technology), PE 0603710A (Night Vision Advanced Technology), PE 0603015A (Next Generation Training and Simulation), and PE 0603007A (Manpower, Personnel, and Training Advanced Technology).

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602716A / <i>HUMAN FACTORS ENGINEERING TECHNOLOGY</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	19.872	21.339	20.988	-	20.988
Current President's Budget	18.161	21.328	23.783	-	23.783
Total Adjustments	-1.711	-0.011	2.795	-	2.795
• Congressional General Reductions	-0.049	-0.011			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.113	-			
• Adjustments to Budget Years	-	-	2.795	-	2.795
• Sequestration	-1.549	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H70: Human Fact Eng Sys Dev	-	18.161	21.328	23.783	-	23.783	23.822	23.784	24.139	24.768	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project conducts applied research on human factors to maximize the effectiveness of Soldiers in concert with their equipment. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks, and Soldier training as well as manpower requirements to improve equipment operation and maintenance. Application of this research will yield reduced workload, fewer errors, enhanced Soldier protection, user acceptance, and allows the Soldier to extract the maximum performance from the equipment.

Major efforts research sources of stress, potential stress moderators, and intervention methods, and identify and quantify human performance measures and methods to address current and future warrior performance issues. Individual efforts exploit adaptive learning methods and strategies, enhance and validate human performance modeling tools; investigate integration of advanced concepts in crew stations designs, optimizes interfaces for information systems and improves human robot interaction (HRI) in a full mission context.

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

Results of these efforts are transitioned to the Research, Development, and Engineering Centers, the Program Executive Offices (PEO) & Program Managers, U.S. Army Training and Doctrine Command (TRADOC), U.S. Army Medical Command (MEDCOM), Manpower and Personnel Integration (MANPRINT) G1, U.S. Army Test and Evaluation Command (ATEC), etc.

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

Work is performed by the U.S. Army Research Laboratory (ARL), Aberdeen, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Interfaces for Collaboration and Decision Making	3.238	3.359	3.361
Description: Beginning in FY14, the title of this effort is renamed from Adaptive Learning Methods and Strategies to Interfaces for Collaboration and Decision Making to more accurately reflect the current nature of the project. This effort looks at the study of how networks influence, and are influenced by, human behavior in the context of military decision making. The studies, which			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>range from computational modeling, to networked simulations in a laboratory environment, to large-scale simulation exercises, will investigate the effects of technology on information flow, cognitive workload, team collaboration, organizational effectiveness, situational awareness, and decision making.</p> <p>FY 2013 Accomplishments: Continued to focus efforts on the data rich environment of command and control (C2) planning and execution; enhanced FY12 methods/tools by investigating mission context data aggregation and alert capabilities; investigated and designed user personalization alternatives and techniques for decision-specific queries, summarization, and extraction; refined human-in-the-loop evaluation methods; and established initial evaluation criteria for human decision making and collaboration.</p> <p>FY 2014 Plans: Concentrate on influencing network-enabled operations at the Company level; assess mission command work/information flow, network knowledge requirements, cognitive workload, situation awareness, and unit performance; develop and validate a cognitive work analysis/computational model of the Company Intelligence Support Team and its relationship to Company planning, execution and Commander's decision-making; assess networked handheld decision support tools; continue development and validation of key models (Social Network Analysis, Command, Control and Communication Techniques for Reliable Assessment of Concept Execution (C3TRACE), and Chemical Warfare Agents) of the evolving mission command work domain; support Mission Command Battle Lab network simulation exercises.</p> <p>FY 2015 Plans: Will examine communication capabilities of small team operations at the "edge" of the battlefield, with a focus on the effectiveness of different types of interfaces and (information) presentation techniques; and enhance experimental platforms for studying mission command network operations in civil-military scenarios. Goals are to develop techniques for improved information sharing, more effective use of available information, and new and enhanced metrics and methods leading to a better understanding of how human-network interactions impact distributed team performance. Research will be conducted via human-system information flow modeling, lab, simulation, and field experimentation using novel information and collaboration technologies in realistic networked environments with teams ranging from squads to command headquarters sizes.</p>				
<p>Title: Human Performance Modeling</p> <p>Description: Enhance human performance modeling tools to reduce workload and human errors and increase user acceptance of developing technologies allowing the Soldier to extract the maximum performance from the equipment. Collect and analyze empirical data on human perception (vision and hearing) to support human and system performance models used for equipment design and training. Efforts are coordinated with PE 0602786/project H98.</p> <p>FY 2013 Accomplishments:</p>		2.960	3.531	3.521

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Assessed a theory-based decision quality metric for the Command, Control, and Communications module for future evaluations of decision effectiveness. FY 2014 Plans: Collect and analyze empirical data to support human and system performance models used for equipment design and training; continue to investigate the effects of physical and cognitive stress on Soldier performance, and transition results to Soldier performance models; investigate Soldier load physical and cognitive algorithms developed in FY13 and their application to the human performance models; and examine human performance as a function of cognitive stress, weapon system dynamics, load distribution, etc. FY 2015 Plans: Will develop Human System Integration (HSI) tools and methodologies to quantify the usability of systems developed to support team environments. These tools will provide quantitative data that can be used to support acquisition and design trade off decisions. Research will be conducted using findings from human sciences, algorithm development, field trials with military use cases, and feedback from the research, military, analyst, and system design and development communities.				
Title: Brain-Computer Interaction Description: Beginning in FY14, this effort is renamed from Interfaces for Vehicle and Mobility Systems to Brain-Computer Interaction Technologies to more accurately reflect the nature of the project, a 6.2 program in neuroscience. Investigate the use of neurophysiological and behavior-based technologies for enhancing the interaction between Soldiers and systems such as autonomous systems and advanced crew stations. Implement guidelines for: algorithms for characterizing Soldier brain activity in operational contexts; real-time techniques to integrate neurally-based information into systems designs. FY 2013 Accomplishments: Utilized cognitive state modeling and simulation efforts to enhance Soldier-system performance by investigating cognitive state and performance levels using emerging brain-computer neuro-technologies for future applications. FY 2014 Plans: Develop mitigation techniques for enhancing Soldier-system performance that can be triggered by on-line brain-computer neuro-technologies that predict deficits in Soldier cognitive state and performance. FY 2015 Plans: Will develop and mature brain-computer interaction technology for image analysis that is capable of adapting to the user for increased joint Soldier-system performance.		2.040	2.280	2.278
Title: Dismounted Soldier Performance		3.697	5.360	6.354

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: Beginning in FY14, this effort is renamed from Improved Man Machine Interfaces to Dismounted Soldier Performance in order to more accurately reflect the nature of the project. Investigate equipment design standards and human performance measures and create guidelines for maneuver team information systems solutions that improve situational understanding and decision cycle time; identify, mature, and quantify human performance limitations to address future warrior performance issues.</p> <p>FY 2013 Accomplishments: Examined measures and methods to assess the effects and impact of recoil and recoil mitigation devices on Soldier shooting performance; and conducted applied research and analysis on the effects of physical and cognitive loads on Soldier performance for step-wise improvements in equipment design that will contribute incrementally to lightening the Soldier load.</p> <p>FY 2014 Plans: Conduct applied research and analysis on the effects of physical and cognitive loads on Soldier performance for step-wise improvements in equipment design that will contribute incrementally to lightening the Soldier load; characterize effects of weapon recoil on shooting performance by refining multivariate techniques/analyses regarding marksmanship performance; and transition results to Army Marksmanship Unit.</p> <p>FY 2015 Plans: Will expand applied research and analysis on the effects of physical and cognitive loads on Soldier performance to more operationally relevant environments; determine and mature guidelines for equipment developers and the Research and Development Centers that will lighten the Soldier physical, sensory and cognitive burden and enhance Soldier and small team performance; apply techniques developed for quantifying the effects of weapon recoil on shooter performance to a broader area of research (such as the effects of small arms equipment on marksmanship performance); and transition results to the U.S. Army Marksmanship Unit.</p>			
<p>Title: Human-Robot Interaction (HRI)</p> <p>Description: Develop human-centered design requirements and technologies for supervision and Soldier interaction with multiple semi-autonomous unmanned vehicles in urban and unstructured environments.</p> <p>FY 2013 Accomplishments: Supported FY13 capstone field assessments by designing experiments to measure and assess local situational awareness for assisted mobility and Soldier monitoring technologies; and conducted modeling and simulation studies to examine manned-</p>	4.120	4.577	4.247

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
unmanned teaming concepts to create measures and methods for assessing current and future technology capabilities needed to provide manned-unmanned teaming capabilities. FY 2014 Plans: Continue to focus on human-robot interaction by examining such issues as Soldier-robot interaction modes, communication, situation awareness, trust and transparency in coordination with the ARL autonomous systems enterprise partners. FY 2015 Plans: Will continue to focus on human-robot interaction by examining such issues as Soldier-robot interaction modes, communication, situation awareness, trust and transparency in coordination with the ARL Autonomous Systems Enterprise partners.				
Title: Understanding Socio-cultural Influence Description: Investigate and model cognitive aspects of socio-cultural influences on Soldier/Commander decision making and communication to enhance Soldier performance with systems, within teams and in the mission context. Extend models of individual and teams to societal levels to support regional understanding, training, mission rehearsal, and influence. This work complements and is coordinated with PE 0602784/project T41 (Socio-Cultural Modeling) and PE 0602785/project 790 (Leader Development). FY 2013 Accomplishments: Assessed the potential impact to Soldier/Commander decision making and communication using the FY12-developed cognitive framework and began validation and verification of models. FY 2014 Plans: Develop proof-of-concept decision support tools that effectively present relevant socio-cultural information to the Soldier/Commander to enhance Soldier/Commander decision making in diverse environments. FY 2015 Plans: Will validate cognitive framework and proof of concept decision support tools; develop guiding principles for the presentation of socio-cultural information using validated cognitive framework; initiate extension of cognitive framework to encompass societal-level perspective leveraging historical OSD-investments; and determine experiment requirements for validation of extension.		1.157	1.221	2.022
Title: Incorporating MANPRINT Considerations Early in the Acquisition Process Description: Develop system-relevant human performance and human-system interaction requirements for inclusion early in acquisition to ensure that human-system capabilities and limitations are properly reflected and that their associated cost, benefits, and risks are considered during analysis of alternatives when making trade-offs among effectiveness, suitability, and life-cycle costs.		0.949	1.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Developed methodologies (e.g., predictive, model-based methods, methods to harvest human system integration lessons learned from current system acquisition programs) to incorporate MANPRINT considerations in the system acquisition process pre-Milestone A and B; applied promising methodologies to test case scenarios for selected acquisition programs; and developed measures to assess the return on investment (ROI) for applying chosen methodologies earlier in the acquisition process.</p> <p><i>FY 2014 Plans:</i> Apply promising methodologies to test case scenarios for selected acquisition programs; and calculate the return on investment realized by incorporating MANPRINT considerations early in the acquisition process.</p>			
<p><i>Title:</i> Training Effectiveness Research</p> <p><i>Description:</i> Novel technologies and their implementation in Army systems may result in demands on Soldiers that exceed their knowledge, skill, or memory capacity. When demands cannot be remediated by human systems integration, training may enable the demands to be met. This effort will identify human operator tasks in complex, intelligent, and emerging systems critical to mission employment of new technologies. The aspects (particularly knowledge and skill) of those tasks will be determined through experimentation and analysis to inform development of training and simulation technologies, fundamental research on the effectiveness of training regimens, and simultaneous task combinations that must be trained.</p> <p><i>FY 2015 Plans:</i> Will investigate emerging technologies and target those likely to place significant demands on human operators, in particular intelligent, decision-aiding, and autonomous systems for which transparency and trust are crucial; conduct analyses of two emerging or projected technologies in the context of mission performance to determine combinations of tasks, such as, those resulting from use of the emerging technology and those from legacy systems, those requiring understanding of dynamic system models, required for mission performance; and conduct research on task combinations to determine parameters that may inform the development of training technologies.</p>	-	-	1.000
<p><i>Title:</i> Soldier System Architecture</p> <p><i>Description:</i> Soldier performance is affected by mission demands, environment, human characteristics, equipment, and technology. System development requires considering tradeoffs among these factors and sufficient data about them on which to base analyses. This effort will identify and develop human performance measures of effectiveness and performance (MOEs and MOPs) critical to performing individual and team tasks in a mission text. Empirical data will be mined from existing sources or collected where gaps exist to inform the interaction among factors affecting Soldier mission performance for emerging technologies.</p> <p><i>FY 2015 Plans:</i></p>	-	-	1.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602716A / HUMAN FACTORS ENGINEERING TECHNOLOGY	Project (Number/Name) H70 / Human Fact Eng Sys Dev

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Will conduct research to identify relative contributions and interactions of factors critical to Soldier and team system performance; work within Human Systems community to identify and prioritize critical human performance MOEs and MOPs; conduct research to support development of high priority measures not supported by sufficient empirical data involving interaction among factors such as mission demands, environment, human characteristics, equipment and technology; and propose modifications to individual measures to account for small team performance.			
Accomplishments/Planned Programs Subtotals	18.161	21.328	23.783

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-2, RDT&E Budget Item Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	18.259	20.304	15.659	-	15.659	19.087	20.596	21.278	21.552	-	-
048: <i>Ind Oper Poll Ctrl Tec</i>	-	1.971	2.123	1.567	-	1.567	2.353	2.531	2.660	2.711	-	-
835: <i>Mil Med Environ Crit</i>	-	5.599	6.225	5.457	-	5.457	6.651	7.159	7.360	7.407	-	-
895: <i>Pollution Prevention</i>	-	3.616	4.141	-	-	-	-	-	-	-	-	-
896: <i>Base Fac Environ Qual</i>	-	7.073	7.815	8.635	-	8.635	10.083	10.906	11.258	11.434	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decrease attributed to General Congressional Reductions for (-37 thousand); SBIR/STTR transfers (-376 thousand); and Sequestration reductions (-1.423 million))FY15 funding realigned to support higher Army priorities.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and evaluates enabling tools and methodologies that support the long-term sustainment of Army training and testing activities. Specific focus is on maintaining regulatory compliance while limiting future Army liability in operations and training, and maintaining resilient and adaptive ranges. Project 048 improves the Army's ability to comply with requirements mandated by federal, state and local environmental/health laws and reducing the cost of this compliance. Project 835 develops enabling technologies for advanced life cycle analysis, advanced sensing, and advanced remediation of Army unique hazardous and toxic wastes at sites containing waste ammunition, explosives, heavy metals, propellants, smokes, chemical munitions, and other organic contaminants. Project 895 focuses on reducing hazardous waste generation through process modification and control, materials recycling and substitution and developing technologies to predict and mitigate range and maneuver constraints associated with current and emerging weapon systems, doctrine, and regulations. Project 896 investigates technologies for ecosystem vulnerability assessment, and ecosystem analysis, monitoring, modeling and mitigation to support sustainable use of Army lands and airspace to reduce or eliminate environmental constraints to military missions.

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

Technologies developed in this PE are transitioned to PE 0603728A (Environmental Quality Technology Demonstrations).

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	20.095	20.316	20.616	-	20.616
Current President's Budget	18.259	20.304	15.659	-	15.659
Total Adjustments	-1.836	-0.012	-4.957	-	-4.957
• Congressional General Reductions	-0.037	-0.012			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.376	-			
• Adjustments to Budget Years	-	-	-4.957	-	-4.957
• Other Adjustments 1	-1.423	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>				Project (Number/Name) 048 / <i>Ind Oper Poll Ctrl Tec</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
048: <i>Ind Oper Poll Ctrl Tec</i>	-	1.971	2.123	1.567	-	1.567	2.353	2.531	2.660	2.711	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project designs and develops tools and methods to enable the Army to reduce or eliminate environmental impacts both in the United States and abroad. These technologies reduce the impact of legal and regulatory environmental restrictions on installation facilities, training and testing lands and ranges, as well as provide a means to avoid fines and facility shutdowns within the United States and reduce environmental impacts to the Warfighter abroad. New and innovative technologies are essential for the effective control and reduction of military unique hazardous and non-hazardous wastes on military installations and associated with contingency operations bases worldwide. Efforts focus on the impacts of new materiel that will enter the Army inventory within the next decade and beyond. This project focuses on developing sustainable environmental protection technologies that help the Army maintain environmental compliance for sources of pollution such as production facilities, facility contamination and other waste streams. Efforts abroad include a focus on designing and developing technologies for deployed forces with environmentally safe, operationally enhanced and cost effective technologies and/or processes to achieve maximum diversion, minimization, or volume reduction of base camp and field waste. This project focuses on Army-unique ecosystem vulnerability assessment, and ecosystem analysis, modeling, adaptation and mitigation technologies for installations associated with air quality and endangered species management and their impacts on training and testing mission.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Sustainable Ranges and Lands	1.971	2.123	1.567
Description: This effort supports management of operations on ranges and training lands with the intent to reduce constraints and restrictions resulting from environmental regulations. Technologies are targeted both toward solutions for environmental compliance and associated requirements, as well as solutions that will enhance training and testing operations.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 048 / <i>Ind Oper Poll Ctrl Tec</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Continued effort to assess, predict, and mitigate the consequences of altered fire regimes on concurrent management of threatened and endangered species (TES) and air quality at installations; completed mechanistic models of the role of multiple stressors in governing plant physiological responses to fire; began integration of vegetation response models with prescribed-fire emission and management models to provide foundation for integrated installation air quality and endangered species management.</p> <p>FY 2014 Plans: Complete field studies and analysis of physiological consequences of wound closure of trees and woody vegetation after burning; compartmentalization and rot resistance for woody species persistence under variable fire regimes; complete characterization and forecasting capabilities to assess multi-scale ecological response to altered fire regimes and the consequences for sustainable military land management; complete prescribed fire planning and scenario analysis capabilities to identify burn regime prescriptions that support emissions management; complete a predictive framework for assessing community and ecosystem response to changes in fire regime; refine net zero energy installation optimization algorithms to reduce environmental impacts and to incorporate in the installation energy, water, and waste modeling development in PE 0602784, project T41.</p> <p>FY 2015 Plans: Will investigate technologies/methods for national, regional and installation Threatened and Endangered Species management strategies to enable fielding of materiel systems, minimize adverse training and testing impacts, and reduce compliance costs associated with currently listed and anticipated increases in federally listed species.</p>			
Accomplishments/Planned Programs Subtotals	1.971	2.123	1.567

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 835 / <i>Mil Med Environ Crit</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
835: <i>Mil Med Environ Crit</i>	-	5.599	6.225	5.457	-	5.457	6.651	7.159	7.360	7.407	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates a quantitative means to determine the environmental effects resulting from exposure to Army-unique explosives, propellants, smokes and products containing nanomaterials and new and emerging compounds and materials across the Army training and operations. This research provides the basis for tools and methods to respond to regulatory constraints, and to protect the health of the Soldier and the extended Army community. Results of this research will be integrated into the life cycle analysis of all new Army materials and chemicals. The specific results of this research include: determination of acceptable contaminant concentration levels for residual Army-unique chemicals and materials of concern that minimize adverse effects on the environment and human health. This includes development of methods that guide the design of nanomaterials and other new and emerging materials such that adverse effects on the environment are minimized in their designed state and when they enter the environment where they may break down. Example areas of research include genomics analysis, cutting edge nanomaterial analysis, and computational/molecular modeling. Interim projects are used by PEO Ammo and IEW&S for use in life cycle analysis, risk assessment, and cleanup. Interim products are also US Environmental Protection Agency approved criteria documents to be used in risk assessment procedures and establishing regulatory limits. The Army uses these criteria during negotiations with regulatory officials to set scientifically and economically appropriate cleanup and discharge limits on Army lands.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Life Cycle of Military Materials in the Environment	2.446	2.721	3.321
Description: This effort provides a quantitative means to determine the environmental and human health effects resulting from exposure to existing and emerging compounds and materials produced in Army industrial, field and battlefield operations or disposed of through past activities. Results of this research will be integrated into the life cycle analysis process.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 835 / <i>Mil Med Environ Crit</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Began to assess the impact of climate change on Army relevant contaminants and develop a screening level vulnerability assessment for the planning and life cycle analyses processes for Army lands.</p> <p>FY 2014 Plans: Develop a web-based visualization tool that provides a framework for assessing multi-stressor climate change impacts to current military installations management objectives; develop new analytical techniques to detect and identify contaminants in the battlefield providing quantitative or semi-quantitative chemical and biological values for operational decision-making (in FY13 this work was funded under PE 0602720 Project 896).</p> <p>FY 2015 Plans: Will develop tools to provide near real-time data for identification and semi-quantification of environmental chemical hazards to support life cycle analysis, expeditionary operations, and computational tools to predict potential environmental hazards of existing and emerging munitions and pyrotechnics.</p>				
<p>Title: Advanced Materials and Nanotechnology: Environmental Effects previously called Nanotechnology-Environmental Effects</p> <p>Description: This effort enables the Army's ability to field advanced nano-based technologies by appropriate identification and assessment of the environmental impacts of nanomaterials. The end result of this research is the development of tools that guide and influence the design of nanomaterials based on such factors as adverse effects on human health or the environment.</p> <p>FY 2013 Accomplishments: Completed quantitative models for fate and uptake of select military relevant nanomaterials to predict impacts and inform decision analysis techniques; began environmental assessment of products containing nanomaterials as fielded in Army relevant items (i.e. textiles, machinery, vehicles) to inform the development of regulations and life cycle analysis for nanomaterials.</p> <p>FY 2014 Plans: Develop a risk-based process to quantitatively assess benefit and impact of nanomaterial-based Army products in the environment and computational approaches for the smart design of functional nanomaterials. Results of this research will inform nanomaterial remediation technologies.</p> <p>FY 2015 Plans: Will develop methodologies to evaluate Army-unique materials comprised of nanomaterials for environmental health and safety impacts throughout their lifecycle. These methodologies are needed to make risk informed decisions and enable rapid fielding of advanced nanomaterial based products.</p>		2.248	2.472	2.136
<p>Title: Advanced Remediation Technologies</p>		0.905	1.032	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 835 / <i>Mil Med Environ Crit</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort enables the Army to predict and understand the fate and transport of Army-unique compounds and materials which improves the capability to detect, control, and remediate. This effort develops advanced engineering concepts utilizing advanced materials, biological processes, and nanomaterials in remediation processes.</p> <p>FY 2013 Accomplishments: Investigated technologies/methods for the cost effective & environmentally protective stabilization, containment and management of depleted Uranium and residues on test and training ranges; developed scenarios exploiting fate and transport knowledge of range contaminants in order to control and remediate in a continuous process allowing for remediation activities while avoiding an impact to training.</p> <p>FY 2014 Plans: Examine green remediation technologies for common range contaminants (i.e., RDX, TNT, and metals); investigate innovative wastewater treatment technologies for munitions production to improve water quality of surface water and wetlands impacted by development and use of new munitions compounds; develop standardized protocols and analytical methods to generate high quality environmental, biological and chemical risk values for acquisition decision processes.</p>			
Accomplishments/Planned Programs Subtotals	5.599	6.225	5.457

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 895 / <i>Pollution Prevention</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
895: <i>Pollution Prevention</i>	-	3.616	4.141	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

The project develops pollution prevention technologies required to reduce/eliminate the environmental footprint resulting from the manufacture, maintenance, use and surveillance of Army ordnance and other weapon systems. This project researches and develops revolutionary technologies to eliminate or significantly reduce the environmental impacts that threaten the sustainment of production and maintenance facilities, training ranges and operational areas. The project supports the transformation of the Army by ensuring that advanced energetic materials required for high-performance munitions (gun, rocket, missile propulsion systems, and warhead explosives) are devised to meet weapons lethality/survivability stretch goals in parallel with, and in compliance to, foreseeable sustainment requirements. Specific technology thrusts include environmentally-benign explosives developed with computer modeling using Department of Defense high-performance computing resources; novel energetics that capitalize on the unique behavior of nano-scale structures; chemically engineered explosive and propellant formulations produced with minimal environmental waste, long-storage lifetime, rapid/benign environmental degradation properties, and efficient extraction and reuse; and fuses, pyrotechnics, and initiators that are free from toxic chemicals. Other focus areas include base camp energy reduction initiatives, elimination of waste streams in contingency operations and toxic metal reductions from surface finishing processes.

