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**Department of Defense  
Fiscal Year (FY) 2014 President's Budget Submission**

April 2013



**Army**

*Justification Book*

***Research, Development, Test & Evaluation, Army***

**RDT&E - Volume I, Budget Activity 2**

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FY 2014 RDT&E Program  
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Exhibit R-1

Summary

20-Feb-2013

Summary Recap of Budget Activities		Thousands of Dollars				
		FY2012	FY2013	FY2014	FY2014 OCO	FY2014 Total
Basic research		408,842	444,071	436,725	0	436,725
Applied Research		929,984	874,730	885,924	0	885,924
Advanced technology development		1,067,459	890,722	882,106	0	882,106
Advanced Component Development and Prototypes		513,368	629,981	636,392	26,625	663,017
System Development and Demonstration		3,135,367	3,286,629	2,857,026	0	2,857,026
Management support		1,341,545	1,153,980	1,159,610	0	1,159,610
Operational system development		1,303,974	1,664,534	1,126,602	0	1,126,602
Total	RDT&E, Army	8,700,539	8,944,647	7,984,385	26,625	8,011,010

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Line No	Program Element Number	Act	Item	Thousands of Dollars				
				FY2012	FY2013	FY2014	FY2014 OCO	FY2014 Total
Basic research								
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	20,395	20,860	21,803		21,803
2	0601102A	01	DEFENSE RESEARCH SCIENCES	207,983	219,180	221,901		221,901
3	0601103A	01	UNIVERSITY RESEARCH INITIATIVES	78,380	80,986	79,359		79,359
4	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	102,084	123,045	113,662		113,662
Total: Basic research				408,842	444,071	436,725	0	436,725
Applied Research								
5	0602105A	02	MATERIALS TECHNOLOGY	37,707	29,041	26,585		26,585
6	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	42,189	45,260	43,170		43,170
7	0602122A	02	TRACTOR HIP	14,207	22,439	36,293		36,293
8	0602211A	02	AVIATION TECHNOLOGY	43,430	51,607	55,615		55,615
9	0602270A	02	ELECTRONIC WARFARE TECHNOLOGY	15,667	15,068	17,585		17,585
10	0602303A	02	MISSILE TECHNOLOGY	65,591	49,383	51,528		51,528
11	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	19,392	25,999	26,162		26,162
12	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	20,356	23,507	24,063		24,063
13	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	62,339	69,062	64,589		64,589
14	0602618A	02	BALLISTICS TECHNOLOGY	60,507	60,823	68,300		68,300
15	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	4,753	4,465	4,490		4,490
16	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	8,010	7,169	7,818		7,818
17	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	53,883	35,218	37,798		37,798
18	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	74,518	60,300	59,021		59,021
19	0602709A	02	NIGHT VISION TECHNOLOGY	54,002	53,244	43,426		43,426
20	0602712A	02	COUNTERMINE SYSTEMS	32,226	18,850	20,574		20,574
21	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	21,540	19,872	21,339		21,339
22	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	20,389	20,095	20,316		20,316
23	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	25,703	28,852	34,209		34,209
24	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	8,433	9,830	10,439		10,439
25	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	75,465	70,693	70,064		70,064

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26	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	18,623	17,781	17,654		17,654
27	0602786A	02	WARFIGHTER TECHNOLOGY	46,864	28,281	31,546		31,546
28	0602787A	02	MEDICAL TECHNOLOGY	104,190	107,891	93,340		93,340
Total: Applied Research				929,984	874,730	885,924	0	885,924
Advanced technology development								
29	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	55,679	39,359	56,056		56,056
30	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	101,655	69,580	62,032		62,032
31	0603003A	03	AVIATION ADVANCED TECHNOLOGY	60,333	64,215	81,080		81,080
32	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	75,607	67,613	63,919		63,919
33	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	142,833	104,359	97,043		97,043
34	0603006A	03	SPACE APPLICATION ADVANCED TECHNOLOGY	4,158	4,157	5,866		5,866
35	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLOGY	10,063	9,856	7,800		7,800
36	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	67,673	50,661	40,416		40,416
37	0603009A	03	TRACTOR HIKE	8,142	9,126	9,166		9,166
38	0603015A	03	NEXT GENERATION TRAINING & SIMULATION SYSTEMS	14,970	17,257	13,627		13,627
39	0603020A	03	TRACTOR ROSE	12,577	9,925	10,667		10,667
40	0603105A	03	MILITARY HIV RESEARCH	22,552	6,984			
41	0603125A	03	COMBATING TERRORISM - TECHNOLOGY DEVELOPMENT	21,939	9,716	15,054		15,054
42	0603130A	03	TRACTOR NAIL	4,271	3,487	3,194		3,194
43	0603131A	03	TRACTOR EGGS	2,257	2,323	2,367		2,367
44	0603270A	03	ELECTRONIC WARFARE TECHNOLOGY	23,046	21,683	25,348		25,348
45	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	87,749	71,111	64,009		64,009
46	0603322A	03	TRACTOR CAGE	10,299	10,902	11,083		11,083
47	0603461A	03	HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM	176,533	180,582	180,662		180,662
48	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	30,687	27,204	22,806		22,806
49	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	7,473	6,095	5,030		5,030
50	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	41,283	37,217	36,407		36,407
51	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	15,247	13,626	11,745		11,745
52	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	40,496	28,458	23,717		23,717

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53	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECHNOLOGY	29,937	25,226	33,012		33,012
Total: Advanced technology development				1,067,459	890,722	882,106	0	882,106
Advanced Component Development and Prototypes								
54	0603305A	04	ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	23,463	14,505	15,301		15,301
55	0603308A	04	ARMY SPACE SYSTEMS INTEGRATION	9,557	9,876	13,592		13,592
56	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	16,399	5,054	10,625		10,625
57	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	4,357	2,725			
58	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	40,201	30,560	30,612		30,612
59	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	62,343	14,347	49,989		49,989
60	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	13,720	29,933	6,703	26,625	33,328
61	0603766A	04	TACTICAL ELECTRONIC SURVEILLANCE SYSTEM - ADV DEV	5,757	8,660	6,894		6,894
62	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT		10,715	9,066		9,066
63	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY - DEM/VAL	4,788	4,631	2,633		2,633
64	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	177,122	278,018	272,384		272,384
65	0603790A	04	NATO RESEARCH AND DEVELOPMENT	4,612	4,961	3,874		3,874
66	0603801A	04	AVIATION - ADV DEV	6,879	8,602	5,018		5,018
67	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	12,107	14,605	11,556		11,556
68	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION AND ANALYSIS	5,090	5,054			
69	0603807A	04	MEDICAL SYSTEMS - ADV DEV	34,809	24,384	15,603		15,603
70	0603827A	04	SOLDIER SYSTEMS - ADVANCED DEVELOPMENT	23,516	32,050	14,159		14,159
71	0603850A	04	INTEGRATED BROADCAST SERVICE	1,494	96	79		79
72	0604115A	04	TECHNOLOGY MATURATION INITIATIVES	11,839	24,868	55,605		55,605
73	0604131A	04	TRACTOR JUTE		59			
74	0604319A	04	INDIRECT FIRE PROTECTION CAPABILITY INCREMENT 2-INTERCEPT (IFPC2)		76,039	79,232		79,232
75	0604785A	04	INTEGRATED BASE DEFENSE (BUDGET ACTIVITY 4)	3,926	4,043	4,476		4,476
76	0305205A	04	ENDURANCE UAVS	51,389	26,196	28,991		28,991
Total: Advanced Component Development and Prototypes				513,368	629,981	636,392	26,625	663,017

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System Development and Demonstration								
77	0604201A	05	AIRCRAFT AVIONICS	115,890	78,538	76,588		76,588
78	0604220A	05	ARMED, DEPLOYABLE HELOS	80,323	90,494	73,309		73,309
79	0604270A	05	ELECTRONIC WARFARE DEVELOPMENT	33,164	181,347	154,621		154,621
80	0604280A	05	JOINT TACTICAL RADIO			31,826		31,826
81	0604290A	05	MID-TIER NETWORKING VEHICULAR RADION (MNVR)	47,000	12,636	23,341		23,341
82	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	7,400	5,694	4,839		4,839
83	0604328A	05	TRACTOR CAGE	23,535	32,095	23,841		23,841
84	0604601A	05	INFANTRY SUPPORT WEAPONS	81,081	96,478	79,855		79,855
85	0604604A	05	MEDIUM TACTICAL VEHICLES	3,835	3,006	2,140		2,140
86	0604611A	05	JAVELIN	9,655	5,040	5,002		5,002
87	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	5,239	3,077	21,321		21,321
88	0604633A	05	AIR TRAFFIC CONTROL	22,218	9,769	514		514
89	0604641A	05	TACTICAL UNMANNED GROUND VEHICLE (TUGV)		13,141			
90	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	68,442				
91	0604661A	05	FCS SYSTEMS OF SYSTEMS ENGR & PROGRAM MGMT	257,513				
92	0604663A	05	FCS UNMANNED GROUND VEHICLES	34,845				
93	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	55,412	32,621	43,405		43,405
94	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	2,008	2,132	1,939		1,939
95	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	29,206	44,787	18,980		18,980
96	0604716A	05	TERRAIN INFORMATION - ENG DEV	1,593	1,008			
97	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE - ENG DEV	57,050	73,333	18,294		18,294
98	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	27,530	28,937	17,013		17,013
99	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	13,932	10,815	6,701		6,701
100	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENG DEV	15,357	13,926	14,575		14,575
101	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT) CORE	21,541	17,797	27,634		27,634
102	0604798A	05	BRIGADE ANALYSIS, INTEGRATION AND EVALUATION		214,270	193,748		193,748
103	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	13,384	14,581	15,721		15,721
104	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	173,902	43,706	41,703		41,703
105	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	79,188	20,776	7,379		7,379

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106	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPMENT - ENG DEV	26,316	43,395	39,468		39,468
107	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	73,955	104,983	92,285		92,285
108	0604814A	05	ARTILLERY MUNITIONS - EMD	45,821	4,346	8,209		8,209
109	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWARE	91,490	77,223	22,958		22,958
110	0604820A	05	RADAR DEVELOPMENT	3,093	3,486	1,549		1,549
111	0604822A	05	GENERAL FUND ENTERPRISE BUSINESS SYSTEM (GFEBS)	787	9,963	17,342		17,342
112	0604823A	05	FIREFINDER	12,032	20,517	47,221		47,221
113	0604827A	05	SOLDIER SYSTEMS - WARRIOR DEM/VAL	41,680	51,851	48,477		48,477
114	0604854A	05	ARTILLERY SYSTEMS - EMD	116,293	167,797	80,613		80,613
115	0604869A	05	PATRIOT/MEADS COMBINED AGGREGATE PROGRAM (CAP)	377,610	400,861			
116	0604870A	05	NUCLEAR ARMS CONTROL MONITORING SENSOR NETWORK	7,160	7,922			
117	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	35,714	51,463	68,814		68,814
118	0605018A	05	INTEGRATED PERSONNEL AND PAY SYSTEM-ARMY (IPPS-A)	66,612	158,646	137,290		137,290
119	0605028A	05	ARMORED MULTI-PURPOSE VEHICLE (AMPV)			116,298		116,298
120	0605030A	05	JOINT TACTICAL NETWORK CENTER (JTNC)			68,148		68,148
121	0605380A	05	AMF JOINT TACTICAL RADIO SYSTEM (JTRS)			33,219		33,219
122	0605450A	05	JOINT AIR-TO-GROUND MISSILE (JAGM)	123,100	10,000	15,127		15,127
123	0605455A	05	SLAMRAAM	1,186				
124	0605456A	05	PAC-3/MSE MISSILE	86,139	69,029	68,843		68,843
125	0605457A	05	ARMY INTEGRATED AIR AND MISSILE DEFENSE (AIAMD)	262,032	277,374	364,649		364,649
126	0605625A	05	MANNED GROUND VEHICLE	434,977	639,874	592,201		592,201
127	0605626A	05	AERIAL COMMON SENSOR	31,415	47,426	10,382		10,382
128	0605766A	05	NATIONAL CAPABILITIES INTEGRATION (MIP)			21,143		21,143
129	0605812A	05	JOINT LIGHT TACTICAL VEHICLE (JLTV) ENGINEERING AND MANUFACTURING D		72,295	84,230		84,230
130	0303032A	05	TROJAN - RH12	3,914	4,232	3,465		3,465
131	0304270A	05	ELECTRONIC WARFARE DEVELOPMENT	13,798	13,942	10,806		10,806
Total: System Development and Demonstration				3,135,367	3,286,629	2,857,026	0	2,857,026
Management support								
132	0604256A	06	THREAT SIMULATOR DEVELOPMENT	25,838	18,090	16,934		16,934

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133	0604258A	06	TARGET SYSTEMS DEVELOPMENT	10,973	14,034	13,488		13,488
134	0604759A	06	MAJOR T&E INVESTMENT	47,972	37,394	46,672		46,672
135	0605103A	06	RAND ARROYO CENTER	19,730	21,026	11,919		11,919
136	0605301A	06	ARMY KWAJALEIN ATOLL	141,365	176,816	193,658		193,658
137	0605326A	06	CONCEPTS EXPERIMENTATION PROGRAM	27,923	27,902	37,158		37,158
138	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	208,324				
139	0605601A	06	ARMY TEST RANGES AND FACILITIES	366,327	369,900	340,659		340,659
140	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	68,968	69,183	66,061		66,061
141	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	42,088	44,753	43,280		43,280
142	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	18				
143	0605606A	06	AIRCRAFT CERTIFICATION	5,555	5,762	6,025		6,025
144	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	7,062	7,402	7,349		7,349
145	0605706A	06	MATERIEL SYSTEMS ANALYSIS	19,498	19,954	19,809		19,809
146	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	5,435	5,535	5,941		5,941
147	0605712A	06	SUPPORT OF OPERATIONAL TESTING	68,311	67,789	55,504		55,504
148	0605716A	06	ARMY EVALUATION CENTER	62,845	62,765	65,274		65,274
149	0605718A	06	ARMY MODELING & SIM X-CMD COLLABORATION & INTEG	3,312	1,545	1,283		1,283
150	0605801A	06	PROGRAMWIDE ACTIVITIES	82,015	83,422	82,035		82,035
151	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	52,085	50,820	33,853		33,853
152	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFETY	53,530	46,763	53,340		53,340
153	0605857A	06	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	4,801	4,601	5,193		5,193
154	0605898A	06	MANAGEMENT HQ - R&D	17,480	18,524	54,175		54,175
155	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	90				
Total: Management support				1,341,545	1,153,980	1,159,610	0	1,159,610
Operational system development								
156	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	64,609	143,005	110,576		110,576
157	0607141A	07	LOGISTICS AUTOMATION			3,717		3,717
158	0607665A	07	BIOMETRICS ENTERPRISE	44,155				
159	0607865A	07	PATRIOT PRODUCT IMPROVEMENT		109,978	70,053		70,053

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160	0102419A	07	AEROSTAT JOINT PROJECT OFFICE	317,382	190,422	98,450		98,450
161	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	28,649	32,556	30,940		30,940
162	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	35,046	253,959	177,532		177,532
163	0203740A	07	MANEUVER CONTROL SYSTEM	39,282	68,325	36,495		36,495
164	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAMS	144,904	280,247	257,187		257,187
165	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	800	898	315		315
166	0203758A	07	DIGITIZATION	7,771	35,180	6,186		6,186
167	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	52,811	20,733	1,578		1,578
168	0203802A	07	OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS			62,100		62,100
169	0203808A	07	TRACTOR CARD	42,487	63,243	18,778		18,778
170	0208053A	07	JOINT TACTICAL GROUND SYSTEM	27,586	31,738	7,108		7,108
171	0208058A	07	JOINT HIGH SPEED VESSEL (JHSV)		35			
172	0301359A	07	SPECIAL ARMY PROGRAM					
173	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES	2,763	7,591	7,600		7,600
174	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	15,282	15,961	9,357		9,357
175	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	155,813	120,927	41,225		41,225
176	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	11,765	15,756	18,197		18,197
177	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	22,658	14,443	14,215		14,215
178	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	26,508	31,303	33,533		33,533
179	0305208A	07	DISTRIBUTED COMMON GROUND/SURFACE SYSTEMS	31,401	40,876	27,622		27,622
180	0305219A	07	MQ-1 SKY WARRIOR A UAV	121,846	74,618	10,901		10,901
181	0305232A	07	RQ-11 UAV	1,935	4,039	2,321		2,321
182	0305233A	07	RQ-7 UAV	31,896	31,158	12,031		12,031
183	0305235A	07	MQ-18 UAV	4,000	2,387			
184	0307665A	07	BIOMETRICS ENABLED INTELLIGENCE	15,018	15,248	12,449		12,449
185	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	57,607	59,908	56,136		56,136
Total: Operational system development				1,303,974	1,664,534	1,126,602	0	1,126,602
Total: RDT&E, Army				8,700,539	8,944,647	7,984,385	26,625	8,011,010

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

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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.....	174
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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army	<b>DATE:</b> April 2013
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>							
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	37.707	29.041	26.585	-	26.585	29.955	31.013	32.280	33.344	Continuing	Continuing
H7B: <i>Advanced Materials Initiatives (CA)</i>	-	7.968	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H7G: <i>Nanomaterials Applied Research</i>	-	5.156	4.912	3.989	-	3.989	5.622	6.696	7.789	8.393	Continuing	Continuing
H84: <i>Materials</i>	-	24.583	24.129	22.596	-	22.596	24.333	24.317	24.491	24.951	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**Note**

FY12 reprogramming of Congressional add for Silicon Carbide research to PE 0602705A

**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 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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602105A: MATERIALS TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	50.679	29.041	26.592	-	26.592
Current President's Budget	37.707	29.041	26.585	-	26.585
Total Adjustments	-12.972	0.000	-0.007	-	-0.007
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-12.500	-			
• SBIR/STTR Transfer	-0.472	-			
• Adjustments to Budget Years	-	-	-0.007	-	-0.007

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army										<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>				<b>PROJECT</b> H7B: <i>Advanced Materials Initiatives (CA)</i>			
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO<sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H7B: <i>Advanced Materials Initiatives (CA)</i>	-	7.968	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
<b>Note</b> Not applicable for this item.												
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding provided for Advanced Materials Initiatives.												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>									<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>	
<b>Title:</b> Nanotechnology Research									7.968	0.000	0.000	
<b>Description:</b> This was Congressional Interest Item.												
<b>FY 2012 Accomplishments:</b> Congressional add funding for Nanotechnology Research												
<b>Accomplishments/Planned Programs Subtotals</b>									7.968	0.000	0.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												
<b>Remarks</b>												
<b>D. Acquisition Strategy</b> N/A												
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602105A: MATERIALS TECHNOLOGY				PROJECT H7G: Nanomaterials Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H7G: Nanomaterials Applied Research	-	5.156	4.912	3.989	-	3.989	5.622	6.696	7.789	8.393	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 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 2012	FY 2013	FY 2014	
Title: Nanomaterials Applied Research									5.156	4.912	3.989	
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 (e.g., scale-up of processes and fabrication into woven materials) to enable revolutionary future Soldier capabilities.												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>	<b>PROJECT</b> H7G: <i>Nanomaterials Applied Research</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b><i>FY 2012 Accomplishments:</i></b> Investigated the incorporation of nanoparticles, nanotubes and nanofibers into materials systems to produce novel sensing capabilities for enhanced situational awareness.  <b><i>FY 2013 Plans:</i></b> Continue to design novel sensor and imaging devices based on carbon nanotube, quantum dot, and photonic crystal technologies; and scale-up nanometallic aluminum alloy processing to characterize performance as potential ballistic protective materials.  <b><i>FY 2014 Plans:</i></b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		5.156	4.912
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>   <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602105A: MATERIALS TECHNOLOGY				PROJECT H84: Materials			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H84: Materials	-	24.583	24.129	22.596	-	22.596	24.333	24.317	24.491	24.951	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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 Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Structural Armor									6.823	4.363	2.485	
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.												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>	<b>PROJECT</b> H84: <i>Materials</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>FY 2012 Accomplishments:</b> Developed and validated model capability for composite materials that included high rate effects, thermal effects and fatigue; characterized the high rate properties of structural adhesives and synthesized novel adhesive compositions for inclusion in emerging armor solutions.</p> <p><b>FY 2013 Plans:</b> Investigate novel mechanical deformation processing of magnesium alloy plates that potentially provide very lightweight metal structural materials; provide corrosion mapping for promising aluminum and magnesium alloys and investigate corrosion inhibitors to enable the alloys use for future applications; document materials properties information (such as adhesive strength) for an adhesive database to be used in close collaboration with manufacturers and research universities; fabricate novel boron sub-oxide ceramic materials for use in protection applications; and validate 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><b>FY 2014 Plans:</b> : In ceramic armor materials will 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; will 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; develop novel processing strategies for polymer compositions to enable tunable mechanical response; apply processing science, and modeling and simulation to validate processing technology for the metallic encapsulation of ceramic armor tiles.</p>			
<p><b>Title:</b> Soldier-Borne Armor Materials</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Provided the capability to non-destructively characterize the relationship between ceramic tile quality and ballistic performance; and validated the synthesis of rate dependent soft material tissue surrogates for the development and characterization of personnel armor concepts.</p> <p><b>FY 2013 Plans:</b></p>		2.759	3.252
		5.398	

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>		<b>PROJECT</b> H84: <i>Materials</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Investigate novel materials such as three-dimensional ceramics and fabrics to provide breakthrough technologies for protecting the dismounted soldier under ballistic and blast conditions based on human tissue response data; design novel hybrid material systems with associated processing science to provide lighter, more flexible, more durable and affordable protection to Soldiers and vehicles; transition fabric ballistic modeling tools to armor designers at Natick Soldier Research, Development, and Engineering Center and Tank and Automotive Research, Development, and Engineering Center.					
<b>FY 2014 Plans:</b> Will 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; develop a refined process model to describe the deformation characteristics and fiber-matrix adhesion, provide experimental validation.					
<b>Title:</b> Composites  <b>Description:</b> 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.			3.916	3.000	2.932
<b>FY 2012 Accomplishments:</b> Developed cold spray techniques to successfully deposit novel material compositions in confined spaces; validated methods for the composite cladding of advanced gun barrel designs; and validated improvements in gun barrel erosion.					
<b>FY 2013 Plans:</b> Evaluate composite cladding for reduced gun barrel erosion and transition to the Armaments Research, Development, and Engineering Center; demonstrate ordered structures in various media for active and passive wave mitigation and pulsation management for blast applications and acoustic damping.					
<b>FY 2014 Plans:</b> Will 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); develop materials models and experimental techniques to validate >50% improvement in the adhesion of dissimilar materials used in vehicle protection platforms.					
<b>Title:</b> Electronic Materials			0.514	0.000	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>	<b>PROJECT</b> H84: <i>Materials</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Description:</b> Design and optimize electro-ceramic materials and processing techniques for integration by the Communications-Electronics Research, Development, and Engineering Command (CERDEC) into advanced antennas that will enable affordable and reliable command, control and communications (C3) for current and future force platforms.  <b>FY 2012 Accomplishments:</b> Developed the material designs, fabrication methods, and process science protocols required for CERDEC to achieve high quality, affordable, performance consistent, tunable beam steering antenna elements.			
<b>Title:</b> Multifunctional Armor Materials  <b>Description:</b> This effort researches novel multifunctional armor materials for Army applications such as structural energy storage, armor embedded 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. In FY 13, this effort supports Technology Enabled Capability Demonstration 1c: Force Protection-Occupant Centric Platform [Ultralightweight and Multifunctional Materials for Personnel and Vehicle Protection].  <b>FY 2012 Accomplishments:</b> Provided new multifunctional composite materials with structural and power storage capability; developed synthesis routes for soft polymer nano-composites with controllable electrical properties; and provided composite materials with improved damage tolerance for use in ultra-lightweight structures and armors.  <b>FY 2013 Plans:</b> Design, synthesize, and characterize fiber materials based on biological material mechanics; transition new self-healing technologies to composite fabricators to enhance materials durability; create analytical models to design battery storage composites that can be used in future multifunctional structural composite materials that provide structure and energy storage; investigate improvements in resins, reinforcements, electrodes, and processing techniques to fabricate relevant-size structural capacitors for future multifunctional structural composite materials.  <b>FY 2014 Plans:</b> Will 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 e 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; determine synthetic viability of novel third generation chromophores for use in thick polymer laser protective materials.		9.027	11.778
<b>Title:</b> Nanomaterials		1.544	1.736
			9.977
			1.804



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A: <i>MATERIALS TECHNOLOGY</i>	<b>PROJECT</b> H84: <i>Materials</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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 project H7G.</p> <p><b>FY 2012 Accomplishments:</b> Validated nanograined metallic structures fabrication process using thermodynamic techniques, and provided an initial validation of the improvement in the ballistic capability of transparent materials reinforced with natural cellulose nanofibers.</p> <p><b>FY 2013 Plans:</b> Design synthetic, strain rate dependent polymers to mimic human body tissue; design and evaluate blast resistant cellular topologies using bio-inspired computational algorithms; demonstrate transparent, nano-architected cellulose based composite materials; and investigate nano-tungsten materials to evaluate engineering properties for ballistic launch survivability.</p> <p><b>FY 2014 Plans:</b> Will 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 nano-crystalline tungsten; identify tungsten carbide microstructures and properties for rigid body penetration of armor; develop environmentally friendly binder materials for tungsten carbide.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>		24.583	24.129
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602120A: <i>Sensors and Electronic Survivability</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	42.189	45.260	43.170	-	43.170	47.802	57.460	52.969	54.285	Continuing	Continuing
H15: <i>Ground Combat Id Tech</i>	-	2.033	2.181	2.328	-	2.328	2.330	4.384	4.456	4.536	Continuing	Continuing
H16: <i>S3I Technology</i>	-	19.699	20.726	20.808	-	20.808	21.198	21.382	21.370	21.755	Continuing	Continuing
SA2: <i>Biotechnology Applied Research</i>	-	5.321	4.852	4.037	-	4.037	4.059	4.491	3.372	3.795	Continuing	Continuing
TS1: <i>Tactical Space Research</i>	-	3.606	4.303	5.306	-	5.306	6.278	6.950	7.052	7.179	Continuing	Continuing
TS2: <i>Robotics Technology</i>	-	11.530	13.198	10.691	-	10.691	13.937	20.253	16.719	17.020	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**Note**

FY14 - Funding realigned to higher priority efforts

**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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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army	<b>DATE:</b> April 2013
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> 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 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>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2012</u></b>	<b><u>FY 2013</u></b>	<b><u>FY 2014 Base</u></b>	<b><u>FY 2014 OCO</u></b>	<b><u>FY 2014 Total</u></b>
Previous President's Budget	43.453	45.260	50.877	-	50.877
Current President's Budget	42.189	45.260	43.170	-	43.170
Total Adjustments	-1.264	0.000	-7.707	-	-7.707
• Congressional General Reductions	-0.068	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.823	-			
• Adjustments to Budget Years	-	-	-7.707	-	-7.707
• Other Adjustments 1	-0.373	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability				PROJECT H15: Ground Combat Id Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H15: Ground Combat Id Tech	-	2.033	2.181	2.328	-	2.328	2.330	4.384	4.456	4.536	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Combat Identification (CID) Technologies	2.033	2.181	2.328
<b>Description:</b> 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.			
<b>FY 2012 Accomplishments:</b> Improved algorithms to deconflict, fuse and correlate warning receiver and blue force emitter data with DCGS-A, provided intelligence, surveillance and reconnaissance, based on initial user jury results; Investigated data transport requirements needed to support the generation of an enterprise-wide ground and air common operating picture that provides accurate and timely reporting of high value targets for enterprise-wide as well as organic platform SA for increased CID awareness.			
<b>FY 2013 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> H15: <i>Ground Combat Id Tech</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Evaluate 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; evaluate capacity of existing mobile/handheld platforms to perform CID display and training; investigate signature data from multiple sensor types (infrared, RF and other) to support non-cooperative CID technology development.			
<b>FY 2014 Plans:</b> Will 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 be implemented on existing mobile and handheld platforms being targeted by applicable programs of record.			
<b>Accomplishments/Planned Programs Subtotals</b>		2.033	2.181
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability				PROJECT H16: S3I Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H16: S3I Technology	-	19.699	20.726	20.808	-	20.808	21.198	21.382	21.370	21.755	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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; 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 Army Research Laboratory (ARL), Adelphi, MD.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> H16: <i>S3I Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Non-Imaging Intelligence, Surveillance, and Reconnaissance (ISR) Sensing  <b>Description:</b> 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 RF with unique capabilities for Army & DoD applications such as technologies that enable detection of underground facilities.  <b>FY 2012 Accomplishments:</b> Investigated new fusion techniques for enhanced discrimination between vehicles, humans and animals and developed algorithms for acquiring 360 degree situational awareness from multisensory wide-area persistent surveillance platforms; applied acoustic, seismic, magnetic, and E-field to subsurface anomaly detection and characterization; applied advanced transient event classification algorithms to fielded acoustic systems; and enhanced detection range and localization accuracy of airborne acoustic systems to include an unmanned aerial vehicle (UAV) with both acoustic and E-field sensors.  <b>FY 2013 Plans:</b> Continue 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 investigate, code 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.  <b>FY 2014 Plans:</b> Will evaluate combination of co-located passive IR sensors to discriminate humans from animals with high confidence; investigate new algorithms to detect digging using seismic and magnetic sensors; develop and evaluate algorithms to fuse input from acoustic velocity sensors, electric-field charge detectors, narrow-band burn-product sensor and infrared flash detector to improve detection and classification of hostile threats such as gunfire, mortars, and rockets.			5.790	4.014	5.590
<b>Title:</b> Networked Sensing and Data Fusion  <b>Description:</b> 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) multi-modal 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 (i.e., 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 & E-field sensors. This effort is complementary with PE 0601104A/H50 and PE0601104A/J22.			5.057	5.650	6.022