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

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

Technologies developed in this project are fully coordinated and complementary to PE 0603728A, Project 025.

Work in this project is performed by the Research, Development and Engineering Command Army Research Laboratory, Aberdeen Proving Ground, MD, the Armaments Research, Development, and Engineering Center, Picatinny Arsenal, NJ, the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL, the Natick Soldier Research, Development and Engineering Center, Natick, MA, and the Tank Automotive Research, Development and Engineering Center, Warren, MI.

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

	FY 2013	FY 2014	FY 2015
Title: Pollution Prevention Technologies	3.616	4.141	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 895 / <i>Pollution Prevention</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Description: This effort develops pollution prevention technologies to reduce/eliminate the environmental footprint resulting from the manufacture, maintenance, use and surveillance of Army ordnance and other weapon systems.</p> <p>FY 2013 Accomplishments: Conventional Ammunition: developed model for binder interaction and performance in energetic formulations; Pyrotechnics: conducted limited performance evaluation of environmentally sustainable white smoke; Toxic Metal Reduction: evaluated hexavalent chromium-free pretreatments in a laboratory environment for use on mixed metal substrates; Zero Footprint Camp: evaluated promising approaches to reducing water demand and wastewater generation in contingency bases, including demand reduction options, wastewater reuse options and wastewater treatment options.</p> <p>FY 2014 Plans: Conventional Ammunition: conduct limited performance evaluation of novel lead-free primer formulations; Rocket and Missile Propellants: explore lead-free alternatives for minimum signature applications; Toxic Metal Reduction: evaluate emerging hexavalent chromium-free processes for generating wear resistant surface coatings.</p>				
Accomplishments/Planned Programs Subtotals		3.616	4.141	-
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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>				Project (Number/Name) 896 / <i>Base Fac Environ Qual</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
896: <i>Base Fac Environ Qual</i>	-	7.073	7.815	8.635	-	8.635	10.083	10.906	11.258	11.434	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project designs and develops tools and identification and assesment methodologies for ecosystem vulnerability assessment, analysis, monitoring, modeling and mitigation to support sustainable use of Army facilities, training lands, firing ranges and airspace to reduce or eliminate environmental constraints to military missions. This project provides the Army the technical capability to manage, protect and improve the biophysical characteristics of training and testing areas needed for realistic and sustainable ranges and training lands. Technologies within this project enable users to match mission events and training schedules with the resource capabilities of specific land areas and understand how the use of those resources effect mission support and environmental compliance. The project investigates, designs, and develops novel methods and technologies to adapt and restore lands damaged during training activities and allow sustained use of Army resources. The project supports readiness and full use of training lands through development of invasive, threatened, and endangered species monitoring technology and management technologies for species at risk. The project also designs and develops tools and technologies to avoid training restrictions and reduce constraints on training lands associated with potential impacts from climate change.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Sustainable Ranges and Lands	3.654	4.246	4.536
Description: This effort provides ecosystem vulnerability assessment, analysis, monitoring, modeling and mitigation technologies to support sustainable use of Army facilities, training lands, firing ranges, and airspace to reduce or eliminate environmental constraints to military missions. This effort targets integrated military land appropriate management and control technologies for selected high priority Army land management issues including Threatened and Endangered Species (TES), Species at Risk (SAR), and invasive species. This effort enables effective management of training lands by understanding the cumulative impacts of training and non-training land use activities on critical natural resources under current and potential future climate conditions.			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 896 / <i>Base Fac Environ Qual</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Developed optimal allocation of land for training and non-training uses for rapid analysis and quantification of impacts of natural resources decisions on training land capacity, and developed a preliminary network model for analysis of potential ecological response to changing weather intensity and climate. Network model incorporated high priority Army land management issues including Threatened and Endangered Species (TES), Species at Risk (SAR), and invasive species.</p> <p><i>FY 2014 Plans:</i> Develop predictive models and analytical approaches for natural infrastructure response and installation adaptation planning to climate change; investigate novel sensor networks for adaptable installation noise management and mitigation practices; integrate Installation energy, water, and waste modeling algorithms for net zero energy installation optimization efforts in PE 0602784, project T41.</p> <p><i>FY 2015 Plans:</i> Will investigate new analytical methods for incorporating the direct impacts of climate change, and related dynamic processes such as urban encroachment, into Army enterprise long-term planning processes that enable Army transformation and materiel fielding; will develop advanced decision metrics that quantify climate uncertainty on mission relevant m-made and natural infrastructure and processes in a manner that is consistent with current Army plans and planning processes: will investigate the underlying fundamental physical and ecological processes of these advanced decision metrics and their response to projected climate change. Will initiate development of next generation real-time noise management technologies to provide the ability to adaptively manage and reduce noise impacts to live training for installations experiencing existing and emerging encroachment impacts on training lands.</p>				
<p><i>Title:</i> Military Materials in the Environment</p> <p><i>Description:</i> This effort develops models to predict chemical behavior in simple and complex environmental media (e.g. soils, water). These models will allow for improved understanding of how compounds and materials will move, bind and degrade when introduced into the environment.</p> <p><i>FY 2013 Accomplishments:</i> Completed predictive models of chemical behavior with information on how military relevant contaminants interact with basic soil components with emphasis on the new insensitive munitions compounds; expanded predictive models for complex surfaces such as typical mineral and soil particles.</p> <p><i>FY 2014 Plans:</i></p>		3.419	3.569	4.099

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602720A / <i>Environmental Quality Technology</i>	Project (Number/Name) 896 / <i>Base Fac Environ Qual</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Develop new technologies to predict the environmental fate and transport of contaminants on complex surfaces to improve operational intelligence; characterize and fuse data from ecological parameters, environmental conditions and social dynamics in locations critical for Army missions and operations in support of Combatant Command requirements.</p> <p><i>FY 2015 Plans:</i> Will design tools for detecting and modeling the source of emerging threat agents in areas of denied access. This capability will identify and predict fate of unique contaminant threats and provide information about the quality and spatial distribution of water sources at a landscape scale within an operational area. Will begin the development of tools to predict soil characteristics and contaminant behavior in soil using remote sensing and sparse data extrapolation techniques in areas of limited access to improve initial entry operations and expeditionary force movement and maneuver.</p>			
Accomplishments/Planned Programs Subtotals	7.073	7.815	8.635

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research	R-1 Program Element (Number/Name) PE 0602782A / Command, Control, Communications Technology
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	26.200	34.191	33.817	-	33.817	36.423	38.681	38.802	39.224	-	-
779: Command, Control And Platform Electronics Tech	-	11.900	13.707	14.685	-	14.685	15.920	17.197	17.455	17.586	-	-
H92: Communications Technology	-	14.300	20.484	19.132	-	19.132	20.503	21.484	21.347	21.638	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY 13 decreases attributed to sequestration (-2.251 million), Congressional general reductions (-63 thousand) and SBIR/STTR transfers (-338 thousand)

A. Mission Description and Budget Item Justification

This program element (PE) researches and investigates communications, command and control (C2), and electronics components, sub-components, software and protocols that provide the Army with enhanced capabilities for secure, mobile, networked communications, assured information delivery, and presentation of information that enables decision-making. Commercial technologies are continuously investigated and leveraged where possible. Project 779 researches and develops C2 software, algorithms, protocols and devices that enable management of information across the tactical and strategic battle space; provides automated cognitive reasoning and decision making aids; and allows timely distribution, presentation/display and use of C2 data on Army platforms. Project H92 supports research in communications components, software, algorithms and protocols which potentially allow field commanders to communicate on-the-move to/from virtually any location, through a seamless, secure, self-organizing, self-healing network.

Work in this PE is complimentary of PE 0602705A (Electronics and Electronic Devices), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and is fully coordinated with PE 0602120A, (Sensors and Electronic Survivability), PE 0602783A (Computer and Software Technology), and PE 0602874A (Advanced Concepts and Simulation).

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

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	28.852	34.209	36.580	-	36.580
Current President's Budget	26.200	34.191	33.817	-	33.817
Total Adjustments	-2.652	-0.018	-2.763	-	-2.763
• Congressional General Reductions	-0.063	-0.018			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.338	-			
• Adjustments to Budget Years	-	-	-2.763	-	-2.763
• Other Adjustments 1	-2.251	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) 779 / <i>Command, Control And Platform Electronics Tech</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>779: Command, Control And Platform Electronics Tech</i>	-	11.900	13.707	14.685	-	14.685	15.920	17.197	17.455	17.586	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project researches components, software and algorithms that enable commanders at all echelons to have better and timelier information and allows them to execute mission command (MC) from potentially anywhere on the battlefield. Emphasis is on advancements to MC computing platforms with a specific emphasis on positioning, navigation, and timing (PNT), user/computing platform interaction and cognitive burden reduction; informed operations/data to decisions; MC warfighting function advancement and commander-centric capabilities. This project researches technologies that support multi-modal man-machine interaction, battle space visualization, positioning and navigation in degraded environments (poor Global Positioning System (GPS) performance), automated cognitive decision aids, real-time collaborative tactical planning tools, data transfer, distributed data bases, open system architectures, and integration concepts which contribute to more efficient mobile operations.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Battle Space Awareness and Positioning	2.143	3.757	4.794
Description: This effort investigates positioning (pos), navigation (nav) and timing sensor/integration technologies to provide position, velocity, and time information to support operational and training requirements, especially in hostile electro-magnetic interference and other radio frequency (RF) degraded/denied environments. Work being accomplished under PE 0603772A/ project 101 compliments this effort.			
FY 2013 Accomplishments: Investigated and identified sources of error impacting the performance of the integrated radio and sensor navigation brassboard demonstrator, coded advanced algorithms to perform navigation error mitigation in the demonstrator; investigated alternative/			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) 779 / <i>Command, Control And Platform Electronics Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>emerging technologies for enhancing navigation in challenged environments such as exploiting signals of opportunity (SOO) from RF sources like broadcast television stations or natural phenomena such as lightning strikes.</p> <p>FY 2014 Plans: Research and investigate sensors based on emerging advances in micro-electromechanical systems (MEMS) and exploitation of SOOs to reduce dependence upon GPS as a sole navigation source; investigate advanced anti-jam antennas and pseudo-lite sources to protect and enhance weak GPS signals; examine modernized GPS signals for potential integration into Army systems; design, code and develop interfaces, protocols and software for handheld devices to access secure GPS through emerging modernized code (M-Code) capable GPS chips.</p> <p>FY 2015 Plans: Will investigate and analyze new sensor technologies for potential navigation and timing applications such as atomic sensors, multi-Global Navigation Satellite Systems, emerging SOOs, and MEMS focusing on improvements to individual sensors and methods for improved manufacturing techniques allowing the potential for smaller integrated navigation systems; examine vision based sensors and other aiding techniques such as human motion classification and network assisted navigation to enable navigation in the absence of GPS signals; investigate GPS augmentation systems to evaluate compatibility with new M-Code receiver chips and the ability to make GPS user equipment for ground vehicles and dismounted Soldiers less susceptible to interference sources.</p>				
<p>Title: Command and Control (C2) On-The-Move (OTM) Enabling Technologies</p> <p>Description: This effort investigates, designs and codes software to improve the Warfighter's ability to access, use, present and understand relevant mission command information. Work on this effort transitions to PE 0603772A/project 101.</p> <p>FY 2013 Accomplishments: Researched fundamental human centered design principles to reduce information overload in Army MC software; assessed the cognitive impact on Soldiers of software applications operating on different computing platforms (e.g. viewing maps on computers, tablets, and smart phones); investigated the application of computer learning techniques to capture human experience and apply it in similar but different situations to enable non-expert Soldiers to function at or near expert level; investigated the advantages of cloud technology (e.g. centralized management of distributed computing resources) in the disadvantaged, intermittent and low bandwidth tactical mission area; developed software algorithms to analyze audio speech, automatically identify the language and the intended domain or application (e.g. medical, checkpoint, intelligence), such that the algorithms have ability to select the appropriate translation engine to improve translation accuracy; investigated software applications that facilitate execution of C2 and distribution of intelligence information to Soldiers in small units using hand held devices; investigated architectures and techniques for storage and distribution of software applications for tactical handheld devices.</p> <p>FY 2014 Plans:</p>		9.757	9.950	9.891

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) 779 / <i>Command, Control And Platform Electronics Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Investigate software and develop algorithms to increase unmanned platform autonomy and improve multi-platform autonomous collision avoidance; design and refine MC systems that learn and adapt based on the users' preferences and mission needs in order to reduce required training; investigate self-forming MC software solutions to reduce setup/tear-down effort and provide some zero-time (initial startup) capability; architect automated troubleshooting tools to reduce MC field service representative support costs and improve system utility; improve upon advanced computing platform display technologies by researching methods of supporting additional points of touch for multiple simultaneous users, and wireless interface technology to connect to portable computing devices; architect and design a portable, tactical, distributed computing and storage solution to manage the distributed system and data to improve command post (CP) mobility and accessibility from vehicles and dismounts; develop and code a single common cross-platform software interface demonstrator that supports dismounted, mounted, and CP operations to reduce software design and support costs.</p> <p>FY 2015 Plans: Will research and brassboard the required data, system architectures, and leader tools needed to provide continuously available MC capabilities from tactical through strategic echelons; investigate and design multi-echelon, unified MC software with a particular emphasis on enabling small unit commander-centric operations; design and code MC software that dynamically assesses the mission and the battle space to help maximize mission success by managing limited and distributed resources, including operational energy, bandwidth, and cognitive processing; design and code software tools that enable Soldiers to explore data, visualize relationships, and create and modify workflows to update and modify MC software applications without re-programming and revalidation; design MC software that analyzes unstructured and structured data from discourse, social media, and computer systems to provide alerts, suggest collaboration opportunities, and deliver expert level decision support to the commander; design and code software that measures individual and staff workload to facilitate more agile team operation and that applies distributed computing to solve a complex, multi-element problem within a small group of Soldiers without reach back to higher echelons.</p>			
Accomplishments/Planned Programs Subtotals	11.900	13.707	14.685

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) H92 / <i>Communications Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H92: <i>Communications Technology</i>	-	14.300	20.484	19.132	-	19.132	20.503	21.484	21.347	21.638	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates and applies advanced communications and network devices, software, algorithms and services by leveraging and adapting commercial research and new communications and network sciences work by the Army Research Lab, Network Science Collaborative Technology Alliance or other Basic Research efforts. This project focuses development in wireless transport (e.g. mobile radio based communications systems) to develop new techniques for improving communications in high radio frequency (RF) interference environments and to increase the communications capacity of terrestrial and satellite communications (SATCOM) systems. This project also investigates enabling antenna components, materials, designs and configurations to reduce the visual signature of antennas on Soldier, vehicular and airborne platforms and reduce co-site interference on platforms with multiple transceivers such as radios and jammers. Additionally this project investigates cyber security devices, software and techniques to harden narrow band, wireless communications networks against cyber attacks; new mobile networking protocols to make wireless, on-the-move (OTM) communications networks more responsive to user needs. This project also investigates network operations software and techniques that improve the ability of the Soldier to manage and maintain complex, dynamic networks; and improved spectrum management software tools to make more efficient use of over-subscribed RF spectrum.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Antenna Technologies	4.719	6.689	3.948
Description: This effort investigates low cost, power efficient, conformal and directional antenna technologies for terrestrial, airborne, and tactical SATCOM ground terminals to enable them to operate OTM over multiple frequency bands, and further investigates armor embedded antenna and distributed array technologies. Together these efforts will improve ground forces electronic protection, increase signal power and range and provide greater connectivity for both mounted and dismounted forces. Work being accomplished under PE 0602270A/project 906, PE 0603008A/project TR1, and PE 0603270A/project K15 compliments this effort.			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) H92 / <i>Communications Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p><i>FY 2013 Accomplishments:</i> Designed wafer scale/smart card antenna for low profile SATCOM OTM and unmanned aerial system antennas; adjusted embedded antenna designs to improve performance observed from ballistic assessments; investigated new metamaterials for broadband low profile antennas and nanotechnology for low visual signature armor and ballistic glass embedded transparent antennas; designed antenna modifications for interference mitigation to reduce RF communications and electronic warfare (EW) cosite interference between EW and blue force communication systems.</p> <p><i>FY 2014 Plans:</i> Develop optically non-intrusive antenna arrays for transparent Armor; investigate and advance smart switching for distributed antenna system arrays enabling higher output power, interoperability and improved link connectivity for terrestrial, SATCOM and EW communications; investigate and evolve antenna systems that provide capacity to support simultaneous EW jamming and communications without interference; establish standard interface for distributed terrestrial and SATCOM antenna systems to support interchange of communications modes on battlefield platforms.</p> <p><i>FY 2015 Plans:</i> Will design and mature a smart switching system for distributed antenna arrays enabling higher output power, interoperability and improved link connectivity for SATCOM; investigate and mature antenna systems and arrays that provide improved communications performance and reliability through EW jammed environments; develop and finalize a government standard architecture to provide standard form-fit and electronic interfaces for distributed terrestrial and SATCOM antenna systems to support interchange of communications modes on battlefield platforms.</p>				
<p><i>Title:</i> Wireless Information Assurance (IA)</p> <p><i>Description:</i> This effort investigates, codes and fabricates software, algorithms and devices to protect wireless tactical networks against computer network attacks. Effort includes technologies that are proactive rather than reactive in countering attacks against tactical military networks. Work being accomplished under PE 0603008A/project TR2 compliments this effort.</p> <p><i>FY 2013 Accomplishments:</i> Researched different types of frameworks upon which future cyber security can be developed to remove redundancies and conflicts between disparate software tools and techniques; designed and developed communications architecture that standardizes how cyber-security tools and applications should share information (e.g., messages, protocols, cryptography, concealing communications); investigated techniques, limitations and risks of protecting networks by using software methods that obscure the network details to prevent cyber attackers from mapping networks and traffic in preparation for an attack.</p> <p><i>FY 2014 Plans:</i></p>		2.742	9.437	9.302

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) H92 / <i>Communications Technology</i>

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

	FY 2013	FY 2014	FY 2015
<p>Design and code sophisticated software assurance algorithms to differentiate between stealthy life cycle attacks and software coding errors; design and assess secure coding methodologies that can detect and self correct against malicious code insertion; investigate theoretical control graph techniques for improvements in malware detection that can detect malware variants incorporating polymorphic and metamorphic transformation engines; research and design sophisticated, optimized cyber maneuver capabilities that incorporate the use of reasoning, intuition, and perception while determining the optimal scenario on when to maneuver, as well as the ability to map and manage the network to determine probable attack paths and the likelihood of exploit; investigate dynamically and efficiently altering tactical network services, ports, protocols and systems to inhibit red force ability to perform malicious network reconnaissance to determine location of critical networking services; research and assess data sharing and collaboration techniques between offensive and defensive operations to enable advanced warning and response actions.</p> <p>FY 2015 Plans: Will evaluate and mature optimized cyber maneuver capabilities that incorporate the use of reasoning, intuition, and perception while determining the optimal scenario on when to change network configurations and settings to increase the difficulty for red forces to perform malicious network reconnaissance prior to attack; encode, evaluate and mature software to provide a feedback system to optimize the effectiveness of cyber maneuver and threat assessments; research algorithms and evaluate the effectiveness of dynamically maneuvering computer operating systems and applications to further restrict red force ability to perform malicious reconnaissance on tactical network components and hosts; mature and optimize data sharing and collaboration techniques between offensive and defensive operations and across security boundaries to enable advanced warning and response actions; research trans-disciplinary computer experimentation models that emulate attackers-defenders-users interactions and associated technological and human interrelationships; research a software based cryptor point solution that meets NSA formal requirements to eliminate the need for physical encryption devices on Army tactical communications systems.</p>			
<p>Title: Cognitive Networking</p> <p>Description: This effort investigates, codes, fabricates and evaluates a set of advanced networking devices, software and algorithms to enable wireless networks to sense the dynamic and uncertain nature of mobile ad-hoc multi-tiered, multi-band network environments and spectrum conditions, and automatically adapt network topologies or traffic flows to increase overall performance while reducing the time and human effort required to operate the network. Work being accomplished under PE 0601104A/project H50 and PE 0603008A/project TR1 compliments this effort.</p> <p>FY 2013 Accomplishments: Researched methods based upon game theory coupled with statistical estimation and machine learning to design new network control protocols and software that improves the ability of tactical wireless communications networks to change behavior, network</p>	3.053	0.908	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) H92 / <i>Communications Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>topology and traffic flow based on changing RF environments and network congestion; designed and coded new software algorithms that increase the efficiency of current internet protocols.</p> <p>FY 2014 Plans: Research software for self initiating and managing tactical wireless networks that supports spectrum efficiency in austere tactical environments; research ad-hoc routing, digital voice and disruption tolerant networking to deliver 2 way voice, data and position-location information to small units.</p> <p>Title: Dynamic Spectrum and Network Technologies</p> <p>Description: This effort investigates and fabricates components and codes software for radios and network management systems to enable access to spectrum that is unavailable because of current inefficient spectrum management methods. This includes new management and visualization modalities as well as improved RF modulation techniques, devices and software. This effort also investigates RF signal processing, signal transmission and codes software to detect and overcome the interference of SATCOM due to jamming or atmospheric conditions such as scintillation. Work being accomplished under PE 0603008A/project TR1 compliments this effort.</p> <p>FY 2013 Accomplishments: Researched new software and algorithms to visualize/present and alert Soldiers to the operational state of wireless networks at the Company, Battalion and Brigade levels; used distributed multi-agent software and algorithms to integrate situation awareness of networks (mission and cognitive) with real-time event correlation by timestamp/location to provide Soldiers with correlated event alerts; investigated new SATCOM waveforms to increase communications capacity and improve anti-jam performance.</p> <p>FY 2014 Plans: Research and develop software and hardware techniques allowing EW and communications systems to interoperate without mutual interference; research components, software and algorithms that support a waveform capable of simultaneous automated jamming and communication; investigate coordinated resource allocation, dynamic spectrum access (DSA) and interference cancellation algorithms to support interoperability between different wireless communication networks; investigate spectrum compatibility techniques to enable detection, identification, exploitation, location, disruption and neutralization of adversary RF systems in dense co-channel and multi-path interference environments, while allowing friendly communications and other RF systems to operate effectively in the same spectrum space.</p> <p>FY 2015 Plans: Will research network and physical layer models for tactical networking waveforms to enable the evaluation of the effectiveness of new signal processing and networking technologies to overcome RF interference such as red force jamming; design and code network reasoning software to enable the dynamic selection of signal processing and RF transmission techniques such as adaptive signal cancellation, coordinated scheduling of discontinuous signals, directional networking and multiple input</p>		3.786	3.450	5.882

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602782A / <i>Command, Control, Communications Technology</i>	Project (Number/Name) H92 / <i>Communications Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
multiple output networks to overcome adversarial RF jamming; develop a waveform architecture to define interfaces between the various RF, networking and signal processing hardware components; evaluate and develop signal analysis algorithms to detect RF interference of SATCOM signals; research and perform system analysis for protected SATCOM architectures to support modulation, coding and redundancy protection methods; research and analyze precision polarization concepts to support multiple communications paths and bandwidth expansion; perform modeling, simulation and emulation of networks to assess performance in contested environments; mature and evaluate performance of a signals management module for integration into the Soldier Radio Waveform to manage communications and blue force jamming RF emissions to prevent cosite interference while maintaining communications/jamming performance.			
Accomplishments/Planned Programs Subtotals	14.300	20.484	19.132

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602783A / <i>COMPUTER AND SOFTWARE TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	8.886	10.434	10.764	-	10.764	12.742	13.896	14.089	14.225	-	-
Y10: <i>Computer/Info Sci Tech</i>	-	8.886	10.434	10.764	-	10.764	12.742	13.896	14.089	14.225	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This program element (PE) develops and evaluates hardware and software algorithms enabling enhanced understanding and accelerating the decision cycle time for commanders and leaders operating in a mobile, dispersed, highly networked environment. Project Y10 supports research on information and communications technology.