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability	PROJECT H16: S3I Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>FY 2012 Accomplishments:</b> Applied advanced fusion algorithms to multimodal sensors and systems; exploited magnetic and E-field fusion for equipment characterization, power line monitoring, and target localization; employed acoustic and seismic techniques to augment E-field subsurface imaging; enhanced sensing from airborne platforms with multi-modal sensors, cueing and fusion algorithms; and implemented fusion algorithms to discriminate humans versus other targets with high accuracy.</p> <p><b>FY 2013 Plans:</b> Continue to develop and assess novel multi-modal sensing and processing algorithms for acquiring information on human activity; investigate and perform experiments in a realistic or simulated environment to evaluate FY12 distributed networking and interoperability algorithms and tools for coalition information sharing and decision making; and implement quality of information (QoI) based data discovery, collection and fusion techniques to extract desired information from large data sets.</p> <p><b>FY 2014 Plans:</b> Will 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 E-field sensing systems to enable passive ranging of near-miss bullets based on wave propagation velocity differences; develop passive EM target detection and localization using multi-axis electric-field and magnetic field sensors.</p>				
<p><b>Title:</b> Tagging Tracking and Locating (TTL)</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Optimized and transitioned TTL technologies to CERDEC and implemented improvements to RF and IR Tags.</p> <p><b>FY 2013 Plans:</b> Investigate alternate technologies including ultra violet (UV), infrared (IR), radio frequency (RF), and acoustic modalities for application to TTL; design advanced hyperspectral algorithms for locating and tracking targets of interest; develop advanced biometric techniques for locating and identifying humans of interest.</p> <p><b>FY 2014 Plans:</b></p>		1.553	2.072	2.189



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> H16: <i>S3I Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will investigate battery free tags for extending the operating life of tags; develop and extract signals from targets of interest using mechanical and electromechanical coupling methods combined with applicable sensing modalities.				
<b>Title:</b> Ultra Wideband Radar  <b>Description:</b> Design technical underpinnings of ultra wideband (UWB) radar for several key Army concealed target detection technology requirements including landmine detection, sensing through-the-wall (STTW), and obstacle detection. Validate advanced computational electromagnetic algorithms, estimate performance improvements of proposed radar systems, and predict target signatures for advanced detection requirements.  <b>FY 2012 Accomplishments:</b> Collected data with improved forward-looking UWB radar testbed to assess IED detection performance gains relating to the following areas: increased antenna height above ground, new antenna/balun design with enhanced low frequency content for better ground penetration, and polarimetric effects; and investigated techniques to utilize information embedded in low frequency radar data to develop an effective combination of interior building maps, moving target indication algorithms and RF Measurement & Signatures Intelligence technology.  <b>FY 2013 Plans:</b> Complete 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; continue to investigate utilizing radar data to build interior structure maps as well as stationary target detection techniques using 3-D computer-generated radar images.  <b>FY 2014 Plans:</b> Will develop techniques for combining UWB radar with complementary sensors (e.g., video, thermal IR) for improving probability of detection and confirmation of targets; investigate computational electromagnetic models of the radar signature of RF devices placed in a complex building environment.		3.341	2.114	2.529
<b>Title:</b> Networked Compact Radar, Wide Bandgap Optoelectronics, and Laser Protection Technologies  <b>Description:</b> Design Networked Compact Radar for use on small ground and air vehicles and future Soldier technologies. Develop understanding of phenomenology for an integrated RF sensor that performs radio, radar, and control functions to allow communications, combat ID, and target acquisition/tracking,. Develop semiconductor-based ultraviolet (UV) optoelectronics for communications, water/air/surface purification, and detection and identification of biological threats. Conduct applied research in sensor and eye protection from laser threats.  <b>FY 2012 Accomplishments:</b>		1.291	4.115	1.544

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> H16: <i>S3I Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Developed new methods of moving target classification based on micro-doppler analysis; explored the phenomenology and image processing associated with sub-mmW imaging of human-borne IEDs and validated new sub-mmW / terahertz device technology; extended research on 230-275-nm optical sources including LEDs, lasers, and detectors.  <b>FY 2013 Plans:</b> Assess the application of RF micro-Doppler algorithms to the remote sensing of human activities for counter-IED applications; investigate non-traditional radar modes in a compact radar device for force protection and surveillance; improve performance of UV lasers, LEDs, and detectors operating at wavelengths of 230-275-nanometers for enabling communications, water/air/surface purification, and detection and identification of biological threats; and investigate new optical limiting components for detecting emerging laser threats.  <b>FY 2014 Plans:</b> Will 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; 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.				
<b>Title:</b> Adaptive Information Collection and Fusion (previously titled Information Fusion)  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Developed algorithms and enhanced applications directed to persistent surveillance, sensor management, and asset-to-asset taskings to minimize the cognitive workload of a lower echelon commander.  <b>FY 2013 Plans:</b> Assess Cloud-based cellular architectures and explore implementation of decision support tools at the sensor level to more effectively support the collection and dissemination of information specifically tailored to the Soldiers cognitive requirements for more accurate decision making.  <b>FY 2014 Plans:</b> Will 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		2.667	2.761	2.934

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> H16: <i>S3I Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
awareness; integrate these filtering algorithms into an autonomous collaborative collection framework and assess the impact on delay and situation awareness.			
<b>Accomplishments/Planned Programs Subtotals</b>		19.699	20.726
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

# UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability				PROJECT SA2: Biotechnology Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
SA2: Biotechnology Applied Research	-	5.321	4.852	4.037	-	4.037	4.059	4.491	3.372	3.795	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 2012	FY 2013	FY 2014	
Title: Biotechnology Applied Research									5.321	4.852	4.037	
Description: This effort exploits breakthroughs in biotechnology basic research invented at the ICB to enable capabilities in sensors, electronics, photonics, and network science.												
FY 2012 Accomplishments: Designed/built hardware/software required to image single cells in 3D and collect initial 3D images; applied the lessons learned in microbial fuel cells to implement enhanced fermentation, environmental monitoring, and investigated waste water treatment; completed characterization and investigation of bacterial nanowires fabricated artificially from the naturally occurring proteins;												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> SA2: <i>Biotechnology Applied Research</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>completed and validated algorithms for control of data displayed on crew stations based on neural processing; began two new start projects selected in FY11, "Biological Power Source for Unattended Ground Sensors" and "Biomimetic UAV-based System for Soldier Navigation and Situational Awareness."</p> <p><b>FY 2013 Plans:</b> Complete the design and fabricate hardware and software required to image single cells in 3D to better understand the interactions between biological materials and inorganic surfaces; experimentally validate increased electron acceptors ability to improve fermentation for bioprocessing and monitoring systems; analyze wastewater treatment on increased laboratory scale to optimize bioremediation; characterize artificial biofilms doped with organic conductive structures for increased current density microbial fuel cells; evaluate bio-inspired algorithms for control of swarms of micro-unmanned aerial vehicles; evaluate yeast cell based electrodes and membranes in a microbial fuel cell for powering unattended ground sensors.</p> <p><b>FY 2014 Plans:</b> Will improve bio-fuel 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; evaluate protein capture agents and synthetic bio-molecules as materials to improve stability, affinity for overall environmental tolerance.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>		5.321	4.852
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability				PROJECT TS1: Tactical Space Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
TS1: Tactical Space Research	-	3.606	4.303	5.306	-	5.306	6.278	6.950	7.052	7.179	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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.

This project supports Army science and technology efforts in the Command, Control, Communications, and Intelligence (C3I) portfolio.

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 (SMDC) in Huntsville, AL.

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

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Tactical Space Research	2.636	3.292	4.242
<b>Description:</b> 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.			
<b>FY 2012 Accomplishments:</b> Continued development of advanced power technologies for use in space satellite applications; continued component development for small satellite electro-optical/infrared (EO/IR) sensors; developed L-Band communications components for insertion into a small satellite software defined radio.			
<b>FY 2013 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> TS1: <i>Tactical Space Research</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Design and develop optics, processor, and gimbal systems component technologies for small satellite Electro-Optical (EO) video subsystems, small satellite deployable arrays, and small satellite constellation enablers.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Space and Analysis Lab			
<b>Description:</b> This effort provides an in-house capability to design and conduct analytic evaluations of space, high altitude, and cyberspace technologies.			
<b>FY 2012 Accomplishments:</b> Implemented the design of the Space Analysis Lab to stand up an in-house capability to support component development and system integration for ground demonstrations and evaluation of space, high altitude, and cyberspace technology applications.			
<b>FY 2013 Plans:</b> Design payload ground systems to monitor health and status of small satellite systems during flight operations.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		0.970	1.011
			1.064
		3.606	5.306
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602120A: Sensors and Electronic Survivability				PROJECT TS2: Robotics Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
TS2: Robotics Technology	-	11.530	13.198	10.691	-	10.691	13.937	20.253	16.719	17.020	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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 Ground portfolio.												
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 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 2012	FY 2013	FY 2014	
Title: Robotics CTA									7.311	5.925	8.323	
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 systems to display intelligent tactical behavior, formulation of control strategies that will facilitate use of unmanned systems in												



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> TS2: <i>Robotics Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
populated environments and minimize the cognitive workload on Soldier operators enabling more dexterous manipulation of objects.			
<p><b>FY 2012 Accomplishments:</b> Enabled lower cost sensory capability for smaller unmanned systems; examined issues of trust in automation and developed a common mental picture between soldier and unmanned system; and examined mid- and long- range scene recognition to facilitate tactical behavior in unmanned systems.</p> <p><b>FY 2013 Plans:</b> Design algorithms to enable both improved comprehension of the sensed environment by small unmanned systems and adaptability in planning and execution of tactical behaviors; and investigate concepts for more efficient locomotion by small, legged unmanned systems to improve mobility.</p> <p><b>FY 2014 Plans:</b> Will continue to design perception and intelligence algorithms that will permit unmanned systems to team with soldiers in moderately complex environments and conduct missions; will instantiate learning algorithms to enable robots to continually learn from experience and recognize intent of other agents; will focus on the implementation of hybrid cognitive/metric architecture to minimize the workload placed upon soldier, including implementation of non-traditional control techniques; and will implement concepts for manipulation of objects and improved ground mobility for complex and constrained environments.</p>			
<p><b>Title:</b> Perception and Intelligent Control</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Conducted applied research for improved shared understanding of tactical environment between soldier and unmanned systems.</p> <p><b>FY 2013 Plans:</b> Investigate FY12 learned understanding of tactical environment between soldier and unmanned systems for improving autonomous tactical behaviors and validate technologies in collaboration with CTA efforts; investigate and evaluate the state-of-the-art in intelligent control and focus on the technology gaps.</p> <p><b>FY 2014 Plans:</b></p>		3.013	7.273
			2.368

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A: <i>Sensors and Electronic Survivability</i>	<b>PROJECT</b> TS2: <i>Robotics Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Will implement algorithms for perception of the local environment employing a hybrid cognitive/metric architecture; will incorporate advanced algorithms for whole body manipulation on to testbed platforms; will implement novel approaches to mobility in complex and constrained environments; and will assess performance of algorithms in an integrated context.			
<b>Title:</b> Autonomous Robotics - Component Maturation		1.206	0.000
<b>Description:</b> Matures component technologies on unmanned ground vehicle test beds by conducting extensive field evaluation and technology characterization to establish improved capability for near autonomous UGVs. Conduct regular, periodic evaluation at Ft. Indiantown Gap, PA, and other military facilities that will stress the technology in complex environments to further focus CTA sponsored research, assess performance, and provide the opportunity for US Army Training and Doctrine Command to engage in the early development of the tactics, techniques, and procedures required for successful utilization of unmanned systems in future conflicts. Work is done collaboratively with industry, academia and other government agencies to include Tank and Automotive Research, Development, and Engineering Center (TARDEC) to support future transitions of knowledge and emerging technologies.			
<b>FY 2012 Accomplishments:</b> Conduct initial assessments to establish baseline capability for unmanned systems to understand terrain and behaviors.			
<b>Accomplishments/Planned Programs Subtotals</b>		11.530	13.198
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602122A: <i>TRACTOR HIP</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	14.207	22.439	36.293	-	36.293	29.575	12.035	12.238	12.459	Continuing	Continuing
622: <i>D622</i>	-	1.649	2.657	2.440	-	2.440	2.407	2.407	2.284	2.325	Continuing	Continuing
B72: <i>AB72</i>	-	3.285	12.693	23.467	-	23.467	14.140	4.516	4.755	4.841	Continuing	Continuing
B73: <i>AB73</i>	-	9.273	7.089	10.386	-	10.386	13.028	5.112	5.199	5.293	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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).

<b>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2012</u></b>	<b><u>FY 2013</u></b>	<b><u>FY 2014 Base</u></b>	<b><u>FY 2014 OCO</u></b>	<b><u>FY 2014 Total</u></b>
Previous President's Budget	14.207	22.439	30.357	-	30.357
Current President's Budget	14.207	22.439	36.293	-	36.293
Total Adjustments	0.000	0.000	5.936	-	5.936
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	5.936	-	5.936

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602122A: TRACTOR HIP				PROJECT 622: D622			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
622: D622	-	1.649	2.657	2.440	-	2.440	2.407	2.407	2.284	2.325	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602122A: TRACTOR HIP				PROJECT B72: AB72			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
B72: AB72	-	3.285	12.693	23.467	-	23.467	14.140	4.516	4.755	4.841	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602122A: TRACTOR HIP				PROJECT B73: AB73			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
B73: AB73	-	9.273	7.089	10.386	-	10.386	13.028	5.112	5.199	5.293	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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)(I)

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602211A: <i>AVIATION TECHNOLOGY</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	43.430	51.607	55.615	-	55.615	57.280	51.185	58.980	60.947	Continuing	Continuing
47A: <i>AERON &amp; ACFT Wpns Tech</i>	-	37.946	45.898	48.812	-	48.812	48.597	42.458	50.568	52.051	Continuing	Continuing
47B: <i>Veh Prop &amp; Struct Tech</i>	-	5.484	5.709	6.803	-	6.803	8.683	8.727	8.412	8.896	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**A. Mission Description and Budget Item Justification**

This program element (PE) conducts rotary wing vehicle component design, fabrication and evaluation to enable Army aviation transformation. Emphasis is on developing rotary wing platform technologies to enhance manned and unmanned rotary wing 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 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 Aviation and Missile Research, Development, and Engineering Center (AMRDEC), located at Redstone Arsenal, AL; Joint Base Langley Eustis, VA; Moffett Field, CA; and at the 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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602211A: AVIATION TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	44.539	51.607	53.663	-	53.663
Current President's Budget	43.430	51.607	55.615	-	55.615
Total Adjustments	-1.109	0.000	1.952	-	1.952
• Congressional General Reductions	-0.071	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.609	-			
• Adjustments to Budget Years	-	-	1.952	-	1.952
• Other Adjustments 1	-0.429	-	-	-	-