Work in this PE complements and is fully coordinated with efforts in PE 0602705A (Electronics and Electronic Devices), 0602716A (Human Factors Engineering Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and PE 0603008A (Command, Control, Communications Advanced Technology).

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL) at the Adelphi and Aberdeen Proving Ground, MD locations.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	9.830	10.439	10.501	-	10.501
Current President's Budget	8.886	10.434	10.764	-	10.764
Total Adjustments	-0.944	-0.005	0.263	-	0.263
• Congressional General Reductions	-0.020	-0.005			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.150	-			
• Adjustments to Budget Years	-	-	0.263	-	0.263
• Other Adjustments 1	-0.774	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602783A / COMPUTER AND SOFTWARE TECHNOLOGY				Project (Number/Name) Y10 / Computer/Info Sci Tech			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Y10: <i>Computer/Info Sci Tech</i>	-	8.886	10.434	10.764	-	10.764	12.742	13.896	14.089	14.225	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project develops and evaluates information and communications processing software to automate the delivery of information for planning, rehearsal, and execution by ground commanders. Efforts develop communication/network architectures and software and the information fusion software necessary to simplify the understanding and interactions from humans to humans, humans to computers, computers to humans. Research enables enhanced understanding of many information sources and accelerates the decision cycle time for commanders and leaders operating in mobile, dispersed, highly networked environment envisioned for the future force.

This project supports Army science and technology efforts in the Command, Control, Communications, and Intelligence portfolio. Work in this project is fully coordinated with PE 0603008A (Command, Control, Communications Advanced Technology) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

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

Work in this project is performed by the U.S. Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Ground, MD.

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

	FY 2013	FY 2014	FY 2015
Title: Information Processing	1.161	1.237	1.248
Description: This effort develops and evaluates fusion software to improve the completeness and timeliness of decision-making in command and control (C2) operations. The goal of this effort is to develop software applicable to the Distributed Common Ground Station-Army (DCGS-A) architecture (an integrated architecture of all ground/surface systems) and for future force assessment.			
FY 2013 Accomplishments: Continued to develop scalable decision support and social network analysis algorithms; evaluated network and information visualization software for cellular wireless environments.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602783A / COMPUTER AND SOFTWARE TECHNOLOGY	Project (Number/Name) Y10 / Computer/Info Sci Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Extract/resolve and exploit social network information from multi-source data in order to provide timely accurate assessments of social and cultural influences for small unit decision making.</p> <p>FY 2015 Plans: Will evaluate techniques for predicting crowd attitudes, intent and behaviors from fused text sources; and develop concepts for integrating social network analysis into the command and control process.</p>				
<p>Title: Information Assurance</p> <p>Description: This effort designs and evaluates software for the protection of information and networks in wireless tactical environments. The goal is to develop software algorithms that detect and defeat malicious activities of adversaries in the bandwidth constrained tactical networks.</p> <p>FY 2013 Accomplishments: Designed and evaluated new software algorithms and architectures, along with predictive models, for distributed intrusion detection of cyber attacks in bandwidth-constrained environments.</p> <p>FY 2014 Plans: Evaluate experimental implementation of intrusion detection software algorithms and architectures; and develop and analyze predictive models for distributed intrusion detection of cyber attacks in bandwidth constrained environments to improve ability to detect and defeat malicious activities on Army networks and hosts.</p> <p>FY 2015 Plans: Will design and evaluate an intrusion prevention architecture that dynamically monitors host and network data to detect, analyze, respond, and protect against unauthorized cyber activity in bandwidth and power-constrained environments; investigate models that will be used to develop and evaluate secure protocols that may be used in tactical networks; and explore active protection approaches that may be managed and/or deployed locally, centrally or in a distributed environment.</p>		1.108	1.215	2.194
<p>Title: Information Exchange</p> <p>Description: This effort will investigate and develop software that integrates sensor data from local and external information sources. The goal is to enable tactical users to cooperatively share relevant and timely tactical information within a distributed wireless environment.</p> <p>FY 2013 Accomplishments: Developed and assessed fusion and information exchange software to reduce network bandwidth necessary to transmit information; and evaluated the software using tactically realistic equipment and text/video data.</p> <p>FY 2014 Plans:</p>		1.186	1.264	1.280

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602783A / COMPUTER AND SOFTWARE TECHNOLOGY	Project (Number/Name) Y10 / Computer/Info Sci Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Develop workflow and algorithms to enable end-user's ability to define and refine the collection, correlation, and aggregation of raw and processed data from both local and higher echelon information sources to produce summaries that are directly relevant to the user's current operations.</p> <p>FY 2015 Plans: Will develop and evaluate text, image, and full motion video processing algorithms for use within representative state transfer services operating across a suite of distributed nodes using realistic network connectivity and data sources.</p>				
<p>Title: Language Translation</p> <p>Description: This effort develops and assesses computational multilingual algorithms and software frameworks to enable commanders and troops to bridge language barriers in order to counter adversaries and collaborate with allies.</p> <p>FY 2013 Accomplishments: Developed and evaluated adaptive optical character recognition and machine translation (OCR/MT) workflow analysis software to improve the quality of automated reasoning techniques when applied to human intelligence documents (both foreign and English).</p> <p>FY 2014 Plans: Develop an experimental framework for evaluation of state-of-the-art academic OCR/MT, entity extraction, and entity resolution algorithms using realistic, representative data; develop, refine, and test advanced algorithms to improve multilingual and machine translation technologies in three areas: (a) OCR of noisy and degraded document images typical of field-captured materials, (b) domain-specific machine translation targeting domains and genres outside of commercial interest, and (c) recognition of key content in handwritten documents typical of materials commonly encountered in the field to facilitate the rapid transition of promising candidate technologies.</p> <p>FY 2015 Plans: Will develop, refine, and test advanced algorithms to improve machine translation technologies by incorporating data subset selection techniques into algorithms to generalize existing MT modules to new domains of military interest.</p>		1.361	2.104	2.142
<p>Title: Network Theory</p> <p>Description: This effort investigates and designs theory based software models to evaluate and validate emerging network protocols and structures. The goal of this effort is to develop software algorithms that maintain effective communications in networks in spite of disruptive effects such as task reorganization, mobility of friendly forces, and adversarial attacks on friendly networks.</p> <p>FY 2013 Accomplishments:</p>		1.632	1.887	1.171

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602783A / COMPUTER AND SOFTWARE TECHNOLOGY	Project (Number/Name) Y10 / Computer/Info Sci Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Continued to investigate and evaluate algorithms to improve delivery time and quality of information in unreliable tactical mobile networks; and investigated and evaluated software algorithms that exploit network user movement and usage to improve communication and information delivery. FY 2014 Plans: Investigate and evaluate techniques for improving network performance and Soldier decision making by adapting data processing and delivery behaviors based on current network abilities and user information quality preferences; develop and evaluate non-traditional communications techniques, such as optical and ultra violet (UV), to provide alternative means of communications in radio frequency (RF)-challenged environments; and investigate techniques for using mobile infrastructure and user movement to improve communication networks and information delivery in hybrid (wired & wireless) networks. FY 2015 Plans: Will develop and evaluate UV communications components that attach to the RF common sensor radio; use simulation to investigate how mobility and autonomy may be exploited to maintain connectivity; and investigate mapping connectivity regions to blend with mobility planning and sensing.				
Title: Heterogeneous Computing and Computational Sciences Description: This effort researches and develops software algorithms to allow information processing across different computing hardware platforms. The goal of this research is to provide high performance computing (HPC) equivalent processing capabilities to the Soldier on the battlefield. FY 2013 Accomplishments: Developed and evaluated scalable algorithms for battle command applications, such as modeling electromagnetic propagation in urban areas on a HPC cloud hybrid computing platform; evaluated algorithm performance and accuracy for developing high fidelity models of complex battlefield scenarios. FY 2014 Plans: Develop, implement and validate discrete mathematical algorithms for high fidelity electromagnetic propagation and electromagnetic interference for use in real time modeling and optimization of ad hoc mobile networks; test, analyze, and optimize the performance of current and proposed mobile ad hoc network simulations; develop code enabling algorithm deployment for extremely large networks using inter-core load balancing between standard computing cores and specialized accelerators such as Graphics Processing Units; and perform validation of the models and results based using standard battle command benchmarks. FY 2015 Plans: Will investigate approaches for computational off-loading to disparate, hybrid cores focused on extracting maximum performance from the parallel nature of many-core pervasive technologies; create new models to describe offered load and computational		1.519	1.682	1.673

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602783A / COMPUTER AND SOFTWARE TECHNOLOGY	Project (Number/Name) Y10 / Computer/Info Sci Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
capacity within cloudlet-based services in Army-centric mobile and ad hoc networked technologies; and develop software engineering protocols and methods to promote portability while maintaining efficiency with heterogeneous systems.				
Title: Material Modeling-Force Protection		0.919	1.045	1.056
Description: This effort designs and evaluates software to improve parallel processing for computational intensive physics. Intent is to create a computational science environment to assist researchers from different disciplines to work collaboratively and to exchange models and results.				
FY 2013 Accomplishments: Designed new parallel computational science environment architecture, as well as theory and implementation strategies for coupling multi-physics modeling software; and evaluated new data models and formats for using petascale data from multi-physics applications to enable higher resolution/fidelity simulations.				
FY 2014 Plans: Develop parallel computational common software environment on emerging multi-core petaflop high performance computing (HPC) systems; and implement interface algorithm, data models and formats to solve multi-scale/multi-physics software developed for coupling between molecular dynamics and finite element methods.				
FY 2015 Plans: Will develop and extend capabilities to couple multi-scale/multi-physics software that will be designed to achieve efficiency across a growing base of computing cores; and investigate the use of domain specific languages to couple novel HPC capabilities within the material modeling domain and facilitate rapid software deployment.				
Accomplishments/Planned Programs Subtotals		8.886	10.434	10.764
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	71.553	70.027	63.311	-	63.311	62.757	66.845	69.813	74.823	-	-
855: <i>Topographical, Image Intel & Space</i>	-	14.094	17.738	15.478	-	15.478	16.203	17.635	18.445	18.595	-	-
H71: <i>Meteorological Research For Battle Command</i>	-	5.784	6.358	6.459	-	6.459	6.492	6.498	6.609	6.661	-	-
T40: <i>Mob/Wpns Eff Tech</i>	-	31.288	31.197	27.107	-	27.107	26.659	28.272	29.959	34.655	-	-
T41: <i>Mil Facilities Eng Tec</i>	-	5.812	6.363	5.642	-	5.642	4.880	5.843	5.969	6.013	-	-
T42: <i>Terrestrial Science Applied Research</i>	-	4.665	5.138	5.204	-	5.204	5.185	5.172	5.362	5.403	-	-
T45: <i>Energy Tec Apl Mil Fac</i>	-	2.919	3.233	3.421	-	3.421	3.338	3.425	3.469	3.496	-	-
T53: <i>Military Engineering Applied Research (CA)</i>	-	6.991	-	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY15 funding realigned to support higher Army priorities.

A. Mission Description and Budget Item Justification

This program element (PE) investigates, evaluates, and advances technologies, techniques and tools for depiction and representation of the physical and human environment for use in military planning and operations; for characterizing geospatial, atmospheric and weather conditions and impacts on systems and military missions; for conducting mobility, counter-mobility, survivability and force protection; and for enabling secure, sustainable, energy efficient facilities. Research focuses on special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Project 855 conducts geospatial research and development supporting a standard sharable geospatial foundation enabling a common operating environment across mission and command systems. Project H71 supports the materiel development, testing, and operations communities in evaluating the impacts of weather and atmospheric obscurants on military materiel and operations. Project T40 advances technologies for adaptive and expedient force protection across the range of military operations (includes Deployable Force Protection). This project also designs and evaluates software and hardware to identify and mitigate positive and negative ground obstacles; characterizes austere navigation environments and designs/evaluates materiel solutions including rapidly emplaceable bridging, ground stabilization and breakwater structures; and builds and uses modeling and simulation tools to advance understanding of the interactions of weapons/munitions and novel defeat methodologies with buildings, shelters, bunkers, berms and bridges. Project T41 investigates and evaluates application of technologies to enable garrison/post commanders to plan, monitor and operate facilities more efficiently, cost-effectively, securely and sustainably; and creates tools (including advanced models and simulation) that provide a framework for making trades and decisions, and also supports research to evaluate non-combat population characteristics and status from social and cultural

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>
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perspectives to achieve mission objectives. Project T42 develops and validates models and simulations to understand the impacts of the physical environment on the performance of forces, ground and air vehicles, and sensors; as well as the impact of natural and man-made changes in the environment on military operations. Project T45 investigates and evaluates materials, components and systems that have potential to reduce energy losses in buildings and shelters; and potential to detect and mitigate consequences of contaminants such as bacteria and molds in air handling equipment and building materials.

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

Research is transitioned to PE 0603734A (Military Engineering Advanced Technology) and PE 0603125A (Combating Terrorism, Technology Development).

Work in this PE is led, managed or performed by the U.S. Army Engineer Research and Development Center, Vicksburg, MS, and the Army Research Laboratory, Aberdeen Proving Ground, MD. Deployable force protection activities are coordinated with research, development and engineering centers and laboratories across the US Army, Navy and Air Force.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	70.693	70.064	73.011	-	73.011
Current President's Budget	71.553	70.027	63.311	-	63.311
Total Adjustments	0.860	-0.037	-9.700	-	-9.700
• Congressional General Reductions	-0.177	-0.037			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	7.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.659	-			
• Adjustments to Budget Years	-	-	-9.700	-	-9.700
• Other Adjustments 1	-5.304	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) 855 / Topographical, Image Intel & Space
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
855: Topographical, Image Intel & Space	-	14.094	17.738	15.478	-	15.478	16.203	17.635	18.445	18.595	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and advances capabilities for collection, processing, and creation of data and information depicting physical and human terrain, environmental conditions, and relationships in time and space; for digital map creation, transmission, and dissemination; and for map-based analytics for planning, decision making and execution. This project uses non-traditional methods that exploit existing open source text, multi-media and cartographic materials addressing social, cultural and economic geography to advance the capability to produce and transmit high fidelity digital maps depicting the physical terrain, human terrain and environmental conditions. This project also develops software tools and methods for map-based analytics that allow deeper insights into the effects of the physical terrain, human terrain and environmental conditions on military operations, to include tactics and effects upon equipment and Soldier's performance. This project explores and advances components and methods that optimize the utility of the Army Geospatial Enterprise (AGE) to the total Army which provides map and geospatial data, information, and software services to the total force.

Work in this project supports the Army S&T Command, Control, Communications and Intelligence (C3I) Portfolio.

Work in this project complements efforts in PE 0602784A, Project H71.

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

The work in this project is performed by the U.S. Army Engineer Research and Development Center, Vicksburg, MS.

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

	FY 2013	FY 2014	FY 2015
Title: Terrain Analysis for Signal and Sensor Phenomenology	0.533	3.869	2.647
Description: This effort develops means to collect, process, and visualize very high-fidelity data and information to capture the dynamic effects of the physical and human terrain impacting military ground operations. The research focuses on tactical, rather than national or commercial, remote sensing of physical terrain to achieve the fidelity required for current and future operations. Research includes methods for radical, effective sensor systems and materials to 'tag' features, items and people of interest;			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) 855 / Topographical, Image Intel & Space

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>these capabilities are based upon novel and emerging light detection and ranging (LiDAR) sensor systems and an array of other sensor systems for intermittent and persistent optimal data collection, object identification, and classification for ground operations.</p> <p>FY 2013 Accomplishments: Evolved an Army Geospatial Enterprise capability supporting mission and battle command functions and processes.</p> <p>FY 2014 Plans: Investigated LiDAR detectable, engineered optical materials to perform adversary tagging, physical location, disturbance, and tracking for area and point operations; investigated uncertainties associated with bio-affected sensors and sensing modalities (i.e., time-varying, and terrain-varying conditions) to enhance capabilities for target of interest identification in high clutter environments; developed geospatial display layers for digital maps that depict sensor performance and associated sensor uncertainties. Conduct research and experiments to develop standoff detection and early warning capability of threats to critical infrastructure in extreme environments using innovative fiber optic sensing technology.</p> <p>FY 2015 Plans: Will develop advanced collection and processing strategies for the exploitation and visualization of high-fidelity, persistent remote sensing technologies (e.g., LiDAR, Hyperspectral imaging) for the generation of geospatial foundation data, rapid detection of change, dynamic terrain characterization, object identification and tracking to support ground operations, surveillance, and force protection.</p>			
<p>Title: Imagery and GeoData Sciences</p> <p>Description: This effort advances map creation and content through both conventional and non-traditional methods. This research exploits existing open source text, leverages multi-media and cartographic materials, and investigates data collection methods to ingest geospatial data directly from soldiers (i.e., crowd sourcing) to characterize parameters of social, cultural and economic geography. Results of this research augment existing conventional geospatial datasets by providing the rich context of the human dimension which offers a holistic view of the operational environment for the Warfighters.</p> <p>FY 2013 Accomplishments: Applied and evaluated non-traditional mapping methods to representative data holdings for Afghanistan and Pacific Command (PACOM) for verification and improvements; designed and evaluated utility of socio-cultural Wiki in unclassified and secret modes to take advantage of existing open source materials addressing social, cultural and economic geography.</p> <p>FY 2014 Plans:</p>	2.835	2.976	2.438

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) 855 / Topographical, Image Intel & Space

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Continue development of remote sensing capabilities to support multi-agency efforts in remote illicit crop monitoring; develop and integrate cultural mapping into military geospatial narratives; develop visualization and analysis tools for user generated content and volunteered geographic information to support ongoing collaboration with partner Commands.</p> <p>FY 2015 Plans: Will develop methods to process and quantify relationships in typically non-exploitable data (i.e., social media and open source data) of a highly qualitative and unstructured nature. Efforts will add novel context to conventional quantitative data sources and information, thereby providing increased awareness and surveillance of both the human and physical dimensions. Will develop automated workflows to provision high-resolution imagery and geodata to mobile, dismounted devices for mission command platforms in mounted and mobile computing environments. Will develop open geospatial techniques to process and transform massive datasets rapidly and accurately into usable knowledge that will be sharable across the Army Geospatial Enterprise enabling a common situational understanding through a standard, shareable geospatial foundation.</p>			
<p>Title: Geospatial Reasoning</p> <p>Description: This effort develops and evaluates software analysis tools and methods to provide impact and context of the effects of the physical terrain, human terrain and environmental conditions on military operations. This analysis examines and models these effects upon unit tactics, equipment and Soldiers' performance.</p> <p>FY 2013 Accomplishments: Developed and implemented a web presence, compliant with Defense Information Systems Agency, and enterprise for open analytics supporting Army, USMC and Combatant Command (COCOM) Mission Partners addressing the span of counter-insurgency (COIN) and capacity building missions.</p> <p>FY 2014 Plans: Design and develop the framework for a common scalable architecture to deploy geospatial, geo-environmental, and social-cultural data, in the form of analytics and tools, through the Army Geospatial Enterprise. Develop geospatial operational risk zone analytics based on insurgent activity, terrain attributes, mission, and environmental influences; incorporate real-time feedback on integrated sensor performance and effectiveness for enhanced mission planning.</p> <p>FY 2015 Plans: Will develop methods for super-resolution data processing (i.e., imagery, Light Detection and Ranging, Hyperspectral, multispectral), and algorithms to exploit this data. This research will be specific to challenges faced by small units in urban environments that can be addressed through high-fidelity geospatial data. Will initiate development for a geo-environmental</p>	3.141	5.263	5.958

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) 855 / Topographical, Image Intel & Space		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
framework to analyze and predict weather, model and observe terrestrial and environmental data, and geospatial information into a risk-based ensemble system to support predictive battlespace preparation.				
Title: Geospatial and Temporal Information Structure and Framework		7.585	5.630	4.435
Description: This effort designs and evaluates geospatial data and information architecture to ensure content and representation of data and actionable geospatial information for operational decision making. Research advances here allow for the automatic inference and correlation between events and objects (i.e. people, places) through space and time from massive datasets. Success in meeting these objectives advances the Army's ability to network the force to achieve information dominance.				
FY 2013 Accomplishments: Developed a more structured analysis and decision framework capable of describing causal relationships and the effects of operational decisions in security and sustainment operations; developed new feature extraction methodologies and techniques that combine multi-source high-resolution imagery with elevation data to address tactical data gaps; evolved and transitioned an Army Geospatial Enterprise capability supporting mission and battle command functions and processes.				
FY 2014 Plans: Conduct research to integrate geo-environmental and socio-cultural information at the tactical edge; generate geospatial information that defines aggregate constructs of spatial and structural data key to Civil Military Operations (CMO); identify and build relational networks to define the interactive complexity between geospatial structures and actor/event and outcome dynamics. Initiate design for a data and query model, and system architecture capable of ingesting, processing, storing, and searching high volume and velocity multi-modal, multi-scale geospatial data.				
FY 2015 Plans: Will develop algorithms and methods to automatically create narratives in a geospatial format by inferring connections, relating events, times, locations, and actors, this effort will facilitate the existing laborious and manual process of correlating such objects, and serves to automate the discovery of information in a geospatial context. Will investigate the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data				
Accomplishments/Planned Programs Subtotals		14.094	17.738	15.478
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) 855 / Topographical, Image Intel & Space

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) H71 / Meteorological Research For Battle Command
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H71: <i>Meteorological Research For Battle Command</i>	-	5.784	6.358	6.459	-	6.459	6.492	6.498	6.609	6.661	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project develops tactical weather and atmospheric effects/impacts algorithms for their integration into battlefield information products. Efforts include high-resolution, local assessments and forecasts of meteorological conditions in near real time including effects of urban and mountainous terrain; analytical tools to assess the impact of the atmosphere to optimize system performance and operations planning and advanced atmospheric sensing applications to characterize and mitigate wind and turbulence in complex terrain. It provides detailed model applications for various effects of the atmosphere on electro-optical and acoustic target detection, location, and identification. This project develops both physics-based decision aids and rule-based decision support systems for assessing the impacts of weather/atmosphere across a spectrum of friendly and threat weapons systems, sensors, platforms, and operations. Information can be applied to mission planning and execution, battlefield visualization, reconnaissance surveillance and target acquisition, route planning to maximize stealth and efficiency, web enabled tactical decision aids, and also modeling of environmental impacts for combat simulations and war games.