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY				PROJECT 47A: AERON & ACFT Wpns Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
47A: AERON & ACFT Wpns Tech	-	37.946	45.898	48.812	-	48.812	48.597	42.458	50.568	52.051	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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.</p> <p>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).</p> <p>The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering S&amp;T focus areas and the Army Modernization Strategy.</p> <p>Work in this project is performed by the Aviation Development Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), (located at the NASA Ames Research Center, Moffett Field, CA; and Joint Base Langley Eustis, VA).</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: National Rotorcraft Technology Center (NRTC)									6.057	3.912	3.064	
Description: The goal of the NRTC is to focus government, US rotorcraft industry and academia resources on pre-competitive, high priority, military focused technology development to maintain U.S. preeminence in rotorcraft capabilities.												
FY 2012 Accomplishments: Conducted an icing evaluation of a spinning rotor in the NASA Icing Research Tunnel (IRT) to validate prediction tools complete; conducted hover stand evaluation of rotor with Miniature Trailing-edge Effector (MiTE) actuation system; performed validation												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A: <i>AVIATION TECHNOLOGY</i>	<b>PROJECT</b> 47A: <i>AERON &amp; ACFT Wpns Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
testing of an in-flight acoustic detection footprint prediction system and in-cockpit display; and validated analytic predictions with UH-60 wind tunnel and flight test data.			
<b>FY 2013 Plans:</b> Conduct static and cyclic testing to validate thick laminate delamination propagation prediction tools applicable to composite structures; evaluate composite material coupons to determine the effect of nano-particles on strength and weight properties; systematically investigate severe maneuvers using high-fidelity computational fluid dynamic/structural analyses with tight coupling for UH-60 design pull-up maneuver and diving turns; investigate autonomous autorotation landing on a fixed-base simulator; develop an automatic overset grid generation tool to support the use of the Army/NASA Navier-Stokes aerodynamic code for rotorcraft analyses.			
<b>FY 2014 Plans:</b> Will develop modeling tools to determine lubricated/loss-of-lube gear performance and measurable criteria for repairable gear tooth damage and standardized repair methods; and will execute extensive correlation efforts for time-accurate, analytic coupling methods for model-scale rotors in hover and full scale rotors in forward flight.			
<b>Title:</b> Rotor Technology  <b>Description:</b> Evaluate performance enhancements gained from advanced rotor technologies, including on-blade controls. This effort continues in FY13 under the Rotors & Vehicle Management Technologies effort.		4.794	0.000
<b>FY 2012 Accomplishments:</b> Applied advanced, high performance computing tools, simulating UH-60 rotor measurements, to assess accuracy of computed rotor structural loads, deflections and flowfield measurements; performed pre-test computations and participated in an international evaluation of an active twist rotor; and applied aeromechanics analysis tools to rotorcraft configurations for improved performance in support of PE 0603003A, Project 313.			
<b>Title:</b> Flight Controls  <b>Description:</b> Develop advanced rotor and aircraft flight control architectures as well as control laws to permit enhanced vehicle performance over expanded and more challenging flight envelopes. This effort continues in FY13 under the Rotors & Vehicle Management Technologies effort.		4.663	0.000
<b>FY 2012 Accomplishments:</b> Investigated integrated control of large rotorcraft using feedback of rotor state, external loads, and structural measurements.			
<b>Title:</b> Rotors & Vehicle Management Technologies		0.000	8.429
			8.856

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY		PROJECT 47A: AERON & ACFT Wpns Tech
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>Description:</b> 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. This effort consolidates and continues efforts initiated prior to FY13 under the Rotor Technology effort and the Flight Controls effort.</p> <p><b>FY 2013 Plans:</b> Assess advanced computational methods for prediction of helicopter main rotor and pylon aerodynamic interaction with fixed tail surfaces; perform post-test computations for an international active twist rotor experiment; continue to analyze rotorcraft configurations for improved performance; complete new software that includes the ability to model full vehicle interactional aerodynamics including main-rotor, fuselage and tail-rotor interactions; and initiate flight mechanics modeling and handling qualities criteria development for advanced aircraft configurations, including compounds.</p> <p><b>FY 2014 Plans:</b> Will conduct a small-scale rotor test to refine current modeling and simulation tools for rotor structural loads; will conduct sub-scale experimental studies in drag reduction using active and passive techniques where combined rotor and fuselage flows are complex; will analyze rotorcraft configurations for improved performance, including both aerodynamics and structural dynamics; will complete new software that includes the ability to model high fidelity simulations of helicopter missile launch; will conduct analysis and simulation to evaluate autonomous multi-ship teaming (e.g., twin lift); will develop and validate flight simulation models of compound high-speed configurations for handling qualities requirements; and will initiate development of flight control architectures for advanced configurations with many control surfaces and widely changing dynamic responses over the flight envelope.</p>				
<p><b>Title:</b> Aircraft and Occupant Survivability Technologies</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Began design of advanced infra-red(IR)/electro-optical (EO) signature control materials; and developed improved materials and airframe structural configurations that provide threat protection against non-conventional weapons, to include directed energy, blast/overpressure, and high velocity low mass fragments.</p> <p><b>FY 2013 Plans:</b> Continue research into advanced IR/EO signature control materials to counter current and emerging threat sensors; continue investigation and validation 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</p>		8.473	7.147	9.943

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY		PROJECT 47A: AERON & ACFT Wpns Tech
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
fragments; design and validate active crash energy management subsystems; and evaluate and validate fuel containment technologies that provide self-sealing capability independent of fuel type.  FY 2014 Plans: Will begin coupon testing of developed EO/IR materials for signature control and environmental durability; will 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.				
Title: Engine and Drives Technologies  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.  FY 2012 Accomplishments: For a cargo sized aircraft, completed advanced mechanical systems fabrication for improved engine performance and structural life; completed evaluation of advanced compressor for improved engine performance and reduced weight; and transitioned technologies to engine advanced development efforts under PE 0603003A, Project 447.  FY 2013 Plans: Complete component testing of advanced mechanical systems technology in a dynamic laboratory environment for improved engine performance and structural life; complete fabrication of advanced combustor design for reduced size, weight, and cost; and complete design of advanced power turbine design for improved performance and operational capability.  FY 2014 Plans: Will complete component testing of advanced combustor designs for reduced size, weight, and cost; will complete fabrication of advanced power turbine for improved performance and operational capability; will investigate clutch and gear systems to permit multi-speed transmissions required for high speed rotor and prop/rotor operation.		3.542	3.049	5.028
Title: System Concepts Studies  Description: Enables new rotorcraft configurations by evaluating critical advanced technology using design and analysis methods with greater modeling fidelity. Introduces high fidelity methodology for improved performance and design predictions earlier in the development and acquisition process. This effort continues in FY13 under the Platform Design & Structures Technologies effort.  FY 2012 Accomplishments:		2.028	0.000	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A: <i>AVIATION TECHNOLOGY</i>	<b>PROJECT</b> 47A: <i>AERON &amp; ACFT Wpns Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Completed small scale wind tunnel test to validate performance predictions and documented requirements for multi-role configuration technology.			
<b>Title:</b> Platform Design & Structures Technologies  <b>Description:</b> Enables new rotorcraft configurations by evaluating critical advanced aviation technologies using design and analysis methods with greater modeling fidelity. Introduces high fidelity methodology for improved performance and design predictions earlier in the development and acquisition process. Prior to FY13, efforts were exhibited under System Concept Studies, Network Operations and System Integration (advanced rotary wing concept), and Durability & Sustainment Technologies (platform durability & damage tolerance).  <b>FY 2013 Plans:</b> Update advanced technology representations at the component level for design codes used for joint vertical lift aircraft concept size, weight, and performance estimation; assess 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 apply modeling and simulation technologies developed to inform Joint Multi-Role and future aircraft designs.  <b>FY 2014 Plans:</b> Will 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.		0.000	3.735
<b>Title:</b> Network Operations and System Integration  <b>Description:</b> Perform feasibility, operations, and concept studies to identify promising candidate technologies for improved and new platform capabilities. The human/machine interface work of this effort continues in FY13 under the Unmanned and Optionally Manned Technologies effort. The advanced rotary wing weapons integration concept work of this effort continues in FY13 under the Aircraft Weapon & Sensor Technologies effort. The advanced rotary wing concepts work of this effort continues in FY13 under the Platform Design and Structures Technologies effort.  <b>FY 2012 Accomplishments:</b> Investigated Unmanned Aerial System (UAS) supervisory control techniques applied in relevant tactical operations through flight evaluation; and investigated integration of advanced lethality concepts for application to manned and unmanned aviation assets, addressing energy storage, system pointing accuracy, stabilization, and incapacitation effects.		5.428	0.000
<b>Title:</b> Unmanned and Optionally Manned Technologies		0.000	5.311

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY	PROJECT 47A: AERON & ACFT Wpns Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>Description:</b> 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. Prior to FY13, human/machine interface work was exhibited in the Network Operations and System Integration effort.</p> <p><b>FY 2013 Plans:</b> Validate UAS supervisory control techniques from the cockpit for manned-unmanned teaming in high fidelity simulation; complete 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><b>FY 2014 Plans:</b> Will complete evaluation of brown-out symbology software in actual brown-out conditions at Yuma Proving Ground for approach-to-landing, hover and take-off flight regimes; will evaluate simulation of BOSS symbology for forward tactical flight regimes; will 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><b>Title:</b> Aircraft Weapon &amp; Sensor Technologies</p> <p><b>Description:</b> Design and develop innovative approaches for integrating advanced weapons and sensors on aircraft platforms, including smart dispensers, data transfer, and post-launch weapon communication. Prior to FY13, the advanced rotary wing weapons integration concept work was exhibited in the Network Operations and System Integration effort.</p> <p><b>FY 2013 Plans:</b> Investigate advanced lethality concepts to include on-the-move fire control for improved hit probability and reduced collateral damage, and apply concepts to inform future system level demonstration.</p> <p><b>FY 2014 Plans:</b> Will research and determine applicability of advanced sensor technologies for improved situational awareness; will 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>		0.000	1.521	1.624
<p><b>Title:</b> Maintainability &amp; Sustainability Technologies</p> <p><b>Description:</b> Develop prognostic and system health assessment technologies to enable transition to a Condition Based Maintenance supportability structure.</p> <p><b>FY 2012 Accomplishments:</b></p>		2.961	4.827	3.609

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY		PROJECT 47A: AERON & ACFT Wpns Tech
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Developed prognostic algorithms for predicting remaining life of engine controls, sensors, and lubrication systems; performed evaluation of data fusion of structural integrity algorithms for extending component time on wing and damage tolerance; and developed algorithms to assess rotor component health and vehicle control systems. <b>FY 2013 Plans:</b> Develop prognostic technologies for predicting and isolating failures within aircraft electrical wiring systems; validate algorithms for engine controls, sensors, and lubrication systems; develop a multi-functional sensor to provide improved bearing prognostics and reduce system weight; and develop and validate a combined crack and corrosion detection sensor for improved accuracy on airframe structural components. <b>FY 2014 Plans:</b> Will develop technologies to enable lighter weight designs through loads monitoring of critical components; will develop multi-use sensors to monitor cracking and delamination in composites as well as crack growth algorithms; will develop wireless sensors for on-component processing of part health and usage history; will 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; will investigate mission based probabilistic life 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 will investigate durable structural concepts including application of high-strain capability designs through advanced design, analysis and/or material solutions, while also considering repairability.				
<b>Title:</b> Survivability For Degraded Visual Environment Operations <b>Description:</b> Will 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). <b>FY 2013 Plans:</b> Characterize sensor transmission as a function of wavelength, particulate size and volumetric density; define required spatial resolution for safe pilotage, scan rates for terrain updates, and sensor transmission relative to operational dust and snow volumetric densities; investigate multi-band sensor fusion techniques to enhance performance; and investigate cockpit display technology (heads-up and heads-down) to provide terrain representation to aircrew. <b>FY 2014 Plans:</b> Will execute studies that include simulation, laboratory, ground test, and flight test to develop the parametric relationship between aircraft handling qualities, sensors and cueing to allow safe flight operations in degraded visual environments; will define and test		0.000	10.000	6.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A: <i>AVIATION TECHNOLOGY</i>		<b>PROJECT</b> 47A: <i>AERON &amp; ACFT Wpns Tech</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
required levels of handling qualities, appropriate sensor trade-offs to include active and synthetic fusion, as well as visual display (symbology) and tactile cueing..				
<b>Accomplishments/Planned Programs Subtotals</b>		37.946	45.898	48.812
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY				PROJECT 47B: Veh Prop & Struct Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
47B: Veh Prop & Struct Tech	-	5.484	5.709	6.803	-	6.803	8.683	8.727	8.412	8.896	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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).  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 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 2012	FY 2013	FY 2014	
Title: Rotor and Structure Technology									1.981	2.043	2.269	
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 2012 Accomplishments: Completed wind-tunnel evaluation of high performance active twist rotor blades and validated prognostics and diagnostics technologies and framework for computation of remaining useful life of vehicle structures.												
FY 2013 Plans: Enhance damage tolerance analysis and analytical methods to support the Army joint multi-role aircraft development; conduct 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; assess structural health monitoring methods to optimize sensing strategies for reducing Army maintenance labor; validate a												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602211A: AVIATION TECHNOLOGY	PROJECT 47B: Veh Prop & Struct Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
modeling and simulation capability for the study of improved rotor system performance; and investigate nanosecond pulsed plasma actuators for on-blade separated flow control to increase the performance of rotor systems.  <b>FY 2014 Plans:</b> Will 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; will perform prognostic and diagnostic (P&D) inspection experiments aimed at improving structural risk assessment; will develop self sensing strategies to monitor damage precussors; will incorporate optimized sensing strategies into P&D systems; will commission operation of, and begin data collection on the full scale helicopter landing gear test stand facility; will utilize multi-functional structural materials to augment sensing, power and energy storage, or actuation in micro air and ground vehicles. Will also develop coupled plasma/fluid models and utilize computational models to quantitatively assess potential impacts of plasma on rotor aerodynamic performance; will begin experimental studies to determine the potential of nanosecond pulsed plasma discharges for enhancing current and next-gen rotorcraft speed, range, and payload; will develop quantitative technology payoff assessment and analysis models; will expand models from first-order relationships to comprehensive codes. Models will allow researchers to understand which technologies are the most critical to achieving future aviation capabilities.				
<b>Title:</b> Engine and Drive Train Technology (previously titled Propulsion and Drive Train Technology)  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Investigated the feasibility of fabricating hybrid ceramic/metal turbine engine components for future air platforms.  <b>FY 2013 Plans:</b> Continue 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 characterize the dynamics of a pericyclic variable transmission (PVT) for use in rotorcraft applications to reduce transmission weight.  <b>FY 2014 Plans:</b> Will 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; complete dynamic characterization of a PVT to reduce the weight of PVTs for rotorcraft applications.		3.503	3.666	3.934
<b>Title:</b> Micro/Small Scale Unmanned Aerial Systems		0.000	0.000	0.600

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A: <i>AVIATION TECHNOLOGY</i>	<b>PROJECT</b> 47B: <i>Veh Prop &amp; Struct Tech</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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><b>FY 2014 Plans:</b> 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 or its components; 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		5.484	5.709
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2014 Army **DATE:** April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602270A: <i>Electronic Warfare Technology</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	15.667	15.068	17.585	-	17.585	18.459	19.325	20.539	21.124	Continuing	Continuing
906: <i>Tactical Electronic Warfare Applied Research</i>	-	15.667	15.068	17.585	-	17.585	18.459	19.325	20.539	21.124	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## Note

FY14 increase for Electronic Warfare modeling, analysis and optimization

## 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, 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 (EW 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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602270A: Electronic Warfare Technology			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	15.765	15.068	15.221	-	15.221
Current President's Budget	15.667	15.068	17.585	-	17.585
Total Adjustments	-0.098	0.000	2.364	-	2.364
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.098	-			
• Adjustments to Budget Years	-	-	2.364	-	2.364

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602270A: Electronic Warfare Technology				PROJECT 906: Tactical Electronic Warfare Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
906: Tactical Electronic Warfare Applied Research	-	15.667	15.068	17.585	-	17.585	18.459	19.325	20.539	21.124	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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.</p> <p>This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Ground, Soldier and Air portfolios.</p> <p>Work in this project is complimentary of PE 0603270A (EW 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).</p> <p>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.</p> <p>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.</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Multi-Intelligence Data Fusion and Targeting									4.071	3.300	2.787	
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												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A: <i>Electronic Warfare Technology</i>		<b>PROJECT</b> 906: <i>Tactical Electronic Warfare Applied Research</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
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.					
<b>FY 2012 Accomplishments:</b> Investigated biometric data matching and fusion algorithms for use in non-cooperative intelligence collection environment; investigated standards of ingestion to facilitate addition of non-cooperatively collected biometrics (partial iris scans, scents, three dimensional (3D) face, thermal face, etc.) into biometrics database; coded enhanced algorithms to conduct near-real-time matching and fusion of cooperative and non-cooperative biometric intelligence into enhanced biometric intelligence products; finalized data collection process, generated candidate templates, and conducted non-cooperative sensor data collection to assess the process and templates.					
<b>FY 2013 Plans:</b> Create and populate non-cooperative biometrics database and assess effectiveness of near-real-time matching and fusion algorithms and data templates; interface cooperative and non-cooperative biometrics databases together to permit sharing and fusion of data; evaluate ability to simultaneously collect, query and match biometrics data in near-real-time using representative tactical communications system.					
<b>FY 2014 Plans:</b> Will investigate cultural, psychological, social, 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.					
<b>Title:</b> Offensive Information Operations Technologies			4.616	4.454	5.061
<b>Description:</b> 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.					
<b>FY 2012 Accomplishments:</b> Refined techniques to perform computer network manipulation to include, traffic redirection, data-in-transit, and network situational awareness; developed comprehensive visualization interface that takes into account CNO and Electronic Warfare (EW) missions; assessed feasibility of integrating next-generation EW systems with tactical CNO capabilities to maximize effects on targets					

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
and minimize the training requirements on operator to executing a CNO mission; developed anti-tamper and adapted offensive components, networking resource mutation for network manipulation, and virtualization/virtual-machine monitors for isolation.  <b>FY 2013 Plans:</b> Investigate denial of service/offensive cyber techniques to counter new threat devices; extend capabilities developed for legacy threat devices to enable a coordinated tactical cyber capability against multiple targets and threat devices simultaneously; design and evaluate offensive denial of service techniques on tactical cyber-capable platforms, to include software defined radios and other ground/air-based sensors and transmitters.  <b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Multispectral Threat Warning  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Investigated countermeasure techniques against next-generation MANPADS employing digital imaging seekers; used modeling and simulation and limited hardware-in-the-loop methods to investigate potential effectiveness of current platform-resident infrared (IR) focal plane arrays, likely tracking algorithms, digital IR countermeasure lasers and available imaging sources against these advanced seekers.  <b>FY 2013 Plans:</b> Create an end-to-end modeling and simulation (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; use this environment to assess effectiveness of known countermeasures and explore new countermeasure techniques to use against these threats; integrate digital seeker hardware surrogates into this M&S environment for use in hardware-in-the-loop simulations.  <b>FY 2014 Plans:</b>		3.480	3.569
			3.678



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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Will validate M&S environment and new countermeasure techniques; validate digital seeker hardware surrogate performance in the modeling environment and hardware-in-the-loop simulations; evaluate known countermeasures in the M&S environment to assess effectiveness; investigate new countermeasure techniques to use against advanced threats.			
<b>Title:</b> Passive and Active Targeting Techniques		3.500	0.000
<b>Description:</b> This effort investigates passive and active techniques and software algorithm design and coding for three dimensional detection, identification, and precision geolocation of next-generation wireless communication threats and improved situational awareness. This effort also addresses operational conditions such as dense, co-channel, and multipath RF environments. This effort continues in FY13 under Multi-Functional Intelligence, Surveillance and Reconnaissance (ISR) Technologies.			
<b>FY 2012 Accomplishments:</b> Investigated techniques to improve the resolution of conventional non-cooperative time-difference-of-arrival (TDoA) based geolocation techniques; investigated techniques to overcome multipath effects such as reflection, absorption and diffraction found in complex urban environments that cannot be resolved by traditional TDoA and angle of arrival techniques utilizing electromagnetic propagation mapping tools.			
<b>Title:</b> Multi-Function Intelligence, Surveillance and Reconnaissance (ISR) Technologies		0.000	3.745
<b>Description:</b> 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. This effort transitions from Passive and Active Targeting Techniques which ends in FY12. Work being accomplished under PE 63772/243 complements this effort			
<b>FY 2013 Plans:</b> Design and validate radar waveforms to enable communication and coordination between similar radar sensors without the need for a central node; design and implement noise correlation algorithms to mitigate signal interception and compromise, reduce co-site interference and preserve high resolution target detection capability.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Electronic Warfare Architectures and Countermeasures		0.000	2.300

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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><b>FY 2014 Plans:</b> Will 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		15.667	15.068
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602303A: MISSILE TECHNOLOGY							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	65.591	49.383	51.528	-	51.528	55.038	51.649	46.764	44.507	Continuing	Continuing
214: Missile Technology	-	49.620	49.383	51.528	-	51.528	55.038	51.649	46.764	44.507	Continuing	Continuing
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	-	15.971	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
Note FY14 funding increase reflects renewed priority on large scale rocket propulsion systems.												
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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602303A: MISSILE TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	67.079	49.383	43.650	-	43.650
Current President's Budget	65.591	49.383	51.528	-	51.528
Total Adjustments	-1.488	0.000	7.878	-	7.878
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.488	-			
• Adjustments to Budget Years	-	-	7.878	-	7.878

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602303A: MISSILE TECHNOLOGY				PROJECT 214: Missile Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
214: Missile Technology	-	49.620	49.383	51.528	-	51.528	55.038	51.649	46.764	44.507	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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)**

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Smaller, Lighter, Cheaper Tactical Missile Technologies	12.496	12.187	6.450
<b>Description:</b> 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.			
<b>FY 2012 Accomplishments:</b> Performed trade studies and began initial critical component design for a small, light, low power navigation-grade sensor package that can detect and maintain track of the direction north; conducted initial packaging of single chip inertial sensor module; conducted trade studies for small, low cost components for precision munitions; designed component technologies for the next generation of precision weapon systems including: 1) reduced cost, advanced light weight materials; 2) reduced cost, advanced			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
seeker technologies for increased detection range; 3) lethality technologies for performance against increased target sets; and 4) advanced propulsion and controls technology for multiple mission capabilities.				
<b>FY 2013 Plans:</b> Continue design and development of a small, light weight, low power navigation sensor for applications such as precision targeting and miniature precision munitions, and single chip Inertial Measurement Units; based on trade studies for low cost, precision munition components and system concepts, design, fabricate, and evaluate component technologies for the next generation of precision weapon systems including reduced cost, advanced light weight materials; lethality technologies for performance against increased target sets; advanced sensor and tracking technologies for improved target acquisition, and advanced propulsion for multiple mission scenarios.				
<b>FY 2014 Plans:</b> Will 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, 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.				
<b>Title:</b> Missile Seeker Technology			8.962	10.525
<b>Description:</b> This effort focuses on the design and maturation of missile seekers, sensors, and software. The goal is to increase performance of missile seekers through improvement of algorithms, imaging, and thermal management. Beginning in FY13, Fire control seeker technology will be captured in the Sustainment, Simulations, Launchers, and Fire Control Systems effort below.				8.860
<b>FY 2012 Accomplishments:</b> Began to address thermal issues for affordable phased array seeker technologies; continued optimization of phased array seeker operating power levels; began integration of affordable phased array technologies to demonstrate a seeker array with appropriate power levels and in a form factor for missile applications; continued design of the next-generation imaging seeker components including technologies for thermal loading reduction to minimize cool-down time and significantly reduce the cost of infrared seekers; evaluated missile system health monitor performance in a relevant environment; designed reconfigurable Synthetic Aperture Radar (SAR) evaluation test-bed for demonstration of tactical missile applications.				
<b>FY 2013 Plans:</b> Address thermal issues for phased array seekers; optimize operating power levels; integrate components into seeker sub-arrays; design, fabricate, and demonstrate lower cost imaging infrared seekers with advanced cooling technologies; design and fabricate an autonomous radar frequency seeker for miniature guided munitions and evaluate in a laboratory; fabricate evaluation test-bed to demonstrate radio frequency seekers in tactical missile applications; design algorithms to improve image processing, tracking,				

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
and handover from air platform capabilities for missile seekers; and evaluate nanotechnology for power storage, sensors, and guidance in small guided munitions.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Missile Guidance, Navigation and Controls Technologies		7.272	7.052
<b>Description:</b> 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. Beginning in FY13, the Structural Electronics effort below will be included in this effort.			6.745
<b>FY 2012 Accomplishments:</b> Integrated image gyro system hardware and software for captive flight demonstration; completed laboratory and limited environmental evaluation of a one-piece, integrated optical data pipe module; designed enhanced miniaturized image stabilization hardware module for transition to the Small Organic Precision Munition effort in PE 0603313 Project 263; investigated technologies for increased accuracy and precision of acceleration measurements for navigation in a Global Positioning System denied environment; and completed data combination for infrared and millimeter wave multi-mode seeker algorithm development.			
<b>FY 2013 Plans:</b> Evaluate and demonstrate the image gyro navigation solution for image based navigation; continue design of an enhanced miniaturized image stabilization and tracker hardware module; evaluate reduced size, weight, and power inertial navigation systems with increased accuracy and guidance technologies to reduce reliance on global positioning system for missiles; and continue to design and develop structural electronics in missile subsystems and apply to the missile as a whole.			
<b>FY 2014 Plans:</b> Will 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			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
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.			
<b>Title:</b> Missile Sustainment, Simulations, Launchers, and Fire Control Systems  <b>Description:</b> 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. Beginning in FY13, Fire Control efforts from the Missile Seeker Technologies will be captured in this effort and the Missile Aerodynamics efforts will be presented in the Missile Propulsion, Structures, Lethality, and Aerodynamic Technology section below.  <b>FY 2012 Accomplishments:</b> Designed aerodynamic prediction codes for hypersonic flight, dynamic damping derivatives prediction methods, airfoil section enhancements, and inlet aerodynamics; designed an integrated baseline system engineering tool for system-level simulations linking missile component models to system capability; designed and evaluated health monitoring technologies for current and future missile systems.  <b>FY 2013 Plans:</b> Continue development of integrated missile design tool for system-level analysis; design, evaluate, and demonstrate next generation of health monitoring technologies for current fielded applications and future missile system needs; analyze advanced interfaces between launcher and weapon to provide more targeting information to the missile; design and demonstrate small signature, slow air target classification algorithms for fire control radars; and integrate and demonstrate a state-of-the-art, affordable active electronically steered aperture architecture with enhanced target range and classification into a radar test bed.  <b>FY 2014 Plans:</b> Will 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.		2.995	5.480
<b>Title:</b> Missile Propulsion, Structures, Lethality, and Aerodynamic Technology  <b>Description:</b> 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 beginning in FY13, increased understanding of missile aerodynamic interactions previously captured under the High Fidelity Simulation effort above.  <b>FY 2012 Accomplishments:</b>		4.112	6.239
			5.158



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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
Demonstrated high performance propellants; performed signature evaluations of current Army ignition materials as a baseline for the signature metrics; and developed, screened for sensitivity, and characterized candidate ignition materials.				
<b>FY 2013 Plans:</b> Formulate, synthesize, and evaluate higher performance energetic materials for minimum smoke missile propulsion while improving insensitive munitions performance; design, fabricate, and evaluate lightweight thermal barriers for next generation extended range propulsion systems; evaluate and simulate the integration of first iteration variable effects warhead in a missile system form factor; evaluate energetic technologies to enable effects against electronic devices; continue design, fabrication, and evaluation of composite structural components for missile systems and their launchers; continue to design simulations to evaluate high speed missile aerodynamics and separation effects of missiles on weaponized unmanned aircraft.				
<b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Multi-Role Missile Technology			9.647	7.900
<b>Description:</b> 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. Beginning in FY13, the Swarming Missiles Technologies effort below will be captured here. Successful technologies are matured and demonstrated in PE 603313A Project 263.				11.039
<b>FY 2012 Accomplishments:</b> Continue to evaluate components and subsystem technologies including: 1) miniaturized and reduced cost guidance electronics, seekers, and sensors; 2) more efficient and insensitive munitions compliant propulsion systems for small guided munitions; 3) warhead integration for effects against diverse targets; and 4) fire control using hardware-in-the-loop evaluation, live-fire evaluation, and, appropriate test-beds to determine component and subsystem performance as well as suitability to various missions; and continue trade studies to optimize component, subsystem, and system design.				
<b>FY 2013 Plans:</b> Perform system and component level trade studies to design a long range missile; design and evaluate modular components for a lightweight missile system with multiple configurations launched from manned and unmanned aircraft, and refine the design of the lightweight air launched missile based on evaluation of critical components and begin integration for a system-level demonstration;				

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
and design and evaluate guidance and tracking algorithms as well as sensor technology to support attack of a large array of targets.			
<b>FY 2014 Plans:</b> Will 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 aviation systems as well as manned rotary wing platforms; perform laboratory testing to determine feasibility to support attack of a larger target set.			
<b>Title:</b> Swarming Missile Technology <b>Description:</b> This effort evaluates advanced sensors, guidance, control, and fire control components for employing low-cost swarming missile concepts against individual as well as large arrays of air and ground targets. Beginning in FY13, this effort will be captured in Multi-Role Missile Technology. <b>FY 2012 Accomplishments:</b> Finalized key component technology identification based on trade studies performed; began key component technology design; began guidance and control algorithm design to support attack of large arrays of targets; evaluated options for low cost advanced sensor design for tracking of large arrays of targets.		2.856	0.000
<b>Title:</b> Structural Electronics <b>Description:</b> This effort investigates innovative processes to embed electrical connections into the missile case structure for use in smaller missile designs. Beginning in FY13, this effort is captured in Missile Guidance, Navigation, and Control Technology above. <b>FY 2012 Accomplishments:</b> Fabricated and evaluated sample missile electronics subsystems based on prior year results; evaluated suitability for missile system application; and documented design guidelines based on results.		1.280	0.000
<b>Title:</b> Large Long Range Future Fires <b>Description:</b> 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 603313A Project 263.		0.000	5.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A: <i>MISSILE TECHNOLOGY</i>	<b>PROJECT</b> 214: <i>Missile Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Micro Inertial Navigation Sensor for Networked Javelin Command Launch Unit (CLU) with External Far Target Locator (FTL) <b>Description:</b> 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 to support Technology Enabled Capability Demonstration 2.a, Overburdened - Physical Burden. <b>FY 2014 Plans:</b> Will 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.		0.000	0.000
<b>Title:</b> Counter Unmanned Aerial Systems <b>Description:</b> 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 missiles in PE 603313A Project 263. <b>FY 2014 Plans:</b> Will 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.		0.000	0.000
<b>Accomplishments/Planned Programs Subtotals</b>		49.620	51.528
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army										<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A: <i>MISSILE TECHNOLOGY</i>				<b>PROJECT</b> G05: <i>MISSILE TECHNOLOGY INITIATIVES (CA)</i>			
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
G05: <i>MISSILE TECHNOLOGY INITIATIVES (CA)</i>	-	15.971	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
<b>A. Mission Description and Budget Item Justification</b> Congressional special interest item restoring unjustified reductions for missile lethality and precision research.												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>										<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Missile Lethality and Precision Research										15.971	0.000	0.000
<b>Description:</b> This is a Congressional Interest Item.												
<b>FY 2012 Accomplishments:</b> Performed analysis and trade studies for emerging programs in PE 0603313A (e. g., Low Cost-Tactical Extended Range Missile and Low Cost Extended Range Air Defense interceptor); developed missile systems models, simulations, and environments for system performance analysis and assessment; recoverable, short-range air-defense interceptor live-fire testbed; conducted Hostile Fire Sensor System Technology Development and Demonstration in support of counter-battery target detection, identification, and rapid counter-fire mission execution; developed novel materials for increasing missile ballistic performance; component risk reduction for the Lethal Miniature Aerial Munition System/Small Organic Precision Munition requirement.												
<b>Accomplishments/Planned Programs Subtotals</b>										15.971	0.000	0.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												
<b>Remarks</b>												
<b>D. Acquisition Strategy</b> N/A												
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.												