This project supports the Army S&T Command, Control, Communications and Intelligence (C3I) 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.

This work transitions technologies to the Department of Defense weather and operations modeling community, the US Air Force Weather Agency to improve their operational weather support to the Army PM-MaTIC (PM-Meteorological and Target Identification Capabilities) and Marine Corps Systems Command (MCSC) for field artillery systems, the Project Manager, Distributed Common Ground System-Army (DCGS-A), the Joint Improvised Explosive Device (IED) Defeat Organization, the Program Executive Office Aviation, and Tactical Airspace Integration System (TIAS).

Work in this project is performed by the U.S. Army Research Laboratory located at Adelphi, MD and White Sands Missile Range, NM.

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

	FY 2013	FY 2014	FY 2015
Title: Atmospheric Modeling	2.316	2.528	2.564

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) H71 / Meteorological Research For Battle Command

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort develops high resolution, short-range forecasting and high resolution atmospheric modeling capabilities for mountainous, urban and forest complex terrain.</p> <p>FY 2013 Accomplishments: Verified the improved Atmospheric Boundary Layer Environment (ABLE) model against measurements to quantify its performance and accuracy in extreme terrain applications; developed the best set of physics parameterizations and nest configurations for sub-kilometer Weather Research and Forecasting (WRF) model-based Weather Running Estimate-Nowcast (WRE-N) to improve the spatial detail and accuracy of the ABLE complex terrain model and reduce the latency of perishable environmental data used in actionable weather impact decision aids; and developed modeling and post-processing techniques to enhance meteorological accuracy for artillery applications.</p> <p>FY 2014 Plans: Investigate and verify ABLE modeled microscale wind, temperature, and moisture dynamics for more realistic and accurate prediction of turbulence, jets, convective eddies and gusts; investigate and verify the sub-kilometer WRE-N (with tailored four dimensional (4-D) data assimilation) for complex terrain and implement version to supply data for actionable weather impact decision aids; and evaluate modeling post-processing methods for enhancement of meteorological accuracy for artillery applications.</p> <p>FY 2015 Plans: Will continue development of the microscale (local) weather prediction model (ABLE) and mature the capability to implement this model in the mesoscale WRE-N model to provide and increase the reliability of microscale (local) weather forecasts; develop new techniques for using data from traditional and non-traditional weather sources (i.e. surface observations, radar, LIDAR) to produce more accurate forecast model grids of Soldier-focused parameters (e.g. wind direction for improved plume dispersion in urban domains); and implement ABLE model capability for artillery target area domains.</p>			
<p>Title: Atmospheric Diagnostics</p> <p>Description: This effort develops diagnostic technologies and methods to improve the acquisition of environmental data such as temperature, humidity, wind speed and direction for use in decision aids that enhance and protect autonomous and semi-autonomous systems.</p> <p>FY 2013 Accomplishments: Investigated electro-optic/acoustic atmospheric remote sensing techniques for the improved detection of adverse environmental conditions affecting Army operations for force protection and improved target detection, localization, and classification; evaluated the utility of next generation (dual-band) infrared polarimetric imaging systems for use on the battlefield for increased target detection, classification, and identification; collected and analyzed signatures from international infrasound events/experiments for</p>	1.753	1.938	1.974

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>	Project (Number/Name) H71 / <i>Meteorological Research For Battle Command</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>improved situational awareness and force protection for Military Intelligence and Army Operations; and developed web services and mobile applications to enhance and share weather impact and Atmospheric Impacts Routing (AIR) weather information to Army air system and ground systems and personnel.</p> <p>FY 2014 Plans: Investigate and evaluate electromagnetic, intelligent optical and acoustic remote sensing techniques and sensor performance models for the detection of adverse environmental conditions, individual targets and local and regional events to support Army Operations and Military Intelligence; develop anomaly image quality metrics for detecting areas of interest within optical images; investigate and evaluate a prototype dynamic passive optics aperture system for its ability to reduce short exposure turbulence blur as it captures images; and investigate mobile handheld technology applications that determine atmospheric impacts on Soldiers and autonomous systems to enhance mission effectiveness at the lowest echelons.</p> <p>FY 2015 Plans: Will develop the Micro-meso Scale Array (MSA) at White Sands Missile Range, NM to collect highly-detailed meteorological field measurements for precise atmospheric characterization and weather forecast model verification; will determine the performance effectiveness of dual-band (midwave infrared (MWIR) and long wavelength IR (LWIR)) thermal polarimetric imagers to discriminate camouflage under varying environmental conditions; conduct experiments to determine vulnerabilities of various camouflage materials when simultaneously exposed to dual-band thermal polarimetry; develop elevation and location correction algorithms to more accurately detect and track Unmanned Aircraft Systems (UASs) by acoustic arrays; and develop elevation correction due to atmospheric propagation for UAS tracking by acoustic arrays.</p>				
<p>Title: Atmospheric Prediction for Local Areas</p> <p>Description: This effort designs and evaluates software models and sensors to improve local characterization and prediction of atmospheric conditions in urban and complex terrain by directly integrating boundary layer meteorological (MET) measurements into high resolution models and decision aids and verifies these improvements with field measurements.</p> <p>FY 2013 Accomplishments: Developed microscale and fine resolution mesoscale model capabilities for analysis and short term forecasting for target areas to enhance mission performance; and developed initial application of ensemble model probabilistic forecast grids for weather Nowcasts and decision support tools.</p> <p>FY 2014 Plans:</p>		1.715	1.892	1.921

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>	Project (Number/Name) H71 / <i>Meteorological Research For Battle Command</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Investigate techniques for integrating forecast grids into weather impacts decision support tools (DSTs); and research, develop, and verify impact enhancements to DSTs to improve the characterization of local atmospheric impacts and support source identification of aerosol particles. FY 2015 Plans: Will research tactical network capabilities to identify the most efficient methods to transmit/receive weather data for mobile weather decision aid applications; mature techniques and algorithms for integrating forecast grids into weather DSTs and implement initial capabilities in those systems; continue research of underlying methodologies to develop and transition a DST that quantifies and displays friendly versus enemy system/operations performance due to weather-related impacts; develop a DST to exploit anomaly image quality metrics for detecting areas of interest within optical images; and research how weather affects human behavior and begin development of a threat personnel biometeorological impacts and insurgent/terrorist activities prediction system. This system will correlate existing or predicted weather conditions with possible insurgent/terrorist activities, such as improvised explosive device (IED) emplacement.			
Accomplishments/Planned Programs Subtotals	5.784	6.358	6.459

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 2015 Army										Date: March 2014		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY				Project (Number/Name) T40 / Mob/Wpns Eff Tech			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
T40: Mob/Wpns Eff Tech	-	31.288	31.197	27.107	-	27.107	26.659	28.272	29.959	34.655	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates, evaluates, and creates technologies for adaptive and expedient force protection across the range of military operations; for force projection and maneuver, including austere port entry and overcoming battlespace gaps (such as cliffs, ravines, mudflats, shallow rivers, and other natural obstacles) through prediction, definition, avoidance, or defeat of the gaps; for scalable weapons effects; and for high-resolution representation of near-surface terrain and environment for use with sensor models for things such as target detection and unmanned ground systems (UGS) navigation. This research further provides physics-based representations of ground vehicle mobility, obstacle and barrier placement, survivability, and weapons effects in complex and urban terrain modeling and simulation. Work in this project increases the survivability of critical assets from conventional, unconventional, and emerging weapons attacks and enables maneuver support of deployed forces, while reducing their logistical footprint. This project supports Deployable force protection (DFP) efforts for overcoming critical capability gaps for protecting troops operating at smaller bases that are remote or integrated in with local communities.

Work in this project supports the Army S&T Ground, and Command, Control, Communications and Intelligence (C3I), and Soldier Portfolios.

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

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS. Deployable force protection activities are coordinated with research, development and engineering centers and laboratories across the US Army, Navy and Air Force.

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

	FY 2013	FY 2014	FY 2015
Title: Adaptive Protection	6.109	7.546	10.500
Description: This effort develops new analytical techniques, advanced materials, and integrated protection systems to support the protection of critical assets on the battlefield.			
FY 2013 Accomplishments: Provided force protection and assessment technologies for structures located in contingency-based environments for 300 to 6000 person camps; designed comprehensive model of improvised explosive device (IED) detonation in soils to accurately predict blast			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T40 / Mob/Wpns Eff Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>pressure and fragmentation of IEDs on ground vehicle systems over a wide range of operational environments; began effort to defeat complex attacks (multiple weapons and multiple hits) for enhanced 360 degree hemispherical protection of fixed, semi-mobile/mobile forces in a theater of operations.</p> <p>FY 2014 Plans: Develop capability to plan and construct a protected Combat Outpost (COP) or Patrol Base (PB) in 30 days with integrated protective construction, sensing and active defense capabilities; develop a baseline COP construction handbook and decision support tools for planning of overall basing architecture that integrates force protection and basing functions; develop planning tools for the complete lifecycle of the COP; complete development of modeling and simulation capabilities for comprehensive mine and improvised explosive device (IED) blast loads for vehicle occupant threats.</p> <p>FY 2015 Plans: Will provide ability to determine vulnerability of critical facilities and assess degradation to operational capability; will develop protective measures that use indigenous materials and on-site production capability; will provide integrated protection planning tools that include pre-deployment, construction, operations, and relocation.</p>				
<p>Title: Austere Entry and Maneuver</p> <p>Description: This effort investigates, designs, and creates tools and technologies that address theater access, tactical logistics resupply, and tactical maneuver of small units</p> <p>FY 2013 Accomplishments: Created physics-based, multi-scale wave, current, and water-depth forecasting capability; created algorithms to predict the impact of the environment on the transport of military equipment and personnel into austere entry points; investigated use of new sensor systems to measure current and sub-surface conditions that directly affect operations for determining throughput capability at austere entry points given the infrastructure.</p> <p>FY 2014 Plans: Develop the capability to numerically simulate complex, impulsive, fixed and moving infrasonic sources for regional assessment of strategic targets; create a high-performance computational testbed (CTB) for dismounted operations including simulations of potential offloading platforms as well as soldiers in the 9-man squad; provide a rapid remote port assessment capability for improving Force Projection in expeditionary environments; provide improved bridging materiel solutions for spanning gaps (wet or dry) that can impede critical operations; develop advanced force projection technologies for landing zones and port construction in areas of Anti-Access/Area Denied.</p> <p>FY 2015 Plans:</p>		6.910	11.618	13.900

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T40 / Mob/Wpns Eff Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will provide the ability to rapidly and remotely assess the conditions of potential airfields and ports to support operational movement and maneuver in austere/denied locations using space-based/underwater operational remote sensors. Will develop simulation capability to enable rapid remote assessment of real-time structural capacity of infrastructure (airfields, ports, roads), river, estuary, and near shore.				
<p>Title: Scalable Weapons Effects</p> <p>Description: This effort provides a prediction capability for effects from scalable, selectable, and adaptive weapons that can destroy target function and/or neutralize attributes while limiting damage to surrounding structures/personnel.</p> <p>FY 2013 Accomplishments: Created an integrated modeling and simulation capability to predict the penetration and damage effects from threat weapons that enables the capability to perform design analysis of new weapon systems for attack of deep buried hardened structures and assessment of current and future force protection technologies. This work is performed in collaboration with PE 0602618A/H80, PE 0602105A/H84, PE 0602624A/H18/AH28, PE0603004A/232, PE 06022303A/214.</p>		2.856	-	-
<p>Title: Environmental Impacts on Sensor Performance</p> <p>Description: This effort investigates, designs, and creates physics-based, multiscale numerical models of the geo-environment and synthetic environments representing geo-environment impacts on various sensor modalities and systems. These enable such things as development of sensors and sensor algorithms for object or target detection, for sensor-target pairing, and for intelligent autonomous navigation and tactical behaviors in unmanned ground systems. This effort further investigates, designs, and creates non-line-of-sight and beyond- line-of-sight sensing in remote areas, including optimizing coupling of sensors to soil for understanding surface and subsurface activities. This effort supports persistent surveillance and detection capabilities.</p> <p>FY 2013 Accomplishments: Developed advance target detection of non-line-of-sight sensor system in soil resulting in reduced installation time as well as improved detection for persistent surveillance capabilities in dense vegetation and turbulent maritime environments.</p> <p>FY 2014 Plans: Provide system performance optimization of linear sensors for austere deployment environments; develop a sensor model response for tracking of human and vehicular stimuli with 3-dimensional seismic source models; develop high fidelity excitation models of these linear sensors; quantify coupling scenarios for unique geo-environments.</p> <p>FY 2015 Plans:</p>		2.806	2.000	1.479

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T40 / Mob/Wpns Eff Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Will validate three-dimensional source models of human and vehicular traffic in complex environments to determine transduction mechanisms of linear sensors; and will develop physics-based model of linear sensor excitation by high-fidelity viscoelastic and discrete element methods.				
<p>Title: Deployable Force Protection</p> <p>Description: This effort researches, designs, and creates rapidly deployable detection, assessment, passive protection and active defensive technology-enabled capabilities to meet critical capability gaps for troops operating remotely at smaller bases or integrated with local communities. The needs at these smaller bases (less than 300 persons, not all U.S. troops) are unique based on constraints in transportability, manpower, organic resources, lack of hardening of structures, resupply, and training for example. Moreover, lack of interoperability and scalability consume manpower and take away from time needed to perform missions. Threats include bases being overrun by hostiles; direct fire; rockets, artillery and mortars; and improvised explosive devices. Force protection challenges at these remote, smaller bases include providing increased standoff detection, blast and ballistic protection, and kinetic technologies subject to the constraints mentioned above. This work is coordinated with PE 0603784A/T08, PE 0603125A/DF5, PE 0603313A/G03 and PE 0602786A. Work is performed by Army, Navy and Air Force labs and centers.</p> <p>FY 2013 Accomplishments: Developed significantly improved materials and system designs for rapidly erectable, or constructed, personnel protective systems to decrease logistics (e.g., weight, set up time), increased transportability, and increased protection levels for the next-generation systems; researched and developed low-logistics, on-demand structural components for exterior and interior protection of existing structures; integrated and evaluated capabilities to detect, particularly via non-line-of-sight, accurately locate, and suppress hostiles across a range of environments; identified extensions for integrated simulation tool and decision support tools for identifying system improvements; continued research on previously selected technologies for improved detection and assessment of threat, passive protection against enemy threats, and active defense to improve design and performance based on user assessment and feedback.</p> <p>FY 2014 Plans: Complete research and development on selected materials and system designs for rapidly erectable or constructed personnel protective systems to decrease logistics (e.g., weight, set up time), increase transportability, and increase protection levels for the next-generation systems; develop non-lethal stand-off enforcement technologies and conduct analysis to assess suitability for employment at small base entry control points; develop second-generation, low-logistics structural components for exterior and interior protection of indigenous structures; research and development on promising technologies and systems approaches that detect, assess, and accurately locate threats in non-line-of sight and complex environments and will decrease size, weight, and</p>		11.611	8.900	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T40 / Mob/Wpns Eff Tech

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
power requirements. User assessment and feedback gathered from deployable force protection experiments are used to improve technical performance, logistics, and user factors associated with deployable force protection for the activities described above.			
<p>Title: Materials Modeling</p> <p>Description: This effort investigates and leverages physics-based computational models and laboratory experiments to understand the relationships between the chemical and micro-structural composition of material and performance characteristics when used in protecting facilities.</p> <p>FY 2013 Accomplishments: Created initial integrated modeling capability for the investigation, design, and advancement of experimental materials and properties for achievement of improved strength and durability at the nano-composite scale (1 to 100nm). This work is coordinated with ongoing activities in PE 0602720A/835, Nanotechnology - Environmental Effects.</p> <p>FY 2014 Plans: Creating a first version of a computational testbed to simulate materials at the nanometer scale using a combination of the Discrete Element Method coupled with continuum analyses.</p> <p>FY 2015 Plans: Will develop and enhance the fidelity and efficiency of multi-scale predictive design tools to incorporate materials by design principles for development of enhanced protective structures; will develop and integrate novel multiscale reinforced cementitious materials and components of protective structures; will develop additive manufacturing methodologies to facilitate and optimize multi-scale reinforcement augmentation to tailor performance, facilitate manufacture and construction and accelerate transition of this technology to the warfighter.</p>	0.996	1.133	1.228
Accomplishments/Planned Programs Subtotals	31.288	31.197	27.107

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T41 / Mil Facilities Eng Tec
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
T41: Mil Facilities Eng Tec	-	5.812	6.363	5.642	-	5.642	4.880	5.843	5.969	6.013	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and evaluates technologies and techniques to ensure sustainable, cost efficient and effective facilities and to achieve resilient and sustainable installation and base operations. The project focuses on facilities and operations technologies directly supporting training, readiness, force projection, force protection, homeland security, and forward base operations. Facility enhancement technologies contribute to cost reductions in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. This work improves the ability of installations to support forces to meet transformation goals, improves designs for close battle training facilities, and enhances security of Soldiers, families, and civilians. Technologies evolving from this work include integrated planning and design tools for US facilities and forward bases, models predicting water dispersed contaminant effects on facilities and occupants; sustainable facility and base management; collaborative decision support tools; and advanced materials. In addition, technologies from this work will support analysis of socio-cultural and facility issues in forward base operations, including urban environments.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) and Command, Control, Communications and Intelligence (C3I) Portfolios.

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Adaptive and Resilient Installations	3.051	3.405	3.095
Description: This effort develops sustainable, cost efficient and effective facilities; and provides technologies and techniques for achieving resilient and sustainable installation and base operations.			
FY 2013 Accomplishments: Developed and validated algorithms and models that represent the complex adaptive systems for energy, water, waste, and protection impacting forward operating base operations; developed interface component models for water, solid waste, and green			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T41 / Mil Facilities Eng Tec		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
house gas and integrated them into the net-zero energy (NZE) framework to produce a capability for Installation and regional scale analysis and optimization. FY 2014 Plans: Develop and integrate sustainment, restoration and modernization decision models to support planning and analysis of high performance buildings; develop and validate adaptive system algorithms and relationships, and models for power, water, waste and protection to reflect the dynamics at forward operating bases. FY 2015 Plans: Will complete sustainment, restoration and modernization decision models that provide installation managers with information necessary to identify actionable operations and investment opportunities to lower energy usage while maintaining mission functionality, thereby reducing facility lifecycle costs; will complete integrated modeling capability building on the Net Zero Energy Framework to support Installation planning for energy, water, and waste resource optimization.				
Title: Social/Cultural Behavior Description: This effort provides technologies which support analysis of socio-cultural and facility issues in forward base operations, including urban environments. Technology development efforts will include means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations. FY 2013 Accomplishments: Provided computer-aided analysis and reasoning tools and ability to model, simulate and forecast socio-cultural issues and needs; predict the perceptions and actions and reactions of indigenous population groups in relation to on-going or planned military operations. FY 2014 Plans: Develop analytical models that advise the commander on likely socio-cultural consequences of planned military courses of action impacting indigenous population; provide the commander a computer aided methodology to identify insights into socio-cultural issues, needs, and likely perceptions to planned unit actions and tasks in the commander's area of responsibility. FY 2015 Plans: Will investigate the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data; will investigate monitoring tools and decision models reflecting effects of changing conditions on the operating environment for Brigade-level operators and mission planners; will identify levers of change impacting urban security operating environments to provide timely answers to Commanders on whether the effects of actions support the desired strategy.		2.761	2.958	2.547
Accomplishments/Planned Programs Subtotals		5.812	6.363	5.642

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T41 / Mil Facilities Eng Tec

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T42 / Terrestrial Science Applied Research
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>T42: Terrestrial Science Applied Research</i>	-	4.665	5.138	5.204	-	5.204	5.185	5.172	5.362	5.403	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and advances technologies to characterize and respond to impacts of the terrestrial environment on the performance of emerging and deployed Army systems, as well as the impact of natural and man-made changes in the environment on all phases of unified land operations. Research efforts model the dynamics of electromagnetic, acoustic, and seismic propagation in response to changing terrain state and complex terrain features and geometry and their depiction in geospatial information and mission command systems. Numerical modeling of terrain properties as impacted by weather supports intelligence preparation of the battlefield products including mobility estimates and intelligence, surveillance and reconnaissance planning. This effort integrates terrain knowledge and weather forecast in a mission context to provide geospatial information and mission command delivered solutions to the Soldier. The understanding gained and products developed improve the ability to predict signature (emitter) behavior and sensor performance in complex operational environments, and support materiel development, sensor performance products for tactical decision-making, and visualization for mission command.