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602307A: ADVANCED WEAPONS TECHNOLOGY							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	19.392	25.999	26.162	-	26.162	28.376	29.537	28.914	29.339	Continuing	Continuing
042: HIGH ENERGY LASER TECHNOLOGY	-	19.392	25.999	26.162	-	26.162	28.376	29.537	28.914	29.339	Continuing	Continuing

# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

## The FY 2014 OCO Request will be submitted at a later date

Note

FY14 increase for high efficiency laser effort.

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 0602890F (HEL Research) and PE 0603924F (HEL Advanced Technology Program), PE 0605605A (DoD High Energy Laser Systems Test Facility (HELSTF)), PE 0602120A (Sensors and Electronic Survivability), and PE 0603004A (Weapons and Munitions Advanced Technology) Project L96, and is coordinated with PE 0603005A (Combat Vehicle and Automotive Advanced Technology) Project 441.

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

Work is performed by the U.S. Army Space and Missile Defense Command (SMDC), 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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602307A: ADVANCED WEAPONS TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	20.002	25.999	22.862	-	22.862
Current President's Budget	19.392	25.999	26.162	-	26.162
Total Adjustments	-0.610	0.000	3.300	-	3.300
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.610	-			
• Adjustments to Budget Years	-	-	3.300	-	3.300

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602307A: ADVANCED WEAPONS TECHNOLOGY				PROJECT 042: HIGH ENERGY LASER TECHNOLOGY			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
042: HIGH ENERGY LASER TECHNOLOGY	-	19.392	25.999	26.162	-	26.162	28.376	29.537	28.914	29.339	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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.												
This project supports Army science and technology efforts in the Ground Portfolio.												
Work in this project is related to, and fully coordinated with, efforts in PE 0602890F (HEL Research) and PE 0603924F (HEL Advanced Technology Program), PE 0605605A (DoD High Energy Laser Systems Test Facility (HELSTF)), PE 0602120A (Sensors and Electronic Survivability), PE 0603004A (Weapons and Munitions Advanced Technology) Project L96, and to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) Project 441.												
The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan and the Army Modernization Strategy.												
Work is performed by the U.S. Army Space and Missile Defense Command (SMDC), 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 2012	FY 2013	FY 2014	
Title: Solid State Laser (SSL) Effects									5.738	7.934	7.978	
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.												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A: <i>ADVANCED WEAPONS TECHNOLOGY</i>		<b>PROJECT</b> 042: <i>HIGH ENERGY LASER TECHNOLOGY</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b><i>FY 2012 Accomplishments:</i></b> Continued static and dynamic evaluations at various power levels up to 100kW using the SSL at the HELSTF against Rockets, Artillery, and Mortars (RAM) and Unmanned Aerial Systems (UAS) targets in conjunction with the other Services.					
<b><i>FY 2013 Plans:</i></b> Continue to conduct static and dynamic experiments using the SSLT infrastructure to investigate SSL performance against RAM, UAS, and other selected targets; and use data from experiments to validate M&S codes to predict SSL weapon system effectiveness in operational scenarios.					
<b><i>FY 2014 Plans:</i></b> Will 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; will 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.					
<b><i>Title:</i></b> Advanced Beam Control Component Development  <b><i>Description:</i></b> 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.			0.751	1.184	1.267
<b><i>FY 2012 Accomplishments:</i></b> Coated optics, began assembly, and conducted laboratory demonstrations of a lightweight beam director with the performance characteristics required for a tactical HEL weapon system.					
<b><i>FY 2013 Plans:</i></b> Continue 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.					
<b><i>FY 2014 Plans:</i></b> Will 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.					
<b><i>Title:</i></b> High Efficiency Laser Development			12.089	15.947	15.667



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A: <i>ADVANCED WEAPONS TECHNOLOGY</i>		<b>PROJECT</b> 042: <i>HIGH ENERGY LASER TECHNOLOGY</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Completed the design and risk reduction of the 25 kW high efficiency approaches, to include fabrication, integration, and evaluation of laser assemblies at 5 kW and 15 kW; completed the interim design of the 25 kW laboratory devices; completed the conceptual design of the 100 kW class device, to include thermal management techniques; and leveraged small business innovation research efforts to complete eye-safe laser component demonstrations.</p> <p><b>FY 2013 Plans:</b> In concert with the HEL JTO and the other services, evaluate and select one or more high efficiency laser approaches to mature the design, determine interface specifications, purchase hardware items, and begin 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; conduct experiments as components mature to validate performance and efficiency specifications; evaluate high efficiency laser technology approaches for ruggedness, reliability, and affordability; and investigate methods for using high efficiency lasers against sensors.</p> <p><b>FY 2014 Plans:</b> Will 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><b>Title:</b> HEL Research and Development Laboratory</p> <p><b>Description:</b> This effort focuses on developing in-house expertise through SSL assessments.</p> <p><b>FY 2012 Accomplishments:</b></p>			0.814	0.934	1.250

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A: <i>ADVANCED WEAPONS TECHNOLOGY</i>	<b>PROJECT</b> 042: <i>HIGH ENERGY LASER TECHNOLOGY</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>Conducted modeling and simulation studies to characterize and optimize HEL system and component performance; and enhanced state-of-the-art reflectance measurement capability and continued collecting reflectance data of threat targets.</p> <p><b>FY 2013 Plans:</b> Conduct experiments using Adaptive Optics (AO) components to develop and validate algorithms for correction of atmospheric distortions to improve effective range.</p> <p><b>FY 2014 Plans:</b> Will 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		19.392	25.999
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army DATE: April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					PE 0602308A: Advanced Concepts and Simulation							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	20.356	23.507	24.063	-	24.063	24.237	25.956	25.862	25.524	Continuing	Continuing
C90: Advanced Distributed Simulation	-	14.358	17.125	17.566	-	17.566	17.632	19.239	19.031	18.570	Continuing	Continuing
D02: Modeling & Simulation For Training And Design	-	5.998	6.382	6.497	-	6.497	6.605	6.717	6.831	6.954	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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) 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 0602787A (Medical Technology), PE 0603007A (Manpower, Personnel and Training Advance Technology), and PE 0603015A (Next Generation Training & Simulation Systems).

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

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602308A: Advanced Concepts and Simulation			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	20.900	23.507	24.063	-	24.063
Current President's Budget	20.356	23.507	24.063	-	24.063
Total Adjustments	-0.544	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.544	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602308A: Advanced Concepts and Simulation				PROJECT C90: Advanced Distributed Simulation			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
C90: Advanced Distributed Simulation	-	14.358	17.125	17.566	-	17.566	17.632	19.239	19.031	18.570	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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.  Work in this PE complements and is fully coordinated with PE 0602785A (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology), PE 0603007A (Manpower, Personnel and Training Advance Technology) and PE 0603015A (Next Generation Training & Simulation Systems).  The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.  Work in this project is performed by the Army Research Laboratory, Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, FL.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Live, Virtual, Constructive (LVC) Simulations									3.849	4.533	6.708	
Description: This effort 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. In FY13 to FY15, this effort supports Technology Enabled Capability Demonstration 3b,												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A: <i>Advanced Concepts and Simulation</i>	<b>PROJECT</b> C90: <i>Advanced Distributed Simulation</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
Surprise/Tactical Intelligence-Actionable Intelligence. In FY14, this effort supports Technology Enabled Capability Demonstration 7b, Individual Training for Tactical Tasks.				
<b>FY 2012 Accomplishments:</b> Investigated technologies to create visual and aural battlefield effects; produced a more holistic sensory experience for a live training audience; and completed laboratory experiments of dynamic terrain/environment shared architecture, physics based algorithms in virtual and constructive simulations, as well as applied high performance computing in preparation for future advance technology demonstrations.				
<b>FY 2013 Plans:</b> Investigate component level technologies to support advanced dynamic synthetic natural environments to include: advanced handheld environments, underground structures and cross domain interactions; matures and demonstrates rapid generation, scaling of appearance and behaviors for realistic, culturally-specific virtual humans able to interact with other virtual humans and trainees within local/distributed simulations and performs testing and user evaluations of the next generation collaborative training environments.				
<b>FY 2014 Plans:</b> Will explore technologies and methods to provide Soldiers with an adaptive learning environment, tailored to the individual Soldier. Will conduct assessments of a prototype training development environment that will deliver training content to various software environments on different hardware platforms, including mobile. Will conduct assessments on common processes and technologies for Live, Virtual, and Constructive (LVC) distributed simulation for Joint and Coalition Warfare training to ease the difficulty and expense of using LVC distributed simulation for Joint and Coalition Warfare training. Will design components in laboratory for for real-time, physics- based terrain (Combat Operational Environment-COE) that replicates the operational environment and is distributed to support collective training for use in mobile devices and embedded systems. Will design hybrid pos-nav sensor to simulate electronic bullet to replace laser based system to replicate live fire training that replicates operational environment.				
<b>Title:</b> Modeling and Simulation Training Technologies			3.869	3.165
<b>Description:</b> This effort investigates and evaluates the effectiveness of military medical simulation training technologies and ground platform training technologies. The effort also conducts applied research to develop training technologies and techniques for Soldiers operating with unmanned systems. In FY14, this effort supports TECD 3b, Surprise/Tactical Intelligence-Actionable Intelligence.				4.512
<b>FY 2012 Accomplishments:</b>				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A: <i>Advanced Concepts and Simulation</i>		<b>PROJECT</b> C90: <i>Advanced Distributed Simulation</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Conducted human agent teaming research studies to improve collaboration with focus on improving team performance, confidence, multi-tasking and workload with unmanned systems in support of the ARL-Robotics Collaborative Technology Alliance(PE 0601104A, project H09); and investigated game engine and virtual world in terms of improving the human interfaces as well as developed new innovative training environments in accordance with the United States Army Learning Concept for 2015 document.  <b>FY 2013 Plans:</b> Assess weapon orientation measurement software and hardware for use in future unmanned system demonstrations; conduct applied research and assess realism of live tissue replacement technologies, as well as 3D visualization and enhanced representations of virtual humans to include more robust physiological and anatomical representations for future medical training.  <b>FY 2014 Plans:</b> Will 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. Will design hybrid position-navigation sensor to simulate electronic bullet to replace laser based system for live fire training.					
<b>Title:</b> Collaborative and Immersive Environment Technologies  <b>Description:</b> This effort investigates adaptive tutoring and immersive learning environments with social simulations to conduct kinetic and non-kinetic training for individuals and teams. In FY14, this effort supports TECD 7b, Individual Training for Tactical Tasks.  <b>FY 2012 Accomplishments:</b> Continued development of infantry immersive simulation and learning environments to include representing multi-party interpersonal interactions and the development of tools, so these simulation and learning environments could be readily created by others.  <b>FY 2013 Plans:</b> Conduct assessments to support trainee modeling, classification of trainee state and machine-based selection of instructional strategies; investigate methods for a computer-based intelligent tutor capable of assessing the cognitive state of trainees & adapting instruction to optimize individual and team performance across a variety of Dismounted Soldier training tasks; develop wrap-around immersive environment leveraging commercial technology; conduct world-wide challenge on emerging virtual environment technologies and evaluate critical elements necessary for specific types of virtual training.  <b>FY 2014 Plans:</b>			6.640	9.427	6.346

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A: <i>Advanced Concepts and Simulation</i>	<b>PROJECT</b> C90: <i>Advanced Distributed Simulation</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>Will conduct research to develop best practices for authoring computer-based tutors (CBTS), managing instruction provided by CBTS, and assessing learning gains (e.g., knowledge and skill acquisition, retention and accelerated learning) provided by CBTS components, tools, and methods. Research will focus on 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 Army Learning Model (ALM) for 2015. Results of this research will be captured in the Generalized Intelligent Framework for Tutoring (GIFT) to promote standards and reuse.</p> <p>Will 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. Studies will be Institutional. Review Board IRB lead evaluations in the use of science of games and mobile learning in a distributed environment to replicate the complexities of the operational environment for training. Lessons learned insertions will be from the 12-month prototype evaluation to be conducted in FY13 at the Maneuver Center of Excellence, Fort Benning. Experimentation will continue on the difficulties and advantages associated with the human-robotic teaming of unmanned ground systems and Soldiers in collaboration with TARDEC and the ARL Robotics Collaborative Technology Alliance. Demonstrations and briefings will be provided at the Materials Centers of Excellence Interservice/Industry Training, Simulation and Education Conference, GameTech, and Human-Robot Interaction Experimentation at Camp Lejeune. Will conduct the Federal Virtual World Challenge.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>		14.358	17.125
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602308A: Advanced Concepts and Simulation				PROJECT D02: Modeling & Simulation For Training And Design			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
D02: Modeling & Simulation For Training And Design	-	5.998	6.382	6.497	-	6.497	6.605	6.717	6.831	6.954	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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.												
Work in this PE complements and is fully coordinated with PE 0601104A (University and Industry Research Centers), PE 0602785A (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology), PE 0603007A (Manpower, Personnel and Training Advance Technology), and PE 0603015A (Next Generation Training & Simulation Systems). 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 Army Research Laboratory, Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, FL.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Immersive Technology Environments									2.935	3.185	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. In FY13 to FY15, this effort supports TECD 7b, Individual Training for Tactical Tasks.												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A: <i>Advanced Concepts and Simulation</i>		<b>PROJECT</b> D02: <i>Modeling &amp; Simulation For Training And Design</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>FY 2012 Accomplishments:</b> Developed tools that allow others to easily create immersive environments; developed and integrated improved natural language capabilities into the multi-party conversational agent simulation to investigate improved contextual knowledge and understanding of events within the simulation.					
<b>FY 2013 Plans:</b> Collaborate with the Army Medical Department (AMEDD) Center and School at Ft. Sam Houston to investigate and evaluate potential application of developed virtual worlds to support the therapy of veterans and active duty Soldiers for (i.e. PTSD). Examine effectiveness of immersive training on hand-held devices and tablets.					
<b>FY 2014 Plans:</b> Will conduct studies to better understand how humans both perceive and interact with virtual environments. Will develop technologies for: improved low-cost immersive displays to reduce cost of training equipment; enhanced physical locomotion to reduce the physical footprint needed for training facilities; small team training; and improved small unit leadership and capabilities using virtual environments.					
<b>Title:</b> Immersive Technology Techniques  <b>Description:</b> This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments and therefore creating enhanced realism.			3.063	3.197	3.255
<b>FY 2012 Accomplishments:</b> Investigated tools for semi-automatically creating training materials based on rapid assimilation of actual experiences; and conducted analysis of pilot data from a complex negotiation/bargaining task to develop implementation of emotional behaviors in virtual humans.					
<b>FY 2013 Plans:</b> Create training toolkits based on assimilation of actual experiences available for Army use; improve 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 information and speech acts to assist future social cultural training technologies.					
<b>FY 2014 Plans:</b> Will demonstrate computer agents that can track a Soldier's career life long learning experiences to provide both individual training feedback and career guidance. Will finalize the development of a tool that automatically detects poorly synthesized segments of					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A: <i>Advanced Concepts and Simulation</i>	<b>PROJECT</b> D02: <i>Modeling &amp; Simulation For Training And Design</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> speech for the purpose of improving synthesized speech and dialogue for virtual humans. Will finalize and implement model that automatically adapts the dialogue intent recognition to each user.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		5.998	6.382	6.497
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2014 Army **DATE:** April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	62.339	69.062	64.589	-	64.589	72.309	71.803	68.573	72.473	Continuing	Continuing
C05: <i>Armor Applied Research</i>	-	25.276	28.440	27.037	-	27.037	28.407	28.547	27.114	29.804	Continuing	Continuing
H77: <i>National Automotive Center</i>	-	14.893	16.250	15.039	-	15.039	16.606	16.813	17.010	17.316	Continuing	Continuing
H91: <i>Ground Vehicle Technology</i>	-	22.170	24.372	22.513	-	22.513	27.296	26.443	24.449	25.353	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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) 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, 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, PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology, Robotics Technology, PE 0602705A (Electronics and Electronic Devices), PE 0602716A (Human Factors Engineering Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), and PE 0708045A (Manufacturing Technology), PE 0603734 (Military Engineering Advanced 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 2014 Army				DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE				
2040: Research, Development, Test & Evaluation, Army		PE 0602601A: Combat Vehicle and Automotive Technology				
BA 2: Applied Research						
B. Program Change Summary (\$ in Millions)		FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget		64.205	69.062	67.789	-	67.789
Current President's Budget		62.339	69.062	64.589	-	64.589
Total Adjustments		-1.866	0.000	-3.200	-	-3.200
• Congressional General Reductions		-	-			
• Congressional Directed Reductions		-	-			
• Congressional Rescissions		-	-			
• Congressional Adds		-	-			
• Congressional Directed Transfers		-	-			
• Reprogrammings		-	-			
• SBIR/STTR Transfer		-1.049	-			
• Adjustments to Budget Years		-	-	-3.200	-	-3.200
• Other Adjustments 1		-0.817	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT C05: Armor Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
C05: Armor Applied Research	-	25.276	28.440	27.037	-	27.037	28.407	28.547	27.114	29.804	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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), 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.

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

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Vehicle Armor Protection for Lightweight Combat Systems:	9.261	0.000	0.000
<b>Description:</b> This effort designs, fabricates, and investigates add-on lightweight armor packages to protect combat systems against projectiles, warheads, penetrators and blast fragments.			
<b>FY 2012 Accomplishments:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	<b>PROJECT</b> C05: <i>Armor Applied Research</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Completed armor design and fabrication; performed shaker and ballistic assessment to validate and improve armor design, armor attachment durability, and ballistic performance for combat vehicles. This work was done in conjunction with program elements 0602105A, 0602618A, and 0603005A.			
<b>Title:</b> Advanced Armor Development:  <b>Description:</b> 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).  <b>FY 2012 Accomplishments:</b> Developed advanced armor designs at the panel level that will reduce areal density from the threshold level while still defeating threshold threat. Examined integrated armor designs for vulnerability reduction and material cost savings for the threshold armors. Investigated integration of communication antennas and health monitoring equipment into armor recipe and design. This work was done in conjunction with program elements 0602105A, 0602618A and 0603005A.  <b>FY 2013 Plans:</b> Mature high-performance lightweight armor recipes by conducting risk mitigation and system level multi-hit ballistic validation evaluation; examine novel integration methods for transparent armor; mature and evaluate the integration of communication antennas and health monitoring into armor recipe and design; create techniques and procedures for integration of advanced armors.  <b>FY 2014 Plans:</b> This effort will provide initial characterization of next generation advanced light weight combat vehicle armors for identification of future maturation risk; will perform initial performance and cost trade analysis on the integration of advanced armor technologies; and will perform environmental and ballistic testing on vehicle size armor coupons for system level integration.		7.160	10.950
<b>Title:</b> Blast Mitigation:  <b>Description:</b> 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		8.855	11.144

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	<b>PROJECT</b> C05: <i>Armor Applied Research</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
and performance evaluation, modeling and simulation (M&S), experimentation and instrumentation. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.c: Force Protection - Occupant Centric Platform.				
<b>FY 2012 Accomplishments:</b> Increased fidelity in end-to-end modeling and simulation (M&S) tools for occupant protection and vehicle underbody and Soldier blast protection. Validated live fire test and evaluation events with M&S to reduce program risk and expense, and used high fidelity models to identify quick reaction solutions to the Warfighter. Matured techniques to reduce flammability of vehicle tires, track, and composite materials and protect lithium-ion batteries against fire events.				
<b>FY 2013 Plans:</b> Leverage defense, automotive and medical communities to research innovative occupant protection technologies such as restraints, hull structure designs, seats, and crash event simulation tools; refine finite-element M&S tools for quicker assessment of occupant protection technologies; develop a Multi-Axis Blast Simulator (MABS) for rapid component-level testing; mature and evaluate occupant protection technologies in such areas as exterior protection technologies, interior protection technologies, sensor technologies and instrumentation technologies; Create 3D CAD models of the Occupant Centric System Demonstrator to further refine and validate the design through M&S; create standards for occupant protection against underbody blasts and crashes to capture and document the best practices of occupant protection.				
<b>FY 2014 Plans:</b> This effort will 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; will refine and employ modeling and simulation (M&S) tools for assessing occupant protection technologies; will acquire laboratory tools to better assess integrated components, sub-system and system level responses for protection of soldiers in underbody blast, crash and rollover events; will leverage and expand on defense, automotive and medical community efforts for improving vehicle exterior, interior and sensor capabilities; will continue incorporating lessons learned into occupant protection standards and guidelines; and will advance instrumentation capabilities such as anthropometric test devices and blast data collection for research.				
<b>Title:</b> Synergistic Vehicle Protection Technologies:			0.000	5.000
<b>Description:</b> 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				4.440



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	<b>PROJECT</b> C05: <i>Armor Applied Research</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
in the development of survivable combat systems. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.c: Force Protection - Occupant Centric Platform.			
<b>FY 2013 Plans:</b> Synergize vehicle survivability technologies to optimize protection during multi-threat, multi-aspect engagements; design and evaluate assessment methodologies for quantifying and mitigating post-engagement damage and crew casualties from effects such as fire and blast; provide enhanced capabilities to support combat modeling such as COMBAT XXI by providing rapid vehicle/weapon interaction modeling.			
<b>FY 2014 Plans:</b> The effort will provide rapid organization and assessment of threat/countermeasure interaction reducing the overall burden on systems; will design and develop modeling and simulation capability to optimize vehicle protection; design modeling capabilities to represent blast technologies for tradeoff analysis; will provide quick reaction capability to quantify platform baseline survivability and prioritize enhancements.			
<b>Accomplishments/Planned Programs Subtotals</b>		25.276	28.440
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT H77: National Automotive Center			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H77: National Automotive Center	-	14.893	16.250	15.039	-	15.039	16.606	16.813	17.010	17.316	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 and is coordinated with PE 0602705A (Electronics and Electronic Devices).												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Alternative Energy:									8.835	0.000	0.000	
Description: This effort leverages opportunities from industry to develop alternative energy technologies for Army applications.												
FY 2012 Accomplishments: Concluded development of dual-use M&S tools for advanced high-density hybrid engine powered non-tactical vehicle business case analysis; began planning for large scale investigation of vehicle-to-grid and grid-to-vehicle capabilities integrated into a power grid with a high proportion of renewable generation; continued to pursue qualification of alternative fuels for use in ground												

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
vehicle systems; conducted system level assessments of synthetic and renewable fuel blends supporting their implementation into military fleets. This work was done in conjunction with program element 0602705A.			
<b>Title:</b> Conditioned Based Maintenance (CBM) and Intelligent Systems:  <b>Description:</b> This effort advances condition based maintenance and intelligent systems technologies for dual use applications, including the investigation of commercial hybrid electric non-tactical vehicles on military bases to gather performance, reliability and maintainability data.  <b>FY 2012 Accomplishments:</b> Pursued fleet level evaluation of dual-use CBM tools for battery prognostics and diagnostics and began development and investigation of dual-use CBM tools for additional vehicle subsystem prognostics and diagnostics.		2.272	0.000
<b>Title:</b> Power, Energy and Mobility:  <b>Description:</b> This effort investigates dual use power, energy, and mobility technologies leveraging commercial and academic investment to military application focusing 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 program element 0603005A.  <b>FY 2012 Accomplishments:</b> Continued the pursuit of dual-use power and energy component development and integrated initial products into non-tactical vehicles for assessment on military installations. Continued to support transition of distributed generation hardware to PM Mobile Electric Power or other materiel developers.  <b>FY 2013 Plans:</b> Continue 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; conduct operational assessments of advanced propulsion vehicles on military installations; pursue dual use automotive technology collaborations with other government agencies, industry and university partners.  <b>FY 2014 Plans:</b> This effort will 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); will continue to support the transition of technology to/from industry and government; leverage both industry and government facilities for evaluation, integration and testing; will mature new manufacturing processes and material technologies to reduce platform weight through lightweight composite		3.786	5.933
			4.083

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
materials and novel material joining; will continue to pursue collaborations with industry and university partners to develop dual use, energy efficient, automotive technologies.			
<b>Title:</b> Dual Use Technologies:		0.000	10.317
<b>Description:</b> 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 program element 0603005A.			10.956
<b>FY 2013 Plans:</b> Pursue, identify and leverage dual use technology opportunities to benefit both commercial industry and military application through active partnering and outreach; mature vehicle-to-grid and grid-to-vehicle technology and standards; emphasize the use of renewable energy sources to solve military energy problems for base applications; continue to support the transition of distributed power generation hardware to PM Mobile Electric Power or other materiel developers; pursue vehicle based telematics (vehicle networking and communication) solutions in support of Homeland Defense.			
<b>FY 2014 Plans:</b> This effort will 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 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		14.893	16.250
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			

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E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT H91: Ground Vehicle Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H91: Ground Vehicle Technology	-	22.170	24.372	22.513	-	22.513	27.296	26.443	24.449	25.353	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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, 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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Pulse Power:	3.784	1.002	0.962
<b>Description:</b> 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 (Combat Vehicle and Automotive Advanced Technology) and 0602705A (Electronics and Electronic Devices).			
<b>FY 2012 Accomplishments:</b> Investigated silicon carbide (SiC) based super gate turn off (SGTO) switches for electro-mechanical armor applications; investigated SiC components in high power electrical conversion components, and pulse chargers; investigated improvements			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
in fast high energy density capacitors with improved clearing agents using newly developed films for directed energy weapons (DEW).			
<b>FY 2013 Plans:</b> Investigate 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.			
<b>FY 2014 Plans:</b> This effort will perform component development and maturation 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 will continue component development and maturation to decrease space, volume, and thermal requirements while increasing performance.			
<b>Title:</b> Propulsion and Thermal Systems:		5.201	4.334
<b>Description:</b> 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). Currently, less than 1/3 of the total available energy from the fuel is converted into usable mechanical work (propulsion). 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 (Combat Vehicle and Automotive Advanced Technology).			3.058
<b>FY 2012 Accomplishments:</b> Investigated the durability and reliability of advanced fuel systems operating on JP-8 fuel at high temperatures; examined engine performance when using military grade fuels; completed powertrain analysis for efficiency and thermal heat rejection; examined designs to improve the mechanical efficiency of advanced transmissions while increasing ratio spread and electronic controls; investigated and developed components to reduce engine cooling burden.			
<b>FY 2013 Plans:</b> Conduct combat and tactical powertrain simulation and component designs; investigate novel high power density low heat rejection, fuel efficient engine technologies to address increasing combat vehicle weights and thermal burden issues; assess			

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology		PROJECT H91: Ground Vehicle Technology
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
waste heat recovery feasibility from the engine compartment and innovative thermoelectric generator designs to achieve greater conversion to onboard electricity.				
FY 2014 Plans: This effort will 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 will prototype an advance fan design that will provide for a more efficient cooling capability for the engine to increase the overall system capability.				
Title: Power Management Technologies: Description: This effort investigates power management technologies, software, and implementation approaches. Technologies include A/C-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 0603005A, Project 497 for electrical power architectural needs and interface design standards. This effort also coordinates with 0603005A, Project 441 for interoperability with power generation and non-primary power sources.		1.016	3.916	1.903
FY 2012 Accomplishments: Enhanced advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads.				
FY 2013 Plans: Mature a common vehicle power management control architecture as well as write and evaluate power control software, design high voltage power electronics with high operating temperatures to be further matured in 0603005A, project 497. These technologies optimize power distribution and minimize thermal burdens on the vehicle as demands for greater electrical power continue to increase.				
FY 2014 Plans: This effort will design and procure prototype 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 will 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.				
Title: Power Electronics, Hybrid Electric and On-Board Vehicle Power (OBVP) Components: Description: Advanced computing, sensors, survivability and communications systems have driven electrical power demands on ground vehicle platforms beyond current generation capability, requiring some platforms in theater to turn off critical mission		5.329	1.968	2.419