Work in this project supports the Army S&T Command, Control, Communications and Intelligence (C3I) 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.

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

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

	FY 2013	FY 2014	FY 2015
Title: Analysis for Signal & Signature Phenomenology	1.887	2.429	2.756
Description: This effort investigates the dynamics of electromagnetic, acoustic, and seismic signatures in response to changing terrain state and complex terrain features and geometry. Research results improve sensor employment tactics, techniques, and procedures and numerical modeling of terrain properties for tactical advantage and geospatial tactical decision aids.			
FY 2013 Accomplishments:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>	Project (Number/Name) T42 / <i>Terrestrial Science Applied Research</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Developed a sensor to provide the passive, standoff capability to remotely assess soil state as a function of land use/condition providing measures of bulk density, mineralogy and soil texture applicable to mobility, targeting, and cultural assessments; investigated combined terrain-atmosphere modeling and image analysis techniques to remotely establish aircraft landing potential in denied areas.</p> <p>FY 2014 Plans: Develop and integrate into the sensor mission planning tool Environmental Awareness for Sensor and Emitter Employment (EASEE) terrain and weather influences and model predictions for radar and radio frequency modalities; develop and integrate functionality for providing multi-modal propagation predictions for multiple moving platforms; develop an automated remote sensing capability to provide tactical commanders a repeatable assessment of mountainous snowpack extent and snowpack total water storage to inform mission planning decision making social-cultural mission impacts.</p> <p>FY 2015 Plans: Will research and develop a framework to significantly improve geospatial tools that inform mission command systems and the common operational picture by quantifying and displaying risk and uncertainties inherent in data quality of terrestrial properties (soils, vegetation, landscape, structures), weather influences (rapid dynamic changes), and information collection modalities (seismic, acoustic, radio frequency, electro-optical propagation); investigate potential uses of full waveform Light Detection and Ranging (LIDAR) backscatter remote sensing of terrestrial surfaces for remote classification of terrestrial material properties and characterization for geospatial applications.</p>			
<p>Title: Geospatial Reasoning</p> <p>Description: This effort integrates terrain knowledge and the dynamic effects of weather and mission to provide geospatial reasoning solutions to the Soldier. The understanding gained and products developed improve the ability to predict signature (emitter) behavior and sensor performance in complex operational environments, and support materiel development, sensor performance products for tactical decision-making, and visualization for mission command.</p> <p>FY 2013 Accomplishments: Developed mission planning tools for combat outpost applications incorporating infrared, visible, and radar multi-modal terrain signature models incorporating weather impacts; developed and evaluated methods for enhanced bio-sensing surveillance capability applying sensor-vegetation characterization and quantification for bio-affected sensor performance mission planning.</p> <p>FY 2014 Plans: Develop decision support tool for combat outpost applications optimizing human and physical terrain surveillance by matching sensor modalities to mission, terrain complexity, and predict weather effects; investigate and develop components of a sensor coverage and management framework for integrating ground and air surveillance assets based upon site specific terrain and</p>	2.778	2.709	2.448

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>	Project (Number/Name) T42 / <i>Terrestrial Science Applied Research</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
weather conditions; investigate sensor modalities and develop software to perform rapid, stand-off assessments of austere entry locations by remotely assessing terrain condition (soil physical properties) and integrating weather effects. <i>FY 2015 Plans:</i> Will research and establish an Environmental Intelligence modeling framework supporting broad Army mission utility including trainers, Soldiers, planners and materiel developers, with real world operational environment terrestrial and climate modeling integral to training scenarios, mission planning, and materiel performance, through geospatial tools depicting terrain and climate influences in a unit's operational environment, landscape and climate impacts to stability operations (land use, water resources), courses of action (COA) development, and capability development analysis of alternatives (AoA).			
Accomplishments/Planned Programs Subtotals	4.665	5.138	5.204

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T45 / Energy Tec Apl Mil Fac
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
T45: Energy Tec Apl Mil Fac	-	2.919	3.233	3.421	-	3.421	3.338	3.425	3.469	3.496	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and evaluates technologies necessary for secure, efficient, sustainable military installations, and contingency bases, emphasizing facility systems protection in response to evolving needs. Technologies and processes are also applied to the Army's industrial base to maintain its cost-effective readiness for munitions production, training, and in the theater of operations to reduce logistical footprint. This effort provides technologies to protect facility indoor air quality from contaminants such as mold, bacteria and viruses in work and living spaces as well as develops methods to optimize sustainable operations and maintenance to minimize lifecycle costs. In addition, technologies from this work provide a better understanding of critical infrastructure interdependencies to support sustainable and flexible facility operations and evolving mission requirements.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Adaptive and Resilient Installations	2.919	3.233	3.421
Description: This effort investigates and develops technologies necessary for energy efficiency and sustainable military installations, emphasizing energy and utility systems.			
FY 2013 Accomplishments: Validated thermal models and long term thermal performance prediction of phase change materials and emerging materials for mitigation of energy losses in building envelopes; provided to installation planners an operational user assessment decision support tool capability for integrated energy analysis and optimization in support of Net Zero Energy Installations.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>MILITARY ENGINEERING TECHNOLOGY</i>	Project (Number/Name) T45 / <i>Energy Tec Apl Mil Fac</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Develop and begin integration of sustainment, restoration and modernization decision models that maximize effectiveness of facility retrofits, specifically for energy performance; validate multi-dimensional models and algorithms using emerging building envelope materials to reduce energy losses and transition innovative concepts for application of advanced technology to meet mandated energy reduction goals. FY 2015 Plans: Will develop sustainment, restoration and modernization decision models that provide installation managers with information necessary to identify actionable operations and investment opportunities to lower energy usage while maintaining mission functionality, thereby reducing facility lifecycle costs; will investigate use of indigenous materials for forward operating bases and contingency bases; will investigate smart and multifunctional materials and systems that increase strength, durability, resilience and EM shielding for buildings and hard shelter envelopes.			
Accomplishments/Planned Programs Subtotals	2.919	3.233	3.421

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / MILITARY ENGINEERING TECHNOLOGY	Project (Number/Name) T53 / Military Engineering Applied Research (CA)
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
T53: Military Engineering Applied Research (CA)	-	6.991	-	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Military Engineering applied research.

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

	FY 2013	FY 2014	FY 2015
Title: Congressional Program Increase	6.991	-	-
Description: This is a Congressional Interest Item.			
FY 2013 Accomplishments: Developed tools to allow for rapid evaluation of Force Projection and Protection platforms operating in an Anti-Access Area Denied environment.			
Accomplishments/Planned Programs Subtotals	6.991	-	-

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602785A / <i>Manpower/Personnel/Training Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	15.979	17.645	23.295	-	23.295	24.889	26.193	25.043	25.333	-	-
790: <i>Personnel Performance & Training Technology</i>	-	15.979	17.645	23.295	-	23.295	24.889	26.193	25.043	25.333	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 decrease attributed to Congressional General reductions (-40 thousand); SBIR/STTR transfers (-226 thousand); and Sequestration reductions (-1.536 million) FY15 funding increased for human behavioral research.

A. Mission Description and Budget Item Justification

This program element (PE) conducts applied behavioral and social science research that provides non-materiel solutions to ensure that Soldiers can adapt and excel and improve the Army's capability to fully leverage advances in networks, systems, and technologies as they evolve. This research provides the scientific basis to recruit, select, assign, promote, educate, train, and retain Soldiers and leaders that comprise a ready and relevant Landpower capability. The human science applied research conducted in this program element provides knowledge-products, methods, techniques, and tools that will enable the Army to: select Soldiers who are predicted to perform well in future jobs; assign Soldiers to Military Occupational Specialties (MOS) and jobs that better match their skills and abilities; retain an effective career force through improved strategies and behavioral incentives to influence Soldiers to stay in the Army for longer periods of time; accelerate the development of leader critical thinking and interpersonal skills through virtual practice so that junior leaders are more adaptable and prepared for uncertain, rapidly changing missions; develop innovative training strategies for complex battle command skills in network-enabled environments; and design training tools for dismounted squad leadership and team maneuver with ground Soldier systems technologies. Additional research is focused on training techniques and procedures that make it easier for trainers and training developers to rapidly respond to changes in mission or operational requirements and provide a more synergistic training and education process (e.g., automated and improved diagnostics, coaching and mentoring, performance measures, and feedback methods.

Work in this PE complements and is fully coordinated with PE 0603007A (Manpower/Personnel/Training Technology.)

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.

This project is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Arlington, VA.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602785A / <i>Manpower/Personnel/Training Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	17.781	17.654	18.513	-	18.513
Current President's Budget	15.979	17.645	23.295	-	23.295
Total Adjustments	-1.802	-0.009	4.782	-	4.782
• Congressional General Reductions	-0.040	-0.009			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.226	-			
• Adjustments to Budget Years	-	-	4.782	-	4.782
• Sequestration	-1.536	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602785A / <i>Manpower/Personnel/ Training Technology</i>	Project (Number/Name) 790 / <i>Personnel Performance & Training Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>790: Personnel Performance & Training Technology</i>	-	15.979	17.645	23.295	-	23.295	24.889	26.193	25.043	25.333	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

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

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Personnel	5.424	7.119	8.501
Description: Conduct applied research that provides the Army with improved predictability of potential performance, behaviors, attitudes, and resilience of Soldiers, as well as an improved ability to recruit and sustain an effective career force.			
FY 2013 Accomplishments: Completed longitudinal research that validates the predictive quality of non-cognitive measures that can be used to improve selection efficiency; identified and validated predictors of junior officer performance.			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602785A / <i>Manpower/Personnel/ Training Technology</i>	Project (Number/Name) 790 / <i>Personnel Performance & Training Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Initiating research on the use of non-cognitive measures to improve the officer classification process; completing multi-year validation of selection efficiency research; determining higher-order skill sets required for enlisted performance assessment across multiple clusters of job types to improve classification process and personnel/job matching. Initiating research on new measures to improve the selection of cyber personnel.</p> <p>FY 2015 Plans: Will conduct longitudinal validation of non-cognitive measures for awarding ROTC scholarships to high-potential officer candidates. Will initiate validation of the Information/Communications Technology Literacy Test (ICTL) as a measure to predict performance in cyber-related domains.</p>				
<p>Title: Personnel Readiness and Performance</p> <p>Description: This effort, previously titled "Training," will investigate and develop effective training and leader development methods to assess, enhance, and sustain individual and unit readiness, resilience, and effectiveness.</p> <p>FY 2013 Accomplishments: Created training that adapts to the needs of the trainee and tools that effectively deliver and assess training within technology enabled learning environments; developed training approaches and tools (e.g., diagnostic tools, collective training groups, pedagogical interventions) that improve units' ability to develop and manage training.</p> <p>FY 2014 Plans: Developing automated assessment tool for trainee performance to enable the Army Learning Model (i.e., accelerating learning and increasing adaptation to changing operational requirements); developing innovative training framework and methods for collective training of units that must perform exceptionally well in complex operational environments.</p> <p>FY 2015 Plans: Will develop training methods that expedite training across a range of tasks and training environments. Will initiate training research to improve Non-commissioned Officers' (NCOs) ability to develop junior Soldiers. Will initiate the development of strategies (e.g., training) for small unit leaders to create ready and resilient units.</p>		7.219	8.524	6.328
<p>Title: Leader Development and Culture</p> <p>Description: This effort, previously titled "Leader Development," will investigate and develop efficient and empirically valid measures and methods to assess command climate and associated outcomes. Will develop methods to enable leaders and units to ensure climates of dignity, respect, and inclusion.</p> <p>FY 2013 Accomplishments:</p>		3.336	2.002	8.466

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602785A / <i>Manpower/Personnel/ Training Technology</i>	Project (Number/Name) 790 / <i>Personnel Performance & Training Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Created methods and strategies to develop leader skills (e.g., cross-cultural competency, strategic thinking for mission command) needed in complex environments and designed assessment and training tools for leader development skills. <i>FY 2014 Plans:</i> Investigating strategic decision-making of leaders to inform a comprehensive design guide for commanders and staff; investigating knowledge/skill/ability requirements for an operational environment to design a training framework and integrate multiple cross-cultural skills to improve leader performance in cross-cultural situations. <i>FY 2015 Plans:</i> Will develop innovative methods and techniques to develop leader skills (e.g., techniques for mentorship, coaching, and subordinate development). Will initiate research to develop innovative training methods for Sexual Harassment/Assault Response and Prevention (SHARP).			
Accomplishments/Planned Programs Subtotals	15.979	17.645	23.295

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	53.206	31.529	25.751	-	25.751	31.241	31.831	33.534	35.544	-	-
283: <i>Airdrop Adv Tech</i>	-	2.133	2.363	2.392	-	2.392	3.102	3.448	2.822	2.786	-	-
E01: <i>Warfighter Technology Initiatives (CA)</i>	-	25.435	-	-	-	-	-	-	-	-	-	-
H98: <i>Clothing & Equipm Tech</i>	-	18.499	21.790	18.991	-	18.991	23.041	20.942	22.419	24.496	-	-
H99: <i>Joint Service Combat Feeding Technology</i>	-	5.677	5.799	3.029	-	3.029	3.327	4.941	5.043	5.087	-	-
VT4: <i>Expeditionary Mobile Base Camp Technology</i>	-	1.462	1.577	1.339	-	1.339	1.771	2.500	3.250	3.175	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 Adjustments attributed to increase for Congressional Add funding (26.0 million); decreases for General Congressional Reductions; (-94 thousand); SBIR/STTR transfers (-450 thousand); and Sequestration reductions (-531 thousand)
 FY15 funding realigned to support higher Army priorities.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and develops integrated technologies which improve Soldier and Small Combat Unit survivability, sustainability, mobility, combat effectiveness, field quality of life and assess impact of each on Soldier performance. This PE supports the design, development, and improvement of components used for air delivery of personnel and cargo (project 283), combat clothing and personal equipment including protective equipment such as personal armor, helmets and eyewear (project H98), combat rations and combat feeding equipment (project H99) and expeditionary base camps (VT4). This PE supports the investigation and advancement of critical knowledge and understanding of Soldier physical and cognitive performance. Project E01 funds congressional special interest items. 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 and Squad Integrated Concepts Development Team, and the DoD Combat Feeding Research and Engineering Board.

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

Work in this PE is related to, and fully coordinated with, PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0603001A (Warfighter Advanced Technology), PE 0602787A (Medical Technology Initiatives), 0602716A (Human Factors Engineering Technology) and PE 0602784A (Military Engineering Technology).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>
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The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	28.281	31.546	32.171	-	32.171
Current President's Budget	53.206	31.529	25.751	-	25.751
Total Adjustments	24.925	-0.017	-6.420	-	-6.420
• Congressional General Reductions	-0.094	-0.017			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	26.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.450	-			
• Adjustments to Budget Years	-	-	-6.420	-	-6.420
• Sequestration	-0.531	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>				Project (Number/Name) 283 / <i>Airdrop Adv Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
283: <i>Airdrop Adv Tech</i>	-	2.133	2.363	2.392	-	2.392	3.102	3.448	2.822	2.786	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project funds research, investigation and evaluation of component technologies to enhance cargo and personnel airdrop capabilities for global precision delivery, rapid deployment, and insertion for force projection into hostile regions. Areas of emphasis include parachute technologies, parachutist injury reduction, precision offset aerial delivery, soft landing technologies, and airdrop simulation.

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

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

Work in this project is fully coordinated with PE 0603001A/Project 242 (Warfighter Advanced Technology).

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

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

	FY 2013	FY 2014	FY 2015
Title: Airdrop/Aerial Delivery Research and Technology	2.133	2.363	2.392
Description: Beginning in FY13, this effort was renamed from Precision Aerial Delivery Enhancements to Airdrop/Aerial Delivery Research and Technology. The effort merged with the Enabling Airdrop Research and Technologies to provide complementary investigations of technologies for enhanced payload extraction and subsequent gliding capabilities, improve delivery accuracy of varying load weights, and investigate technologies for improved insertion safety and security for airborne personnel.			
FY 2013 Accomplishments: Evaluated decelerator design refinements and application of advanced sensors to decrease serious injuries and fatalities during mass tactical aerial insertion; conducted preliminary investigation of parafoil shape while in-flight to increase performance parameters.			
FY 2014 Plans: Investigate navigation technologies in GPS denied areas to reduce Soldier borne equipment load by increasing resupply to austere operational environments; building on results from FY13, investigate the application of e-textiles and embedded miniature sensors in parachute systems to improve aerial decelerator performance characteristics, increase operator safety (increased			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) 283 / <i>Airdrop Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
control and glide enhancement), decrease system costs, and reduce load burden for Soldiers engaged in airborne operations by lowering the retrograde/retrieval weight and volume of current equipment.			
<i>FY 2015 Plans:</i> Will investigate wind detection methods/methodologies for precision guidance, navigation and control; develop static line reserve parachute automatic activation technologies for future incorporation into personnel parachute systems to increase operator safety; design system to increase safety of high altitude and military free fall parachutists through risk reduction of collision or near-miss events between automated cargo delivery systems; investigate methods/methodologies for enhancing autonomous glide and precision delivery landing accuracy.			
Accomplishments/Planned Programs Subtotals	2.133	2.363	2.392

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602786A / Warfighter Technology				Project (Number/Name) E01 / Warfighter Technology Initiatives (CA)			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
E01: <i>Warfighter Technology Initiatives (CA)</i>	-	25.435	-	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Technology Applied Research.

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

	FY 2013	FY 2014	FY 2015
<p>Title: Power Generation Research</p> <p>Description: This is a Congressional Interest Item.</p> <p>FY 2013 Accomplishments: Conduct research on power generation technologies.</p>	12.435	-	-
<p>Title: Clothing and Equipment Technology</p> <p>Description: This is a Congressional Interest Item</p> <p>FY 2013 Accomplishments: Conduct research on Fibers and Polymers related to Individual Clothing and Textiles and Individual Soldier Protection technologies.</p>	13.000	-	-
Accomplishments/Planned Programs Subtotals	25.435	-	-

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>				Project (Number/Name) H98 / <i>Clothing & Equipm Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
H98: <i>Clothing & Equipm Tech</i>	-	18.499	21.790	18.991	-	18.991	23.041	20.942	22.419	24.496	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates and evaluates components and materials focused on enhancing Soldier survivability from combat threats (flame and thermal threats, blast and ballistic threats, and lasers) and environmental threats (e.g., cold, heat, wet) to increase operational effectiveness while decreasing the Soldier's physical and cognitive burden. Included are technologies and novel materials related to personnel armor, helmets, hearing protection, and eyewear. In addition, this project supports the development and refinement of essential analytic tools needed to predict and/or assess the combat effectiveness of next generation Soldier systems with a focus on human science investigation to identify and develop methods to assess human responses to sensory, physical, cognitive, and affective stimuli and stressors.

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

Work in this PE is fully coordinated with PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0603001A (Warfighter Advanced Technology), PE 0602787A (Medical Technology Initiatives) and PE 0602716A (Human Factors Engineering Technology).

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

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

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

	FY 2013	FY 2014	FY 2015
<p>Title: Soldier Blast and Ballistic Protection</p> <p>Description: Beginning in FY13, this effort was renamed from Ballistic and Blast Protection for the Individual Soldier to Soldier Blast and Ballistic Protection. This effort focuses on material modeling, novel materials, and component designs to protect Soldiers against ballistic and blast threats. This effort utilizes a cross-disciplinary, human-centric approach to develop technologies which optimize tradeoffs in ballistic and blast protective component design. This effort is fully coordinated with PE 0602787A/Project FH2, Project VB3, Project 874 (Medical Technology), PE 0602618A/H80, PE0602105A/Project H84, and PE0602716A/Project H70 (ARL) and PE 0603001/Project J50. This effort supports Force Protection Soldier & Small Unit capability research and addresses the Army top challenge of easing overburdened Soldiers in small units.</p> <p>FY 2013 Accomplishments: Investigated and assessed specific material parameters as well as novel assembling approaches for lightweight shelter and personal protective system applications; furthered design methodologies, processes, tests methods, and analytical tools that</p>	6.458	4.884	4.110

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H98 / <i>Clothing & Equipm Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Will mature active and passive technologies for providing improved eye protection against ballistic and laser threats; demonstrate proof of concept for active variable transmission lenses for enhanced situational awareness in rapidly changing light level conditions; develop novel spray coating process for producing optical quality films; investigate ballistic and optical properties of novel transparent composite materials and nanomaterials that can provide >50% increase in ballistic protection compared to current materials; investigate and determine the individual locomotion and cognitive effects of rapid-transition variable transmission lenses and the trade-offs between optical distortion and the extent of eye protection against laser, flash and ballistic fragmentation.</p>			
<p>Title: Measurement, Prediction and Improvement of Soldier Performance</p> <p>Description: Beginning in FY13, Soldier and Small Unit Modeling and Analysis efforts were combined with this effort to provide a more comprehensive focus on human science methods (psychological, anthropometric, and psychophysical) and biomechanical models to assess human responses to sensory, physical, cognitive and affective stimuli and stressors to support human systems design concepts for Soldier equipment and to enhance Soldier and Small Unit physical and cognitive performance. This work is collaborative with the Army Research Laboratory PE 0602716A/H70 and the Medical Research and Materiel Command PE 0602787A. This effort supports Force Protection Soldier & Small Unit capability research and addresses the Army top challenge of easing overburdened Soldiers in Small Units.</p> <p>FY 2013 Accomplishments: Evaluated mitigation techniques that support spatial memory and navigation such as adaptive display technologies, resilience training, and nutritional intervention; investigated the interactive effects of individual differences (e.g., spatial cognitive performance and working memory capacity) and mission context on Soldier cognitive processes; conducted operational human performance effectiveness modeling and simulation analyses for optimal body armor/load configurations for individual Soldiers and Small Units.</p> <p>FY 2014 Plans: Validate mitigation techniques for enhancing human spatial memory and navigation using adaptive display technologies and nutritional intervention; investigate new mitigation techniques such as enhanced vision technologies and biomechanical, physiological, as well as neurophysiological markers of physical and cognitive fatigue; incorporate data on the effects of individual differences on cognitive state monitoring technologies and mitigation techniques (e.g., measure stress and panic responses through eye movements, inner ear temperature, etc.); will integrate human performance data into performance models to enhance mission performance assessment and analysis for the Small Unit; will design and validate statistical human two dimensional and three dimensional models using updated Soldier anthropometric data to optimize the design, fit and sizing of Soldier clothing and individual equipment; will advance methods for assessing encumbered anthropometry to enable improved design of manned platforms. Investigate concepts for improved biofidelic human models.</p> <p>FY 2015 Plans:</p>	4.111	5.585	4.174

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H98 / <i>Clothing & Equipm Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Will lead the concept development for a suite of human systems performance measurements, approaches, and field analytical tools to support the human systems component of a Soldier Systems Engineering Architecture; develop and evaluate metrics and optimization strategies for human physical, psychological, cognitive, and emotional performance parameters as inputs for modeling and analysis of Soldier and Small Unit combat performance; conduct trade analyses between mobility, lethality, survivability, and mission performance; investigate improved anthropometric approaches for developing improved fidelity models that address vital organ size and location, fit and area of coverage to inform engineering designs for various Soldier equipment; investigate potential for human performance applications through emerging fields such as non-medical synthetic biology.</p> <p>Title: Advancements in Fibers, Textiles and Materials for Soldier Protection</p> <p>Description: Beginning in FY13, this effort is renamed from Multifunctional Fibers, Textiles and Material for the Soldier to Advancements in Fibers, Textiles and Materials for Soldier Protection. This effort focuses on technologies that aid in the design and evaluation of multifunctional protective materials and concealment concepts for Soldier clothing, equipment and shelters. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection Soldier & Small Unit.</p> <p>FY 2013 Accomplishments: Evaluated properties of novel bi- and tri-component fibers for Electro Magnetic Imaging (EMI) shielding, friend/foe identification and signature management; investigated environmentally benign coatings, surface treatments and other novel deposition techniques for flame and thermal protection; investigated the performance of non-traditional textiles to protect against temperature extremes, microbes, and insects threats to increase protection capabilities of Soldier clothing, individual equipment, and shelters.</p> <p>FY 2014 Plans: Investigate cost effective textile-embedded power generation for integration of sensors/detectors into Soldier clothing to reduce power needs and Soldier carried weight; investigate metrics, methods, and treatments for multifunctional materials to enhance Soldier survivability and mission effectiveness by reducing probability of detection by battlefield sensors; validate novel flame resistant (FR) test methodologies for FR materials that more accurately measure thermal material properties and provide trade-off data for developing Soldier clothing; conduct experiments on multi-functional protective textiles and membranes to determine response to environmental extremes and microbial/insect threats to develop increased protection capabilities for emerging pathogenic threats to Soldiers and Small Units.</p> <p>FY 2015 Plans: Will mature novel textile and fiber-based technologies to provide protection against multiple environmental threats to Soldiers and Small Units; investigate use of electrotiles for providing protection to personnel and equipment against electromagnetic threats; investigate methods of incorporating anti-pathogenic functionality into textiles; investigate properties and methods of making novel multi-component fibers, nanofibers, and finished fabrics for use as Soldier protection against cuts/abrasion, cold weather environments, and pathogens; perform experimental proof of concept for thermal signature reduction technology concepts; develop predictive models for thermal signature performance of emerging materials; mature technologies and methods to improve</p>		5.384	7.926	7.196

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H98 / <i>Clothing & Equipm Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
visual signature management/camouflage; investigate inherently flame resistant fiber and novel coating technologies that provide significant performance improvements over Flame Resistant-Army Combat Uniform (FR-ACU) fabrics; investigate alternative fiber technologies for durable, wearable combat identification systems that enable improved visibility to friendly forces; characterize novel thermoelectric textile materials for wearable power generation and personal cooling applications.			
Accomplishments/Planned Programs Subtotals	18.499	21.790	18.991

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H99 / <i>Joint Service Combat Feeding Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
<i>H99: Joint Service Combat Feeding Technology</i>	-	5.677	5.799	3.029	-	3.029	3.327	4.941	5.043	5.087	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project investigates, develops and evaluates novel ration packaging, combat feeding equipment/systems and advanced food processing technologies to prolong shelf-life. This project also investigates technologies that detect food safety hazards on the battlefield and enhance quality, nutritional content and the variety of food items in military rations. Efforts funded in this project support all Military Services, the Special Operations Command, and the Defense Logistics Agency. The Army serves as Executive Agent for this Department of Defense (DoD) program, with oversight and coordination provided by the DoD Combat Feeding Research and Engineering Board. Technologies developed within this effort transition to PE 0603001A/Project C07 for maturation.

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

Work in this PE is fully coordinated with PE 0602787A/Project 869 (Medical Technology).

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

Work in this project is led, performed, and/or managed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA, and this project has collaborative efforts with the US Army Research Institute for Environmental Medicine.

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

	FY 2013	FY 2014	FY 2015
Title: Joint Combat Feeding Equipment Technologies	2.298	2.343	-
<p>Description: Beginning in FY15, this effort will be renamed from Joint Combat Feeding Equipment Technologies to Joint Combat Feeding Equipment and Food Protection Technologies. This effort will investigate technologies in support of DoD Veterinary Service Activity (VSA) to improve field detection and identification capabilities for presence of chemical and biological threats in foods, and provide new tools/sensors for food inspectors. This effort additionally investigates equipment and energy technologies to expand capability and reduce logistics footprint of Joint Services field feeding operations in a wide range of environmental and operational contexts.</p> <p>FY 2013 Accomplishments:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H99 / <i>Joint Service Combat Feeding Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Explored alternative energy solutions to reduce fuel, water, and logistics requirements of current field feeding systems to support a single scalable kitchen platform for the Joint Forces that uses common integrated kitchen components.</p> <p>FY 2014 Plans: Investigate grey water recycling and repurposing technologies within field feeding operations to reduce the contingency basing footprint and cost; investigate logistical support and costs of novel JP8 fueled burner technologies within containerized field kitchen platforms to improve fuel efficiency and reduce troop to task ratio within contingency basing field feeding operations; identify technology gaps in kitchen platforms across Joint Forces to increase use of common kitchen components to improve mean-time between failure while increasing interoperability across Joint systems.</p>			
<p>Title: Joint Combat Feeding Equipment and Food Protection Technologies</p> <p>Description: Beginning in FY15, this effort is renamed from Joint Combat Feeding Equipment Technologies to Joint Combat Feeding Equipment and Food Protection Technologies. This effort will investigate technologies in support of DoD Veterinary Service Activity (VSA) to improve field detection and identification capabilities for presence of chemical and biological threats in foods, and provide new tools/sensors for food inspectors. This effort additionally investigates equipment and energy technologies to expand capability and reduce logistics footprint of Joint Services field feeding operations in a wide range of environmental and operational contexts.</p> <p>FY 2015 Plans: Will explore technology for elimination/prevention of pathogens in fresh fruit and vegetables; develop methods to significantly reduce detection times for viable pathogens; investigate novel technologies to promote Joint field feeding operations and reduce field feeding logistical footprint.</p>	-	-	1.429
<p>Title: Ration Stabilization, Packaging, Novel Nutrient Delivery, and Food Safety Technologies</p> <p>Description: Beginning in FY15, this effort will be renamed from Ration Stabilization, Packaging, Novel Nutrient Delivery, and Food Safety Technologies to Ration Stabilization and Novel Nutrient Delivery Technologies. This effort will provide investigation of complementary food technologies. This effort identifies and develops stabilization techniques and nutrient compositions to maximize Warfighter's cognitive and physical performance on the battlefield and minimizes nutritional degradation to optimize Warfighter's health.</p> <p>FY 2013 Accomplishments: Explored novel drying process to produce shelf stable, nutritionally dense carriers for performance optimizing ingredients; explored efficient food sample preparation/clean-up methods to improve accuracy of biosensor detection technologies for preventing food borne illnesses; investigated simulated digestion model to measure human absorption of bio-active nutrients.</p> <p>FY 2014 Plans:</p>	3.379	3.456	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) H99 / <i>Joint Service Combat Feeding Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
Investigate dehydration technologies to produce lighter weight, condensed, shelf-stable rations that reduce refrigeration requirements in field environments; explore methods of stabilizing amino acids within rations to ensure optimal nutritional absorption by the Warfighter based on results from the FY13 investigation of the simulated digestion model; evaluate performance of new bio-based packaging solutions within ration platforms to meet shelf-stability requirements extending ration life-cycle and reducing cost.				
<p>Title: Ration Stabilization and Novel Nutrient Delivery Technologies</p> <p>Description: Beginning in FY15, this effort is renamed from Ration Stabilization, Packaging, Novel Nutrient Delivery, and Food Safety Technologies to Ration Stabilization and Novel Nutrient Delivery Technologies. This effort will provide investigation of complementary food technologies. This effort identifies and develops stabilization techniques and nutrient compositions to maximize Warfighter's cognitive and physical performance on the battlefield and minimizes nutritional degradation to optimize Warfighter's health.</p> <p>FY 2015 Plans: Will explore nutrient delivery methods within rations to ensure optimal Warfighter nutrition and performance; investigate emerging technologies to produce lightweight, condensed, shelf-stable rations that reduce refrigeration requirements in field environments; explore novel processing and stabilization technologies to improve acceptability and increase consumption while meeting shelf-stability requirements, extending ration life-cycle and reducing cost.</p>		-	-	1.600
Accomplishments/Planned Programs Subtotals		5.677	5.799	3.029
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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) VT4 / <i>Expeditionary Mobile Base Camp Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
VT4: <i>Expeditionary Mobile Base Camp Technology</i>	-	1.462	1.577	1.339	-	1.339	1.771	2.500	3.250	3.175	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project matures and demonstrates fully integrated holistic expeditionary base camp (EBC) capabilities with mission-specific plug and play components, subsystems and modules designed to optimize manpower requirements, improve situational awareness, increase Soldier readiness and survivability, optimize habitation, reduce logistics footprint, enhance supportability and reduce cost. Expeditionary Base Camp (EBC) systems provide an operational capability for Small Combat Units (battalion and below) and Soldiers in varying environments which are rapidly deployable and re-locatable and require no Military Construction and limited materiel handling support. This project integrates mature technologies to create mission specific lab demonstrators and evaluates the performance capabilities using metrics and methodologies developed under PE 0602786A/Project VT4.

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

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

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

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

	FY 2013	FY 2014	FY 2015
Title: Expeditionary Base Camp Component Technologies	1.462	1.577	1.339
Description: Identify and improve component interoperability and mature and scale component technologies for an integrated holistic base camp concept. This effort supports Basing Sustainment and Logistics capability demonstrations.			
FY 2013 Accomplishments: Evaluated technology approaches to address the performance criteria and capability sets identified in FY12; investigated technologies which can increase capabilities to project the force, sustain the force and/or protect the base without increasing			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602786A / <i>Warfighter Technology</i>	Project (Number/Name) VT4 / <i>Expeditionary Mobile Base Camp Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
manpower requirements; conducted experiments to measure protection, power and other sustainment technologies performance using test protocols developed in FY12. FY 2014 Plans: Investigate self-sustaining living module concepts for experiments with technologies investigated in FY13 that reduce dependence on resupply at Contingency Bases by providing protection, water, energy efficiency and power capabilities; validate protection, power and other sustainment performance parameters measured in FY13. FY 2015 Plans: Will investigate emerging technology approaches (e.g., ion-exchange) for handling and treatment of black waste to ensure a hygienic environment and protect Soldier health and readiness at combat outposts; explore self-sufficiency solutions that minimize logistical needs, as well as identify opportunities for co-generation and dual-use technology approaches; investigate the benefits of nonwoven textiles for potential shelter technology applications to achieve a 20% weight reduction over current woven fabrics.			
Accomplishments/Planned Programs Subtotals	1.462	1.577	1.339

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602787A / <i>MEDICAL TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	98.023	93.290	76.068	-	76.068	77.330	77.544	82.783	83.412	-	-
869: <i>Warfighter Health Prot & Perf Stnds</i>	-	34.378	34.709	31.603	-	31.603	30.668	27.638	30.376	30.634	-	-
870: <i>Dod Med Def Ag Inf Dis</i>	-	17.993	19.062	17.745	-	17.745	19.350	20.743	22.418	22.912	-	-
873: <i>HIV Exploratory Rsch</i>	-	7.800	-	-	-	-	-	-	-	-	-	-
874: <i>Cbt Casualty Care Tech</i>	-	17.642	18.261	15.861	-	15.861	17.120	17.531	19.214	19.056	-	-
FH2: <i>Force Health Protection - Applied Research</i>	-	5.565	6.313	6.061	-	6.061	5.314	6.673	5.727	5.727	-	-
VB4: <i>System Biology And Network Science Technology</i>	-	4.645	4.836	4.798	-	4.798	4.878	4.959	5.048	5.083	-	-
VJ4: <i>Suicide Prevention/ Mitigation</i>	-	10.000	10.109	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

Note

FY13 adjustments attributed to Congressional General Reductions (-212 thousand); SBIR/STTR transfers (-1.579 million); Sequestration reductions (-8.912 million) and internal Army reprogrammings (835 thousand)
 FY15 reduction attributed to realignment to other higher priority Army programs.

A. Mission Description and Budget Item Justification

This program element (PE) supports application of knowledge gained through basic research to refine drugs, vaccines, medical devices, diagnostics, medical practices/ procedures, and other preventive measures essential to the protection and sustainment of Warfighter health. Research is conducted in five principal areas: Combat Casualty Care; Military Operational Medicine; Military Relevant Infectious Diseases Clinical and Rehabilitative Medicine; and Systems Biology/Network Sciences. Research is funded in six projects.

Project 869 refines knowledge and technologies on screening tools and preventive measures for post-traumatic stress disorder and mild traumatic brain injuries, physiological monitors, and interventions to protect Soldiers from injuries resulting from operational stress, and exposure to hazardous environments and materials. Also conducts research on medically valid testing devices and predictive models used for the refinement of Soldier protective equipment. This project is being coordinated with the Defense Health Program.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602787A / <i>MEDICAL TECHNOLOGY</i>	
<p>Project 870 designs and refines medical diagnostic devices, drugs, and vaccines for protection and treatment against naturally occurring diseases and wound infections of military importance, as identified by worldwide medical surveillance and military threat analysis. This project is being coordinated with the Defense Health Program.</p> <p>Project 873 conducts research on HIV, which causes acquired immunodeficiency syndrome (AIDS). Work in this area includes refining improved identification methods to determine genetic diversity of the virus, preclinical work in laboratory animals including non-human primates to identify candidates for future vaccine refinement, and evaluating and preparing overseas sites for future vaccine trials. This project is being coordinated with the Defense Health Program, (DHP). This effort and associated funding was transferred to DHP starting FY14.</p> <p>Project 874 identifies and evaluates drugs, biologics (products derived from living organisms), medical devices, and diagnostics for resuscitation, life support, and post-evacuation restorative and rehabilitative care, as well as trauma care systems for use by field medics and surgeons. Research focus is on identifying more effective critical care technologies and protocols to treat severe bleeding, traumatic brain injury and other blast related injuries, and treatments for ocular injury and visual system dysfunction, as well as laboratory and animal studies of regenerating skin, muscle, nerves, and bone tissue for the care and treatment of battle-injured casualties. This project is being coordinated with the Defense Health Program.</p> <p>Project FH2 conducts applied research directed toward the sustainment of a healthy force of Warfighters through the entire deployment life cycle.</p> <p>Project VB4 conducts applied research in systems biology to provide a highly effective mechanism to integrate iterative biological tests, computer simulations, and animal studies. Such refinement efforts using systems biology could ultimately reduce the time and effort invested in medical product refinement. This project is being coordinated with the Defense Health Program.</p> <p>Project VJ4 examines the mental and behavioral health of Soldiers to counter suicidal behavior. This work focuses on advancing the understanding of the multiple determinants of suicidal behavior, psychopathology (study of the causes and nature of abnormal behavior), psychological resilience, and role functioning. Work on this project is being performed by the National Institute of Mental Health through extramural cooperative research grants in collaboration with the Department of the Army. This project is being coordinated with the Defense Health Program.</p> <p>The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.</p> <p>All medical applied research is conducted in compliance with U.S. Food and Drug Administration (FDA) or Environmental Protection Agency (EPA) regulations. The FDA requires thorough testing in animals (referred to as preclinical testing) to ensure safety and, where possible, effectiveness prior to evaluation in controlled human clinical trials (upon transition to 6.3 Advanced Technology Development). This PE focuses on research and refinement of technologies such as product formulation and purification and assay refinement with the aim of identifying candidate solutions. This work often involves preclinical testing in animals. The EPA also requires thorough testing of products, such as sterilants, disinfectants, repellents, and insecticides to ensure the environment is adequately protected before these products are licensed for use.</p>		

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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602787A / <i>MEDICAL TECHNOLOGY</i>
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Program refinement and execution is 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) Committee. The ASBREM Committee serves to facilitate coordination and prevent unnecessary duplication of effort within the Department of Defense (DoD) biomedical research and refinement community, as well as their associated enabling research areas.

Work funded in this project PE is fully coordinated with efforts undertaken in PE 0603002A and the Defense Health Program.

Work in this PE is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD and its overseas laboratories; U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; the U.S. Army Dental Trauma Research Detachment and the U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL; and the Naval Medical Research Center (NMRC), Silver Spring, MD.

B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	107.891	93.340	83.115	-	83.115
Current President's Budget	98.023	93.290	76.068	-	76.068
Total Adjustments	-9.868	-0.050	-7.047	-	-7.047
• Congressional General Reductions	-0.212	-0.050			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.835	-			
• SBIR/STTR Transfer	-1.579	-			
• Adjustments to Budget Years	-	-	-7.047	-	-7.047
• Sequestration	-8.912	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY				Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
869: Warfighter Health Prot & Perf Stnds	-	34.378	34.709	31.603	-	31.603	30.668	27.638	30.376	30.634	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts research to prevent and protect Soldiers from training and operational injuries, refine mechanisms for detection of physiological and psychological health problems, evaluate hazards to head, neck, spine, eyes, and ears, set the standards for rapid return-to-duty, and determine new methods to sustain and enhance performance across the operational spectrum. This research provides medical information important to the design and operational use of military systems, and this work forms the basis for behavioral, training, pharmacological (drug actions), and nutritional interventions.

- The four main areas of study are:
- (1) Environmental Health and Protection
 - (2) Physiological Health
 - (3) Injury Prevention and Reduction
 - (4) Psychological Health and Resilience

Additionally the Soldier Systems Engineering Architecture task advances medical S&T in the areas of injury prevention and performance sustainment in the context of human interaction with new Soldier systems and provide greater insight into informing new research in development of Soldier systems and the interactions between Soldiers and the systems they employ.

Promising efforts identified in this project are further matured under PE 0603002A, project MM3.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; U.S. Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

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

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

	FY 2013	FY 2014	FY 2015
Title: Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments	2.643	1.930	1.337

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort evaluates remote monitoring of Soldier physiological (human physical and biochemical functions) status and mitigating/eliminating the effects of heat, cold, altitude, and other environmental stressors on Soldier performance. This effort supports Technology-Enabled Capability Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2013-2014, and also supports capability demonstrations in the area of decreasing physical burden for Soldiers in FY 2013-2014.</p> <p>FY 2013 Accomplishments: Conducted laboratory studies to determine effects of hypoxia (oxygen depletion) on peripheral blood flow during cold exposure. These results lead to the refinement of preventive measures for Warfighters deployed in high-altitude environments and may be included as components in the altitude and work performance models.</p> <p>FY 2014 Plans: Conduct studies to determine whether physiological fatigue in cold environments increases susceptibility to non-freezing cold injury, such as trenchfoot and hypothermia and develop screening procedures to determine those Warriors most at risk for non-freezing cold injury. Continue studies to determine the impact of hypoxia (oxygen depletion) on peripheral blood flow responses and susceptibility to non-freezing cold injury.</p> <p>FY 2015 Plans: Will identify physiological (human physical and biochemical functions) reflexes that improve hand and finger dexterity during cold exposure and will refine localized heating strategies to improve dexterity (coordination of small muscle movements which occur in body parts such as the fingers, usually in coordination with the eyes) in cold weather operations. Will develop decision aids for trade-off analyses of the impact of body armor protection and load on aerobic performance capabilities in temperate and hot environments. Will also determine if thermoregulatory (ability of an organism to keep its body temperature within certain boundaries) fatigue and altitude exposure increase susceptibility for non-freezing cold injury symptoms including numbness. Will identify biomarkers predictive of individual risk for developing acute mountain sickness at high altitude operations.</p>			
<p>Title: Physiological Health - Nutritional Sustainment and Fatigue Interventions</p> <p>Description: This effort evaluates methods for managing and controlling the effects of nutrition and fatigue on Soldier operational performance. This effort supports Technology Enabled Capability Demonstration 7.d, Brain In Combat in FY 2013-2014.</p> <p>FY 2013 Accomplishments: Determined the capacity of nutrients from plants to alter oxidative stress (condition where potentially damaging substances exist in cells in excess of the cell's ability to detoxify them), reduced oxygen supply, or chemical-induced toxicity. These results lead to interventions designed to protect Warfighters from environmental hazards; defined the effects of metabolic energy availability on cognitive performance; determined whether nutritional interventions can facilitate bone remodeling in response to military training; incorporated a mathematical model of caffeine effects during chronic sleep restriction into the sleep performance model; and refined a cognitive (mental processing) model to predict differential rates of recovery following various chronic sleep restriction</p>	7.779	6.103	3.611

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>operational scenarios. These results increased predictive capability against the effects of fatigue; determined the effects of physiological (human mechanical, physical and biochemical functions) factors, such as genetic makeup, sleep history, and personality on individual differences in physiological resiliency.</p> <p>FY 2014 Plans: Establish the nutritional requirements for optimizing Soldier re-fueling; establish Military Dining Facility serving practices that promote healthy food choices; establish the nutritional requirements for optimizing bone health; and develop dietary support interventions that accelerate cognitive recovery after operational stress. These interventions optimize Soldier recovery from demanding missions through nutrition; develop mathematical models and algorithms for prediction of cognitive resilience based on physiological factors determined from laboratory studies, which allow resilience training to be personally optimized; compare the effectiveness and post-awakening performance profile of novel sleep-inducers against that of currently available pharmaceuticals, which will determine the most efficient intervention for sleep induction; develop a mathematical method for estimating thermal-work strain from non-invasive measures such as heart rate, skin temperature, heat flux, without the use of thermometer pills, which will allow for the optimization of Soldier load distribution and energy expenditure.</p> <p>FY 2015 Plans: Will establish nutrition approaches that promote resistance to physical, cognitive and environmental stressors and promote muscle and bone recovery. Will develop next generation predictive algorithms that non-invasively estimate overheating for incorporation into wearable sensor systems. Will establish sensors and biomathematical models capable of predicting cognitive status and likelihood of risk for musculoskeletal injury. Will determine patterns of physiological (human mechanical, physical, and biochemical functions), behavioral, and cognitive-affective responses in individuals during exposure to multiple stressors and will develop a working operational definition of physiological resilience and algorithms to predict individualized resilience.</p>			
<p>Title: Injury Prevention and Reduction - Neurosensory Injury Prevention</p> <p>Description: The Warrior Injury Assessment Manikin analyzes and models the effects of mechanical and operational stressors on Soldier performance, to include acoustic and impact trauma, vision, vibration, and jolt to model the effects of these stressors on the brain, spine, eyes, and hearing. This effort supports Technology-Enabled Capability Demonstration 1.c, Force Protection-Occupant Centric Platform in FY2013-2014.</p> <p>FY 2013 Accomplishments: Refined standard methodology for the evaluation of vision and ocular sensitivity during rapid transitions between light and dark operational conditions; refined methodology to evaluate blunt facial protection strategies; refined a model to assess the effectiveness of existing and newly developed hearing protection/enhancement strategies during continuous and impulse noise combat operations to predict the effects of hearing loss in an operational environment; determined additive effects of laser pulses</p>	2.744	8.165	2.490

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>to enable the safe use of military laser systems and provide biomedical data to assess eye protection devices; assessed military ocular (eye) trauma from blast or lasers and outcomes to lead to the prevention and effective mitigation of battlefield eye injuries.</p> <p>FY 2014 Plans: Develop improved eye protection standards and ophthalmic (pertaining to the eye) guidelines for protective eyewear that serves the various Warrior occupations and develop hearing protection strategies for optimized active noise-reduction protection. Develop novel assessment methods to detect impulse noise exposures. Develop a computational fluid dynamic model of the eye to evaluate the effects of blast exposures to ocular tissue.</p> <p>FY 2015 Plans: Will develop spinal injury criteria and protection assessment methodologies for military vehicle occupants. Will develop methods for assessing the effectiveness of prevention strategies against hearing and vestibular (sensory system supporting movement and sense of balance, located in the inner ear) injuries. Will develop assessment criteria for prediction of eye injury resulting from blunt, ballistic, and blast-wave forces, and will determine injury prevention criteria for eye injury induced by repetitive blast exposures.</p>			
<p>Title: Injury Prevention and Reduction - Musculoskeletal Injury Prevention</p> <p>Description: This effort evaluates and assesses the effects of repetitive motion during military operations and training on the human body; allows for the prediction of injuries as a result of continuous operations and muscle fatigue; evaluates current standards for return-to-duty; and establishes improved medical assessment methods with the goal of rapid return to duty of Soldiers following injury. This effort supports Technology-Enabled Capability Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2013-2014.</p> <p>FY 2013 Accomplishments: Refined a mounted Soldier injury performance assessment battery and assessed the physical performance requirements and determine minimal acceptable standards for muscle/skeletal injury for the dismounted Soldier. These results provided data for an improved musculoskeletal injury risk analysis capability for the Soldier.</p> <p>FY 2014 Plans: Develop a quantitative computational model that can predict physical performance and risk of injury of individual Soldiers and develop training strategies and/or dietary interventions to improve recovery following intense physical exercise.</p> <p>FY 2015 Plans: Will model functional neuromuscular adaptation following muscle injury and will determine the effect of inflammatory processes on muscle repair and regeneration, risk of re-injury, and incomplete healing. Will determine the modifiable and non-modifiable risk hazards for musculoskeletal injuries.</p>	6.884	5.159	2.076
<p>Title: Injury Prevention and Reduction - Injury Return-to-Duty Standards:</p>	3.058	2.676	3.016

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort evaluates current standards for rapid return-to-duty and establishes improved medical standards and assessment methods with the goal of more rapid return-to-duty of Soldiers following injury.</p> <p>FY 2013 Accomplishments: Evaluated impulse noise measurement techniques to assess the potential for acoustic (hearing) injury to Soldiers. These results provided an increased predictive capability for acoustic trauma. Determined the effect of a low-level repeated-blast exposure environment on vestibular function (balance and movement). These results lead to the refinement of medical guidelines that prevent impaired Soldiers from being prematurely returned to duty.</p> <p>FY 2014 Plans: Compare treatment modalities for impact on return to duty and develop a toolkit for assessment that includes testing vision, hearing, and vestibular (sensory system supporting movement and sense of balance) function; develop models that predict and prevent auditory (process of hearing) injury; and develop criteria to improve hearing conservation and guide development of hearing protection equipment for Warriors.</p> <p>FY 2015 Plans: Will characterize current Warfighter injury trends contributing to lost duty days, reduced mission effectiveness, and occupational disability. Will determine the effects of physical, auditory, and visual system injury on military occupational performance and will define minimal standards for Soldier performance prior to returning to duty. Will evaluate the consequences of injury to the auditory or visual systems of Warfighters diagnosed with brain injury.</p>			
<p>Title: Psychological Health - Psychological Resilience</p> <p>Description: This effort refines, validates, and disseminates early interventions to prevent and reduce combat-related behavioral health problems, including symptoms of post-traumatic stress disorder (PTSD), depression, anger problems, anxiety, substance abuse, post-concussive symptoms, and other health risk behaviors and also assesses and refines interventions to enhance and sustain resilience throughout the Warfighter's career. This effort supports Technology Enabled Capability Demonstration 7.d. Brain In Combat in FY2013-2014.</p> <p>FY 2013 Accomplishments: Finalized assessment of post-deployment reintegration strategies; conducted studies to show the effectiveness of behavioral health and resiliency skills for leaders; and conducted studies to evaluate the effectiveness of behavioral health and resiliency skills for leaders. These results are used to refine preventive and treatment interventions to enhance the psychological resilience of the Warfighter.</p> <p>FY 2014 Plans:</p>	6.566	8.436	14.497

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Evaluate and determine optimal interventions for preventing and treating deployment-related PTSD and comorbidities (more than one illness) to include medications, best psychotherapy and medication combinations, and alternative therapy protocols, including internet- based cognitive (mental processes) therapy. These intervention strategies will be used to optimize treatment outcomes and to implement more effective, efficient, and economical treatment regimens; benchmark emerging behavioral health trends through rapid fielding assessment teams to inform resilience training modifications. This effort ensures rapid response to Warfighter needs and determines evidence-based recommendations for Soldier reintegration strategies into their units and society; develop and refine evidence-based resilience training strategies for the deployment cycle; develop best practice recommendations based on research findings to facilitate Warfighters receiving the best possible training and provider care; and assess factors that contribute to return-to-duty decisions and conduct research to develop criteria and tools to inform return-to-duty decisions following psychological injury. This effort works toward facilitating confidence in the Warfighter and provider that the Warfighter is psychologically fit to return to duty.</p> <p>FY 2015 Plans: Will develop and disseminate validated strategies and early interventions to enhance and sustain mental health and well-being throughout service member's careers and will determine evidence-based recommendations for reintegration strategies. Will benchmark behavioral health problems, risk, and resilience physiological biomarkers (blood, urine, saliva, genetic, protein, etc.) in Soldiers and their Families. Will conduct analyses of neurocognitive (cognitive ability) test scores associated with a wide variety of psychological return-to-duty outcomes. Will conduct studies that explore the utility of sleep monitors and neurocognitive tools for psychological return-to-duty decision making. Will assess various mechanisms and interventions for reducing deployment-related anxiety. Will develop and validate unit-based, post-deployment resilience training for Soldiers. Will conduct trials with active duty Warriors assessing optimal intervention methods for PTSD, including medications. Will determine the correlation between PTSD interventions, such as prolonged exposure adjunct therapy and virtual reality to recreate the context of the original traumatic exposure, and changes in individual biomarker levels.</p>			
<p>Title: Psychological Health & Resilience - Suicide Prevention and Treatment of PTSD</p> <p>Description: This effort supports investigation of methods to treat PTSD in a military population and identifies causative and preventive factors in military suicides.</p> <p>FY 2013 Accomplishments: Refined specific interventions for the most effective means of treating deployment-related PTSD, including medications, psychotherapy, and complementary alternative medicine approaches and refined valid screening and assessment measures for the Soldier at risk of suicide. These early intervention strategies are used to reduce suicide rates among Service members, determined effectiveness of suicide prevention training for increasing suicide awareness and decreasing suicide-related behaviors</p>	3.270	1.014	1.000

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>and intent. These results helped increase psychological resilience and mitigated the potential for suicide. Additionally, these results complement work in 6.3 Project MM3 and related DHP programs.</p> <p>FY 2014 Plans: Test the effectiveness of a brief, telephone-based intervention to increase behavioral health treatment-seeking among Service members at high risk of suicide; learn about the type and range of decisions made by behavioral healthcare providers, chaplains, and leaders to address suicide-related events that occur during deployment, the process for making these decisions, and the lessons learned; assess how suicide-related events were managed and what could be improved; and develop guidelines and decision aids for use in deployed settings when suicide-related events occur.</p> <p>FY 2015 Plans: Will determine risk and protective factors associated with suicide behavior and intent. Will determine effective risk assessment and management methods for suicide prevention. Will deliver interventions to unit leaders and unit members following suicide events in a combat environment including interventions to manage grief and bereavement, and suicide prevention strategies.</p>			
<p>Title: Psychological Health & Resilience - Concussion/Mild Traumatic Brain Injury (mTBI) Interventions</p> <p>Description: This effort refines and evaluates methods to detect and treat concussion as well as identify and evaluate the effects of cognitive deficits in Soldiers during operations. This effort supports Technology-Enabled Capability Demonstration 7.d, Brain In Combat in FY2013-2014.</p> <p>FY 2013 Accomplishments: Refined an evidence (data)-based comparative analysis of the foremost neurocognitive (functions of the brain) tests for assessment of mTBI in Soldiers; conducted an assessment to determine which post-concussion syndrome symptoms are caused by sleep disturbance; and refine guidance on drug interventions to improve psychological and neurophysiological functioning post-concussion. These results lead to the refinement of more effective interventions following concussive injury.</p> <p>FY 2014 Plans: Conduct research to evaluate the utility of magnetoencephalography (MEG), (technique for mapping brain activity by recording magnetic fields produced by electrical currents occurring naturally in the brain, using very sensitive magnetometers), a cutting-edge imaging technique for the brain, as a tool for differentiating PTSD from the brain injury following a post-concussion event; compare two imaging techniques (MEG and functional magnetic resonance imaging) for effectively assessing brain injury following a post-concussion event. These efforts lead to more effective assessment of Warriors brain injury post-concussion and facilitate appropriate care.</p> <p>FY 2015 Plans:</p>	1.434	1.226	1.076

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 869 / Warfighter Health Prot & Perf Stnds
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Will characterize sleep duration, timing, and continuity on post-concussive symptoms using objective sleep measures. Will determine the relative utility of existing neurocognitive tools for assessment of post-concussive symptoms. Will develop algorithms to predict concussion likelihood based on post-exposure symptoms and brain injury			
Title: Soldier Systems Engineering Architecture	-	-	2.500
Description: This effort will advance medical S&T in the areas of injury prevention and performance sustainment.			
FY 2015 Plans: Will advance medical S&T in the areas of injury prevention and performance sustainment in the context of human interaction with new Soldier systems and provide greater insight into informing new research across the S&T community (medical and non-medical) in development of Soldier systems and the interactions between Soldiers and the systems they employ. This effort will leverage the work being done in Physiological Health, Injury Prevention & Reduction, both musculoskeletal and neurosensory, Psychological Health and Resilience and Environmental Health to inform the Soldier Systems Engineering Architecture initiative.			
Accomplishments/Planned Programs Subtotals	34.378	34.709	31.603

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY				Project (Number/Name) 870 / Dod Med Def Ag Inf Dis			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
870: <i>Dod Med Def Ag Inf Dis</i>	-	17.993	19.062	17.745	-	17.745	19.350	20.743	22.418	22.912	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts applied research for medical countermeasures to naturally occurring infectious diseases that pose a significant threat to the operational effectiveness of forces deployed outside the United States. Effective preventive countermeasures (protective/therapeutic drugs and vaccines and insect repellents and traps) protect the Force from disease and sustain operations by avoiding the need for evacuations from the theater of operations. Diseases of military importance are malaria, bacterial diarrhea, and viral diseases (e.g., dengue fever and hantavirus). In addition to countermeasures, this project funds refinement of improved diagnostic tools to facilitate early identification of infectious disease threats in an operational environment, informing Commanders of the need to institute preventive actions and improve medical care. Major goals are to integrate genomics (DNA-based) and proteomics (protein-based) as well as other new biotechnologies into the refinement of new concepts for new vaccine, drug, and diagnostics candidates.

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

- (1) Drugs to Prevent/Treat Parasitic (organisms living in or on another organisms) Diseases
- (2) Vaccines for Prevention of Malaria
- (3) Diagnostics and Disease Transmission Control
- (4) Bacterial Disease Threats (diseases caused by bacteria)
- (5) Viral Disease Threats (diseases caused by viruses)

For the refinement of drugs and biological products, studies in the laboratory and in animal models provide a proof-of-concept for these candidate products, including safety, toxicity (degree to which a substance can damage an organism), and effectiveness, and are necessary to provide evidence to the U.S. Food and Drug Administration (FDA) to justify approval for a product to enter into future human subject testing. Additional non-clinical studies are often needed in applied research even after candidate products enter into human testing during advanced technology development, usually at the direction of the FDA, to assess potential safety issues. Drug and vaccine refinement bears high technical risk. Of those candidates identified as promising in initial screens, the vast majority are eliminated after additional safety, toxicity, and/or effectiveness testing. Similarly, vaccine candidates have a high failure rate, because animal testing may not be a good predictor of human response, and therefore candidate technologies/products are often eliminated after going into human trials. Because of this high failure rate, a continuing effort to identify other potential candidates to sustain a working pipeline of countermeasures is critical for replacing those products that fail in testing.

Work is managed by the U.S. 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 PE 0603002A, project 810.

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 870 / Dod Med Def Ag Inf Dis
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The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; the U.S. Army Medical Research Institute of Infectious Disease (USAMRIID), Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

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

	FY 2013	FY 2014	FY 2015
<p>Title: Drugs to Prevent/Treat Parasitic Diseases (harmful effects on host by an infecting organism)</p> <p>Description: This effort conducts assessments and improves candidate drugs coming from the DoD discovery program and from other collaborations for prevention and treatment of malaria to counter the continuing spread of drug resistance to current drugs; conducts assessments in animal models of currently available drugs for use against cutaneous leishmaniasis (a skin-based disease transmitted by sand flies); and selects the most effective and safe candidates for continued refinement and possible clinical testing.</p> <p>FY 2013 Accomplishments: Evaluated selected compounds for anti-parasitic effectiveness in animal models to further down-select compounds specifically targeted for P. falciparum and P. vivax malaria for human trials and validated animal models for predicting drug effectiveness and toxicity for future drug testing.</p> <p>FY 2014 Plans: Test new refined candidate drug treatment in animal models for drug safety and effectiveness to evaluate anti-malaria and anti-leishmania activities of these compounds.</p> <p>FY 2015 Plans: Will continue to optimize new candidate drugs and drug combinations to stay ahead of emerging drug resistance in malaria parasite.</p>	4.052	4.463	3.360
<p>Title: Vaccines for Prevention of Malaria</p> <p>Description: This effort conducts studies to investigate new candidate vaccines for preventing malaria and selects the best candidate(s) for continued refinement. A highly effective vaccine would reduce or eliminate the use of anti-malarial drugs and would minimize the progression and impact of drug resistance to current/future drugs.</p> <p>FY 2013 Accomplishments:</p>	4.035	4.199	4.830

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 870 / Dod Med Def Ag Inf Dis

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Optimized formulations of candidate antigens (substance that when introduced into the body stimulates the production of an antibody) in animal models for further evaluation in human clinical trials.</p> <p>FY 2014 Plans: Assess immune responses of candidate antigens (substance that when introduced into the body stimulates the production of an antibody) and adjuvant (agent that enhances the effect of vaccines) formulations to optimize immunogenicity (ability of a particular substance to provoke an immune response) and effectiveness in animal challenge models.</p> <p>FY 2015 Plans: Will complete the development of a human challenge model for malaria. Under this model, volunteers vaccinated with a malaria vaccine candidate are deliberately "challenged" with malaria through the bite of malaria-infected mosquitoes to assess whether or not the candidate vaccine can prevent or delay malaria infection. Will test novel Plasmodium falciparum (severe form of malaria) antigens (substance that when introduced into the body stimulates the production of an antibody) and antigen combination in small animals.</p>			
<p>Title: Diagnostics and Disease Transmission Control:</p> <p>Description: This effort designs and prototypes new medical diagnostic and surveillance tools for the field, focusing on bedside and field-deployable diagnostic systems and refines interventions that protect Warfighters from biting insects such as sand flies, responsible for transmitting leishmaniasis, and mosquitoes, which transmit a variety of diseases including dengue fever, Japanese encephalitis, and malaria.</p> <p>FY 2013 Accomplishments: Refined diagnostic tools that provide on-the-spot identification of biting insects/tick/mites and their human/animal pathogen (infectious agent) infection status; evaluated new non-pesticidal technologies for insect population control; refined data package to obtain FDA clearance on the dengue assay designed for Joint Biological Agent Identification and Diagnostic System (JBAIDS); and evaluated next-generation diagnostic system platforms.</p> <p>FY 2014 Plans: Incorporate the vector (organisms that transmit infections) diagnostics and human diagnostic assays into the next-generation diagnostic system managed by Program Executive Office, Chemical Biologics and complete the dengue assay for use on testing mosquitoes to see if they carry the pathogen (infectious agent) of interest to Warfighters.</p> <p>FY 2015 Plans: Will research and develop pathogen (infectious agent) specific reagents (substance used in chemical reaction) and assays for selected diseases of military importance to address the capability gaps of fielded and commercially available Rapid Human Diagnostic Devices (RHDDs). Will refine pathogen detection assays and field test surveillance devices developed to detect</p>	1.882	2.040	1.679

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 870 / Dod Med Def Ag Inf Dis		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
pathogens in medically important arthropods and insects (e.g., ticks, mosquitoes and sandflies). Will test new compounds/formulations for application to personal protection methodologies.				
<p>Title: Viral Threats Research</p> <p>Description: This effort designs and laboratory tests new vaccine candidates against dengue and other hemorrhagic fever viruses such as hantaviruses (cause of Korean hemorrhagic fever) and other lethal viruses such as Lassa fever (viral disease contracted by ingestion or inhalation of rodents' urine and feces) and Crimean-Congo hemorrhagic fever (severe tick-borne viral disease with a 30% mortality rate in infected humans), and assesses other non-vaccine technologies to protect against such lethal viral diseases. Efforts also include establishing and maintaining of clinical trial sites worldwide.</p> <p>FY 2013 Accomplishments: Refined vaccines for viruses of military importance; conducted effectiveness studies to refine and/or maintain vaccine test site infrastructure; refined and validated assays in animal studies for future testing of dengue fever vaccine trials; established partnerships with industry for pre-clinical and clinical evaluation of medical countermeasures; investigated the feasibility of combining vaccines against different agents into single-label, multi-agent vaccines; identified and characterized new populations who are at high risk of being infected with HIV for clinical evaluation of potential vaccine candidates at overseas sites; and produced vaccines for various HIV subtypes and complete evaluation in animals.</p> <p>FY 2014 Plans: Identify and develop reagents, assays, and animal models to test the immunogenicity (ability of a particular substance to provoke an immune response) and protective effectiveness of candidate vaccines and other medical countermeasures against dengue, hantavirus, and other lethal viruses of military interest.</p> <p>FY 2015 Plans: Will identify and maintain vaccine test site infrastructure for evaluation of dengue vaccine candidates in human clinical trials. Will assess safety and immunogenicity (ability of a particular substance to provoke an immune response) data. Will apply this data as down selection criteria to identify superior performing vaccine candidates or administration strategies for advancement to testing of hantavirus and dengue vaccine candidates in human volunteers. Will test research strategies to develop novel assays to rapidly measure hantavirus neutralizing antibodies.</p>		3.571	3.771	3.745
<p>Title: Bacterial Threats</p> <p>Description: This effort conducts studies to refine antibacterial countermeasures, including vaccine candidates, to prevent diarrhea (a common disease in deployed troops caused by three diarrheal pathogens (infectious agents), E. coli, Campylobacter, and Shigella, wound infection, and scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics).</p> <p>FY 2013 Accomplishments:</p>		4.453	4.589	4.131

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 870 / Dod Med Def Ag Inf Dis
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Scaled-up vaccine formulation process and conducted toxicity testing on additional E. coli vaccine candidates to ensure adequate safety and vaccine protection coverage; conducted preclinical animal studies to determine safety and immune response to live-attenuated Shigella bivalent (two types) vaccine; and performed animal wound infection studies on candidate products to prevent wound infection and biofilm (an aggregate of microorganisms in which cells adhere to each other on a surface) formation</p> <p>FY 2014 Plans: Continue to evaluate new vaccine candidates against three diarrheal pathogens (infectious agents), Shigella, Campylobacter, and E. coli in animal models and evaluate safety and toxicity of selected antigens (substance that when introduced into the body stimulates the production of an antibody) in small animals to further down-select best candidates for future human testing.</p> <p>FY 2015 Plans: Will refine and evaluate two diarrheal pathogens (infectious agents), Shigella, and enterotoxigenic E. coli (leading bacterial cause of diarrhea), and vaccine candidates. Will study clinical grade prototype diarrheal disease vaccine candidates for animal testing. Will identify and prepare field sites for evaluation of candidate vaccines. Will maintain a scrub typhus chigger colony that is used as the challenge model to evaluate current Scrub typhus vaccine candidates. Will identify and characterize mechanisms of antibiotic resistance to scrub typhus infection.</p>			
Accomplishments/Planned Programs Subtotals	17.993	19.062	17.745

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY				Project (Number/Name) 873 / HIV Exploratory Rsch			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
873: HIV Exploratory Rsch	-	7.800	-	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts research on Human Immunodeficiency Virus (HIV), which causes Acquired Immunodeficiency Syndrome (AIDS). Work in this area includes refining improved identification methods to determine genetic diversity of the virus and evaluating and preparing overseas sites for future vaccine trials. Additional activities include refining candidate vaccines for preventing HIV and undertaking preclinical studies (studies required before testing in humans) to assess vaccine for potential to protect and/or manage the disease in infected individuals. This funding transferred to the Defense Health Program in FY14. This program is jointly managed through an Interagency Agreement between the U.S. Army Medical Research and Materiel Command (USAMRMC) and the National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH). This project contains no duplication of effort within the Military Departments or other government organizations.

Work is related to and fully coordinated with work funded in PE 0603105A, project H29.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR) and the Naval Medical Research Center (NMRC), Silver Spring, MD, and their overseas laboratories. The Henry M. Jackson Foundation (HMJF), located in Rockville, MD provides support for the U.S Food and Drug Administration (FDA) testing and other research under a cooperative agreement.

Efforts in this project support the Soldier Portfolio and the principal area of Military Relevant Infectious Diseases to include HIV.

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

	FY 2013	FY 2014	FY 2015
Title: HIV Research Program	7.800	-	-
Description: This effort assesses new HIV vaccine candidates and worldwide vaccine test sites, tracks HIV disease outbreaks, and analyzes the genetic attributes of HIV threat.			
FY 2013 Accomplishments:			
Identified, refined, and maintained new clinical trial sites in Africa and Asia; manufactured vaccine candidates based on HIV subtypes present in Africa and Asia to perform pre-clinical testing in laboratory animals; and tested selected vaccine candidates			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>MEDICAL TECHNOLOGY</i>	Project (Number/Name) 873 / <i>HIV Exploratory Rsch</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
in non-human, primate models to test safety and effectiveness of vaccine candidates to down-select best candidates for further testing in humans.			
Accomplishments/Planned Programs Subtotals	7.800	-	-

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY				Project (Number/Name) 874 / Cbt Casualty Care Tech			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
874: Cbt Casualty Care Tech	-	17.642	18.261	15.861	-	15.861	17.120	17.531	19.214	19.056	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project refines and assesses concepts, techniques, and materiel that improve survivability and ensure better medical treatment outcomes for Warfighters wounded in combat and other military operations. Combat casualty care research addresses control of severe bleeding, revival and stabilization, prognostics and diagnostics for life support systems (predictive indicators and decision aids), treatment of burns, and traumatic brain injury (TBI). Clinical and rehabilitative medicine research addresses tissue repair including transplant technologies, orthopedic injuries, eye injuries, and face trauma.

Research involves extensive collaboration with multiple academic institutions to refine treatments for combat wounds through AFIRM. This project is coordinated with the Military Departments and other government organizations to avoid duplication.

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

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

All drugs, biological products, and medical devices are refined in accordance with FDA regulations, which govern testing in animals to assess safety, toxicity, and effectiveness and subsequent human subject clinical trials.

Promising efforts identified in this project are further matured under PE 0603002A, project 840.

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 on this project is performed by U.S. Army Institute of Surgical Research (USAISR), the U.S. Army Dental Trauma Research Detachment (USADTRD), Fort Sam Houston, TX; the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.

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

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 874 / Cbt Casualty Care Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Title: Damage Control Resuscitation</p> <p>Description: This effort develops and refines knowledge products (such as clinical practice guidelines, manuals, protocols, studies, and media), materials, and systems for control of internal bleeding; minimizing the effects of traumatic blood loss; preserving, storing, and transporting blood and blood products; and resuscitation following trauma.</p> <p>FY 2013 Accomplishments: Conducted coagulation (blood clotting) factor and inflammation studies; validated a portable, rapid, point-of-care device to measure clotting ability to guide providers administering resuscitation; transition diagnostic for coagulopathy of trauma (uncontrollable bleeding resulting from injury) to 6.3 and Advanced Development when sufficiently validated; and then seek FDA approval for its use.</p> <p>FY 2014 Plans: Continue validation studies of portable, rapid, point-of-care devices that provide care givers information on clotting ability to guide resuscitation and perform studies of blood product storage technologies suitable for use under battlefield conditions.</p> <p>FY 2015 Plans: Will conduct studies to determine effective means to control bleeding when clotting ability has been impaired due to trauma. Will conduct studies of plasma (fluid component of blood) in combination with other blood products and various drugs in traumatic hemorrhage (bleeding) animal models.</p>		4.931	3.187	3.676
<p>Title: Combat Trauma Therapies</p> <p>Description: This effort conducts research to enhance the ability to diagnose, stabilize, and accelerate wound healing and repair of damaged tissue for casualties with survivable wounds to the face and head, extremities, and brain.</p> <p>FY 2013 Accomplishments: Conducted studies on how biofilms (an aggregate of microorganisms in which cells adhere to each other on a surface) reduce wound healing rate and impair wound closure in traumatic craniomaxillofacial wounds and characterize biofilm diagnostics, dispersal agents, and therapies.</p> <p>FY 2014 Plans: Formulate an anti-biofilm wound gel to combat wound infections, prevent chronic infections, and hasten wound healing.</p> <p>FY 2015 Plans: Will continue development of anti-biofilm gel. Will perform studies to determine means to alleviate persistent wound inflammation to prevent subsequent tissue destruction and excessive scarring.</p>		1.877	0.609	1.245
<p>Title: Combat Critical Care Engineering</p>		1.453	1.829	1.370

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 874 / Cbt Casualty Care Tech
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
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<p>Description: This effort refines diagnostic and therapeutic medical devices as well as associated algorithms, software, and data-processing systems for resuscitation, stabilization, life support, and surgical support that can be applied across the pre-hospital, operational field setting, and initial definitive care facilities.</p> <p>FY 2013 Accomplishments: Refined algorithms to track blood loss under conditions of heat, cold, dehydration, varying rates of blood loss, etc., to determine possible causal relationships.</p> <p>FY 2014 Plans: Work to optimize algorithms to improve fluid resuscitation and prevent hemorrhagic shock and to develop decision support algorithms to guide provision of critical care to casualties at the point of injury, during transport, and in field hospital.</p> <p>FY 2015 Plans: Will conduct studies to identify the physiological (characteristic of or appropriate to an organism's healthy or normal functioning) effects of optimizing the flow of blood returning to the heart as a fluidless resuscitation strategy. Will continue research to optimize algorithms to improve fluid resuscitation, prevent hemorrhagic shock, and to develop decision support algorithms to guide provision of critical care to casualties at point of injury, during transport, and in field hospitals.</p>			
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Title: Clinical and Rehabilitative Medicine	6.907	10.624	7.555
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<p>Description: This effort conducts laboratory and animal studies on regenerating skin, muscle, nerve, bone tissue, and soft tissue (including the genitalia and abdomen) as well as studies regarding ocular and visual system traumatic injury for the care and treatment of battle-injured casualties.</p> <p>FY 2013 Accomplishments: Refined novel drug delivery, diagnostic, and tissue repair strategies including stem cell therapies utilizing knowledge deliverables from FY2012; further refined animal models to assess soft and hard tissue regeneration technologies; continued studies of burn, scar-less wound, soft tissue, and bone repair strategies; expanded refinement and testing of stem cell therapies and scaffolds (tissue-engineered grafts) in animal models; and built on promising approaches by continuing the evaluation of candidate strategies for craniomaxillofacial (head, neck, face and jaw) reconstruction, including wound-healing control and tissue engineering/regeneration techniques to restore facial features.</p> <p>FY 2014 Plans: Down-select novel drug delivery, diagnostic, tissue repair, and treatment strategies including pharmacologic (drugs) and stem cell therapies for eye trauma injury; incrementally build on past successes to refine and develop novel drug delivery, diagnostic, reconstructive, and regenerative strategies; utilize and refine cell-based therapies (including stem cells) and tissue scaffolds (tissue-engineered grafts) in animal models to assess soft and hard tissue repair and regeneration; and build on promising</p>			
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) 874 / Cbt Casualty Care Tech
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>approaches from FY2013 by evaluating candidate strategies for burn and wound- healing bone and soft tissue repair and strategies to repair extremities (arms and legs), craniomaxillofacial (head, neck, face and jaw), genital, and abdominal regions.</p> <p>FY 2015 Plans: Will down-select and direct applied research efforts to further develop drug delivery, diagnostic, tissue repair, and treatment strategies including pharmacologic (drugs) and stem cell therapies for eye trauma; build upon promising cell- and tissue-based regenerative and reconstructive approaches from FY2014 by evaluating candidate strategies for burn and wound-healing bone and soft tissue repair and strategies to repair extremities (arms and legs), craniomaxillofacial (head, neck, face and jaw), genital, and abdominal regions.</p>			
<p>Title: Traumatic Brain Injury</p> <p>Description: This effort supports refinement of drugs and therapeutic strategies to manage brain injury resulting from battlefield trauma, including mature drug technologies, novel stem cell strategies, and selective brain cooling. This effort supports Technology-Enabled Capability Demonstration 7.d, Brain in Combat in FY2013 and FY2014.</p> <p>FY 2013 Accomplishments: Investigated selective brain cooling and non-embryonic stem cells derived from human amniotic fluid as non-traditional therapies for TBI.</p> <p>FY 2014 Plans: Develop selective brain cooling and neural (nervous system) stem cell transplantation as non-traditional therapies for traumatic brain injury and combat-relevant animal model of repeated mild TBI (Traumatic Brain Injury)/concussion.</p> <p>FY 2015 Plans: Will continue to screen and evaluate drugs and other treatment strategies, including brain cooling, stem cell constructs, sleep enhancement, and nutraceuticals (products derived from food sources that provide extra health benefits) for treatment of Traumatic Brain Injury (TBI).</p>	2.474	2.012	2.015
Accomplishments/Planned Programs Subtotals	17.642	18.261	15.861

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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>MEDICAL TECHNOLOGY</i>	Project (Number/Name) 874 / <i>Cbt Casualty Care Tech</i>
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E. Performance Metrics
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) FH2 / Force Health Protection - Applied Research
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
FH2: Force Health Protection - Applied Research	-	5.565	6.313	6.061	-	6.061	5.314	6.673	5.727	5.727	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project conducts research to support applied research directed toward the sustainment of a healthy force of Warfighters from accession through retirement. This research focuses on enhanced protection of Soldiers against health threats in military operations and training. Stressors that adversely affect individual Soldier health readiness are identified and studied to refine interventions that will protect Soldiers and improve their health and performance in stressful environments. This is follow-on research that extends and applies findings from over a decade of research on Gulf War Illnesses and other chronic multi-symptom illnesses that have suspected nerve and behavioral alterations caused by environmental contaminants and deployment stressors. Key databases include the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases allow us to evaluate interactions of psychological stress and other deployment and occupational stressors that affect Warfighter health behaviors.

Force Health Protection applied research is conducted in close coordination with the Department of Veterans Affairs. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services working on Army projects.

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

- (1) Millennium Cohort Research
- (2) Biomarkers of Exposure and Environmental Biomonitoring
- (3) Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injuries

Promising efforts identified in this project are further matured under PE 0603002A, project FH4.

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

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

Efforts in this project support the Soldier Portfolio and the principal area of Combat Casualty Care.

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

	FY 2013	FY 2014	FY 2015
Title: Millennium Cohort Research	3.661	4.517	4.587

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) FH2 / Force Health Protection - Applied Research

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>Description: This effort supports a long-term study of Soldiers that includes psychological, physical, and spiritual impacts of military service throughout their lifetime. The Millennium Cohort and Deployment Health Task area employs a prospective epidemiological (study of health-event patterns in a society) surveillance research designed to address mental health and comorbid (multiple) disorders, including neurological and other chronic degenerative disorders, fitness and readiness performance outcomes, and longer-term physical and mental health illnesses and disease over the life cycle of military Servicemen and women.</p> <p>FY 2013 Accomplishments: Planned and conducted analyses to further identify gender risk differences for PTSD and depression associated with deployment; examined return-to-duty parameters related to multiple health and injury illnesses; and disseminated strategic findings from studies that support policy formation and guide further research to promote the longer term physical and mental health of the force. These results lead to the formulation of strategies designed to mitigate the adverse psychological effects of military deployments.</p> <p>FY 2014 Plans: Determine the long-term and ongoing functional, physical, and mental health issues of Service members (including injury and respiratory/environmental exposures) after military experiences including deployments, training, and other exposures of concern and characterize emerging or high-profile health threats among Service members through longitudinal assessment. These results will inform preventive and intervention strategies to ensure a healthy and fit force and possibly aid providers and leadership in mitigating adverse health outcomes associated with military experiences.</p> <p>FY 2015 Plans: Will evaluate the impact of child health on Family functioning and Service Member health outcome and investigate the impact of the Family's response to deployment on the mental health of the deployed Service Member.</p>			
<p>Title: Biomarkers of Exposure and Environmental Biomonitoring (measurement of the body's response to toxic chemical compounds, elements, or their metabolites, in biological substances)</p> <p>Description: This effort supports refinement and evaluation of methods to detect environmental contamination and toxic exposure during military operations.</p> <p>FY 2013 Accomplishments:</p>	0.701	0.719	-

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) FH2 / Force Health Protection - Applied Research		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
<p>Conducted assessment of high-priority Army research needs in nanomaterial characterization, exposure assessment, toxicity studies, or risk assessment. This research provided Soldiers with exposure risk health assessment to the potential health hazards associated with nanomaterials (materials smaller than a one tenth of a micrometer in at least one dimension) in the environment.</p> <p>FY 2014 Plans: Apply a risk ranking system to provide a screening-level assessment for hazardous exposures to the identified Army nanomaterials (materials smaller than a one tenth of a micrometer in at least one dimension). These studies will identify Army materiel nanomaterials associated with having the highest initial risk rankings of potential exposures to Warriors</p>				
<p>Title: Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injury</p> <p>Description: This effort supports modeling and assessment of the combined effects of blast, impact, and ballistic trauma on the chest and lung system. This effort supports Technology-Enabled Capability Demonstration 7.d, Brain In Combat in FY2013-2014.</p> <p>FY 2013 Accomplishments: Refined software that integrates blast, toxic gas, and blunt trauma injury prediction models into a combined application for integrated blast injury and performance assessment. This research provides Commanders with a single assessment tool for myriad health hazards and with an enhanced capability to assess injury-related risk for the Warfighter.</p> <p>FY 2014 Plans: Develop musculoskeletal models for predicting individualized physical performance outcomes of military-relevant tasks following blast or blunt impacts. This research will show the physical decrement associated with blast or blunt impact exposure.</p> <p>FY 2015 Plans: Will develop models to assess endurance for military relevant tasks including algorithm development to predict musculoskeletal adaptations to fatigue. Will expand biomechanical performance modeling to incorporate relevant tasks, such as lifting and marksmanship that use the upper body and core.</p>		1.203	1.077	1.474
Accomplishments/Planned Programs Subtotals		5.565	6.313	6.061
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 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) FH2 / Force Health Protection - Applied Research

E. Performance Metrics

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) VB4 / System Biology And Network Science Technology
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COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
VB4: System Biology And Network Science Technology	-	4.645	4.836	4.798	-	4.798	4.878	4.959	5.048	5.083	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project encompasses two efforts to support applied research and impact medical research relevant to the Soldier. (A) The core capability for multidisciplinary applied research in systems biology enables integration and analysis of complex data from human and animal studies, development of in silico (via computer simulation) network models, allowing us to differentiate molecular signatures of disease, and supports transition of research to clinical applications. This core capability applies integrative and systemic biological approaches to trace progression of illnesses and diseases of military relevance and has already shown that the approach significantly reduces time, funds and effort invested in medical product development and refinement. (B) Applied research is to identify toxicity-altered pathways (scientists can infer human harm from chemicals on the basis of how they change the activity of biochemical steps in cells and animals) enabling us to understand the mechanisms of toxic environmental chemicals and to develop molecular markers of toxicity for a next generation diagnostic system to support early exposure medical decisions.

These examples of more complex, yet integrated approaches to projects studying biological systems (PTSD project) has been shown to reduce both the time and expense of medical product development for the Army

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

Work in this project is performed by the US Army Medical Research and Materiel Command (USAMRMC), Fort Detrick, MD.

Efforts in this project support the Soldier Portfolio and the principal area of Systems Biology/Network Sciences.

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

	FY 2013	FY 2014	FY 2015
Title: Systems Biology	4.645	4.836	4.798
Description: This project encompasses two efforts to support applied research and impact medical research relevant to the Soldier. (A) The core capability for multidisciplinary applied research in systems biology enables integration and analysis of complex data from human and animal studies and development of in silico (via computer simulation) network models, allowing us to differentiate between molecular signatures of psychological illness, diseases, and other medical conditions for the Soldier, such as heat injury. This core capability has supported transition of research to clinical applications faster, cheaper and better than standard approaches because many forms of data from numerous studies are integrated into a consolidated personalized clinical environment used to treat Soldiers more effectively. (B) Applied research is to identify toxicity-altered pathways (scientists can			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) VB4 / System Biology And Network Science Technology

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
<p>infer human harm from chemicals on the basis of how they change the activity of biochemical steps in cells and animals) enabling us to identify toxic environmental chemicals and materials as well as understand the injury mechanisms of toxic environmental chemicals and to develop molecular and physiological markers of toxicity for a next generation diagnostic system to support early exposure medical decisions.</p> <p>FY 2013 Accomplishments: Performed experiments and high-content screening for host responses to environmental hazards and disease states (initially PTSD and trauma coagulopathy [a condition affecting the blood's ability to clot]); refined and begin validating a computational platform and mathematical models for biological responses to toxicity, disease, and injury; and identify candidate biomarkers for adverse host responses.</p> <p>FY 2014 Plans: Continue to adapt novel state-of-the-art approaches to enable use of clinical samples from illness or diseases of military relevance, including the technology of the SysDataCube database, (data management and analytic system) to further the aims of clinical data integration with the massive datasets from multiomic (interrelated "omic" fields such as proteomics, genomics, and others) approaches and other physiologic findings. Evaluate high-content data sets from environmental exposures using computational platform to identify activated-toxicity pathways (understanding the physiology of toxicity) and screen and down-select candidate PTSD and coagulopathy (abnormal blood clotting) biomarkers for further analysis and validation.</p> <p>FY 2015 Plans: Will design and utilize new tools to solve problems that arise in the course of extracting signatures (distinctive and unique characteristics of a condition or event) related to suicide, coagulopathy (abnormal blood clotting and hemorrhage), and chronic pain experienced by soldiers. Will evaluate and integrate iterative computer modeling with high-content global molecular data sets from PTSD (gathered in human clinical trials) and utilize animal model simulating aspects of PTSD to further basic studies related to therapeutics; following the successful pattern of combining clinical trials with animal models to study coagulopathy and mechanisms of chronic pain. Will develop and enhance capabilities to support transition of research to advanced development by incorporating newly emerging digital FDA-approved approaches. Will evaluate high-content data sets from environmental exposures using computational platforms to identify toxicity-altered pathways (understanding the physiology of toxicity) and develop a panel of molecular markers for assessing adverse reactions from exposure to environmental health hazards with a focus on systemic toxicities (toxicity for specific organ systems). Will verify candidate pathways of toxicity and validate molecular markers in the rodent model.</p>			
Accomplishments/Planned Programs Subtotals	4.645	4.836	4.798

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

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
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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 2015 Army **Date:** March 2014

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY				Project (Number/Name) VJ4 / Suicide Prevention/Mitigation			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
VJ4: <i>Suicide Prevention/Mitigation</i>	-	10.000	10.109	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The Army and the National Institute of Mental Health (NIMH) have jointly initiated the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) to examine how psychosocial (related to both the psychological and social aspects), biological (related to living organisms), and genetic factors affect risk/resilience for suicide, as well as related conditions. This study funds research to examine the mental and behavioral health of Soldiers and related suicidal behavior. Army STARRS component studies (Historical Data Study, New Soldier Study, All Army Study, Soldier Health Outcomes Study, and Pre/Post Deployment Study) examine historical and administrative data collected by the Army from Soldiers in all phases of Army service. As of July 2013, more than 100,000 Soldiers volunteered to participate in Army STARRS.

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 on this project is performed by The National Institute of Mental Health (NIMH) with the Department of the Army providing program oversight.

Efforts in this project support the Soldier Portfolio and the principal area of Military Operational Medicine.

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

	FY 2013	FY 2014	FY 2015
Title: Suicide Prevention/Mitigation	10.000	10.109	-
Description: This effort conducts research to better understand the apparent increase in suicide deaths and nonfatal attempts among active duty Soldiers, as well as identify improved prevention/intervention methods for individuals at risk for suicide based on data-driven recommendations. The efforts will be used to decrease suicide rates in both military populations as well as in the general public.			
FY 2013 Accomplishments: Continued epidemiological (population-based) studies to further identify determinants of suicidal behavior and potential modifiable risk factors; collected data for suicide-death case control study; and conduct research efforts to assist in improved identification of individuals at greatest risk for suicide, validated screening measures, and enhanced prevention/intervention methods			
FY 2014 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Army	Date: March 2014
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / MEDICAL TECHNOLOGY	Project (Number/Name) VJ4 / Suicide Prevention/Mitigation
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2013	FY 2014	FY 2015
Develop data-driven methods for mitigating or preventing suicide behaviors in active duty service members from a longitudinal study; determine modifiable risk and protective factors associated with suicide, mental health and psychological resilience; refine at risk factors for identification of individuals who are at a greater risk for suicide; refine improved suicide prevention interventions.			
Accomplishments/Planned Programs Subtotals	10.000	10.109	-

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

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A