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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<p>systems in order to power other components. Advancing technologies for greater platform capabilities will further exacerbate the problem. To provide the electrical power required by the Warfighter, new efficient power generation systems for platforms must be created. As power increases, waste heat increases and must be removed from the platform. With increased efficiency of the power generation system, less energy will be expended on cooling and can be redistributed to other needs. This effort will design and evaluate high temperature and efficient power generation components using high operating temperature switching devices and advanced electrical generation components such as integrated starter generators and integrated starter alternators as well as advanced control techniques to make these systems more efficient.</p> <p><b>FY 2012 Accomplishments:</b> Investigated the feasibility of increasing the operating temperature of the power electronics components to reduce the thermal management burden of the total vehicle system that incorporates power generation for internal and external use; investigate Integrated Starter Generator controls to provide on-board and export power; investigate and evaluate thermal systems to increase Heating Ventilation Air Conditioning (HVAC) efficiency; evaluate electronics cooling technologies to reduce the system cooling burden.</p> <p><b>FY 2013 Plans:</b> Mature OBVP generation components; model and validate electric machines and power electronics hardware that will meet performance requirements for military ground vehicle electrical power needs.</p> <p><b>FY 2014 Plans:</b> This effort will 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; and investigate the potential controls strategy enhancements of system operation where speed/power of auxiliary systems are easily manipulated. Additionally, this effort will investigate vehicle level benefits (efficiency, space, weight, ambient temperature operating range) of high temperature power electronics compared to traditional power electronics for power generation.</p>					
<p><b>Title:</b> Advanced Non-Primary Power Systems:</p> <p><b>Description:</b> A significant portion of operating time for stationary military ground vehicles is spent with their main engines idling to generate electrical power which consumes considerable fuel and creates greater vulnerability for signature detection. Auxiliary power units (APUs) can produce the required power more efficiently than the main engines at reduced acoustic and thermal signatures. This effort will research, investigate, conduct experiments and validate APU technologies such as modular/scalable engine based APUs, fuel cell reformer systems to convert JP8 to hydrogen, sulfur tolerant JP8 fuel cell APUs and novel engine based APUs for military ground vehicle and unmanned ground systems. This effort will also determine inputs for APU interface control documents, as well as investigate solutions for reducing APU acoustic signature for silent operation during mounted</p>			2.119	2.998	3.115

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
surveillance missions. Finally, this effort investigates the use of small engines and JP8 fuel cell systems for use as prime power solutions for unmanned ground systems.			
<b>FY 2012 Accomplishments:</b> Investigated JP-8 reformer/fuel cell system models and component level evaluation data; finalized JP-8 reformer/fuel cell system design; investigated small engine technologies for use on small unmanned ground vehicles.			
<b>FY 2013 Plans:</b> In order to reduce fuel consumption and meet the increasing power demands of military vehicles, this effort investigates modular/scalable small engine technologies, mature fuel injection strategies and validates their application for use as auxiliary power units for military ground vehicles and unmanned ground systems.			
<b>FY 2014 Plans:</b> This effort will investigate engine based 10 kW Auxiliary Power Unit (APU) oil consumption reduction technologies in order to decrease maintenance intervals and increase reliability; will conduct experiments and takes measurements on acoustic treatments for engine based APUs; will conduct sulfur tolerant JP8 reformer experiments; and will conduct initial assessment of fuel cell based APU solutions.			
<b>Title:</b> Elastomer Improvement Program:		0.000	1.000
<b>Description:</b> Track systems are one of the highest Operations & Sustainment (O&S) cost drivers for combat vehicle platforms. The typical failure mechanism for these systems is associated with the elastomeric (rubber) components. As vehicle platforms operate across a variety of terrain conditions, energy and heat from the environment causes premature fatiguing that can limit the overall life of these track systems. The Elastomer Improvement Program (EIP) uses a state-of-the-art laboratory to research, formulate and laboratory test new elastomer compounds to increase track system durability and reduce O&S costs.			0.990
<b>FY 2013 Plans:</b> Integrate advanced nano-composites into elastomer designs and formulations to increase durability and reduce flammability of materials. In addition, novel running gear elastomers designs are being fabricated and tested in order to reduce maintenance and increase system durability. Finally, this effort is performing laboratory testing of new compounds to validate the new materials/properties are exceeding the properties of existing materials.			
<b>FY 2014 Plans:</b> This effort will expand integration of short fibers into elastomer compounds to augment durability and increase abrasion resistance; will fabricate American Society for Testing and Materials (ASTM) samples and perform laboratory evaluation of short			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
fiber infused elastomer coupons to determine material property improvements; and will fabricate vehicle test articles and perform on vehicle testing to validate laboratory based improvements to material compound changes.			
<b>Title:</b> Intelligent Systems Technology Research:  <b>Description:</b> 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, vehicle and pedestrian safety, active safety, and robotic command and control. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.c: Force Protection - Occupant Centric Platform.  <b>FY 2012 Accomplishments:</b> Conducted initial trade studies in the areas of intelligence, perception, communications, robotic control and payload integration for a weaponized robotic system; advanced technologies for manned/unmanned collaboration and teaming, unmanned tactical behaviors, command and control of the unmanned systems from a common Warfighter machine interfaces, intelligence agents, and developed intelligent architectures for systems level weaponized robotic control.  <b>FY 2013 Plans:</b> Expand development of tactical behaviors utilizing common frameworks and control interfaces to provide drive-by-wire capability to the tactical wheeled fleet; extend this capability to the tracked and wheeled combat fleet, emphasizing combat-unique mission sets and payloads; investigate advanced sensors and control software; continue to advance autonomy and cognition to enable manned/unmanned collaboration and teaming; mature command and control software to enable single-operator control of multiple unmanned vehicles.  <b>FY 2014 Plans:</b> This effort will advance active safety systems to include controls, algorithms and associated hardware onto manned/unmanned wheeled and tracked vehicles; will increase performance of perceptive sensors and planning algorithms and apply to robotic platforms for safe operations in dynamic environments; and will refine tactical behaviors for mission execution on robotic platforms.		4.721	7.909
<b>Title:</b> Energy Storage:  <b>Description:</b> 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. These energy storage devices must 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). Mature advanced batteries are required to reduce		0.000	2.387

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
battery volume and weight while improving their energy and power densities within the same footprint and must be designed in a standardized form factor (6T) to enhance logistics.			
<b>FY 2014 Plans:</b> This effort will 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.			
<b>Title:</b> Petroleum, Oil, and Lubricant (POL) Products: <b>Description:</b> 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 (i.e. anti-lock brakes, semi-active suspension, etc.). In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 4a: Sustainability/Logistics - Basing.		0.000	1.245
<b>FY 2013 Plans:</b> Initiate design and evaluation of POL products to meet new military technology requirements (i.e. anti-lock brakes, semi-active suspension, etc.) while exceeding future and legacy equipment performance and technical requirements; begin research and design of lubricants and fluids which promote improved energy efficiencies, improved performance and are longer lasting; characterize alternative fuels and fuel additives that improve performance and diversify energy sources; initiate research and evaluation of nanofluid technology that suspends nanoparticles in coolants and lubricants to improve thermal, friction, and wear properties.			
<b>FY 2014 Plans:</b> This effort will identify candidate fuel efficient gear lubricants and hydraulic fluids to improve ground system performance and reduce logistics burden; will evaluate new alternative fuels and fuel additives that may improve performance and diversify energy sources; and will identify candidate POL products with high potential to meet new military technology requirements while ensuring legacy equipment performance and technical requirements are maintained.			
<b>Accomplishments/Planned Programs Subtotals</b>		22.170	24.372
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			

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<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	60.507	60.823	68.300	-	68.300	68.298	74.953	74.166	75.429	Continuing	Continuing
H80: <i>Survivability And Lethality Technology</i>	-	60.507	60.823	68.300	-	68.300	68.298	74.953	74.166	75.429	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**Note**

FY14 funding increased for Vulnerability Assessment of Current Technologies

**A. Mission Description and Budget Item Justification**

This program element (PE) investigates and evaluates materials and ballistic technologies required for armaments and armor that will 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 physics-based techniques, methodologies, and models to analyze combat effectiveness of current and emerging technologies for improved lethality and survivability. Project H75 completed in FY11.

Work in this PE complements and is fully coordinated with efforts in PE 0602105A (Materials Technology), PE 0602120A (Sensors and Electronic Survivability), 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 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle Advanced Technology).

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

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

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APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602618A: BALLISTICS TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	59.121	60.823	60.568	-	60.568
Current President's Budget	60.507	60.823	68.300	-	68.300
Total Adjustments	1.386	0.000	7.732	-	7.732
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.266	-			
• SBIR/STTR Transfer	-0.880	-			
• Adjustments to Budget Years	-	-	7.732	-	7.732

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602618A: BALLISTICS TECHNOLOGY				PROJECT H80: Survivability And Lethality Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H80: Survivability And Lethality Technology	-	60.507	60.823	68.300	-	68.300	68.298	74.953	74.166	75.429	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 materials and design for armor/anti-armor formulations that provide advanced protection through tailored terminal ballistic mechanisms. Specific technology 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 physics-based techniques, methodologies, and models to analyze combat effectiveness of current and emerging technologies for improved lethality and survivability.												
This project sustains Army science and technology efforts supporting the Ground and Soldier portfolio.												
Work in this PE makes extensive use of high performance computing (HPC) 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 complements and is fully coordinated with efforts in PE 0602303 (Missile Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602786A (Warfighter Technology), PE 63125A (Combating Terrorism-Technology Development), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), PE 063313 (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.												
Work in this project is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Structural Armor									10.071	7.560	0.000	



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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.</p> <p><b>FY 2012 Accomplishments:</b> Investigated third generation structural armor performance incorporating most promising ceramic-composite and encapsulated ceramic materials technologies; evaluated novel mechanisms against objective level future threats and transition validated concepts to the United States Army Tank Automotive Research, Development and Engineering Center (TARDEC) (PE 0602601A/ project C05); used modeling and simulation coupled with experimentation to validate emerging ballistic defeat mechanisms that couple structural materials with energy absorbing mechanisms against future threats.</p> <p><b>FY 2013 Plans:</b> Optimize weight and validate FY12 encapsulated and laminate ceramic armor technologies for future vehicle platforms; use HPC modeling and simulation tools coupled with experiments to validate emerging passive material concepts and investigate threat defeat mechanisms that provide higher mass efficiency against more aggressive KE threats expected to proliferate during the next decade.</p>			
<p><b>Title:</b> Mine Blast Protection</p> <p><b>Description:</b> 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 and the dismounted Soldier.</p> <p><b>FY 2012 Accomplishments:</b> Incorporated computationally representative energy absorbing seats and local soil characteristics into models and simulations of full scale blast events in order to refine simulations for system design optimization by TARDEC in PE 0603005A; and experimentally validated the simulated results for mine blast events using data from live fire test events.</p> <p><b>FY 2013 Plans:</b> Conduct 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 continue investigations of novel energy absorbing seat materials, restraints and structural designs with refined simulations for system design optimization by TARDEC in PE 0603005A.</p>		5.638	3.869
<b>Title:</b> Underbody Blast & Occupant Protection		0.000	6.188

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>	<b>PROJECT</b> H80: <i>Survivability And Lethality Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Description:</b> 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.  <b>FY 2014 Plans:</b> Will introduce advanced modeling tools developed under the Ballistic and Blast Loading Highly Scalable Software Institute to develop strongly hardened hull designs. Will 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.			
<b>Title:</b> Low Cost Hyper-Accuracy Munition Technologies (formerly Enabling Precision Munitions)  <b>Description:</b> This effort designs advanced components/sub-systems to enable a broad spectrum of future affordable direct and indirect fire precision munitions. The focus is on a multi-disciplinary approach to munition systems design by coupling physics-based models of interior ballistics, launch dynamics, flight mechanics, and high-gravitational force guidance, navigation, and 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).  <b>FY 2012 Accomplishments:</b> Combined reduced state GN&C methods, robust actuators novel guidance technologies, with understanding of interior and exterior ballistics to computationally and experimentally validate accuracy improvements for direct fire individual soldier and weapons platforms.  <b>FY 2013 Plans:</b> Experimentally validate highly maneuverable direct and indirect fire munition 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 develop coupled physics-based models to computationally support munition designs.  <b>FY 2014 Plans:</b> Will implement new derived optimal terminal homing guidance laws and flight control algorithms in simulation code; will conduct parametric studies across a range of attack angles to quantify resulting control effectiveness to more cost effectively and accurately hit targets; will perform lab, wind tunnel and soft launch experiments to investigate lifting surface control mechanisms and lateral & axial thrusters especially at high angles of attack.		4.833	4.588
<b>Title:</b> Disruptive Energetics and Propulsion Technologies (formerly Energetic Materials)  <b>Description:</b> 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.		5.727	6.475

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>	<b>PROJECT</b> H80: <i>Survivability And Lethality Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b><i>FY 2012 Accomplishments:</i></b> Validated ability to characterize energetic materials through multiscale modeling and simulation; provided understanding of energetic material properties to synthesizers and formulators; supported hypergolic propulsion demonstration at the U. S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC) through insertion of green energetics into effort; and investigated solid rocket throttleable propulsion for extending missile range.</p> <p><b><i>FY 2013 Plans:</i></b> Employ validated multi-scale models to conceive new energetic material compounds; design and improve affordable propellant coatings to manage temperature sensitivity and enhance insensitive munitions qualities; and develop and apply advanced, reacting-flow, multiphase, computational fluid dynamics methods incorporating advanced bi-propellant (liquids and solids) chemistry for future missile applications.</p> <p><b><i>FY 2014 Plans:</i></b> Will synthesize two new energetic compounds (binder and explosive) that exhibit increased energy compared to current CHNO compounds; will experimentally quantify their performance with a small scale technique that cost effectively requires only grams (compared to current kilogram technique); will evaluate propellant improvements for small arms ammunition.</p>			
<p><b><i>Title:</i></b> Lethal and Scalable Effects Technologies (formerly Advanced Munitions and Lethality Technologies)</p> <p><b><i>Description:</i></b> 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><b><i>FY 2012 Accomplishments:</i></b> Identified next level in lethality scalability, which expands past blast and fragmentation munitions and offers potential to concepts that defeat a range of threats with a single munition (i.e. collapse calibers); and conducted applied research and prove novel lethal mechanisms for defeat of expanding target set, which includes vehicles, buildings and Soldiers.</p> <p><b><i>FY 2013 Plans:</i></b> Advance FY12 scalable lethality concepts that defeat a range of threats with a single munition; and develop 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><b><i>FY 2014 Plans:</i></b> Will conduct proof of principle experiments for man portable weapons that validate capability to perforate wall targets including double reinforced concrete and adobe; will experimentally investigate and quantify performance improvements of chemical energy weapons when nano-crystalline materials (e.g., copper and tungsten) are used; will conceptualize variations in novel penetrator</p>		3.094	3.449
		3.849	

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>	<b>PROJECT</b> H80: <i>Survivability And Lethality Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
deployment schemes and conduct laboratory experiments to understand how deployment variations affect lethality performance; and will incorporate an optimized multi-component/jacketed shearing composite penetrator into a large caliber cartridge to examine its lethality.			
<b>Title:</b> Survivability/Lethality Analyses  <b>Description:</b> This effort devises state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats against future weapon systems. In FY13-14 this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection-Soldier and Small Unit.  <b>FY 2012 Accomplishments:</b> Developed new methodologies for assessing soldier/platform occupant injury probabilities in support of efforts to develop a new military specific anthropomorphic test device (Warrior Injury Assessment Manikin, WIAMan); conducted advanced experimentation and simulation to improve biofidelic characterization and injury correlation of helmet back face deformation; incorporated an enhanced shot-line viewer, virtual components, active protection systems and multiple threat functionalities to Modular UNIX-based Vulnerability Estimation Suite (MUVES) 3.  <b>FY 2013 Plans:</b> Improve vulnerability analysis methodologies for injury criteria and injury assessment to address crew protection and survivability for mine blast threats (WIAMan); and prepare for FY14 validation and verification of the MUVES 3 ballistic vulnerability and lethality code.  <b>FY 2014 Plans:</b> Will develop new methodologies to characterize Personnel Protective Equipment armor back face deformation and assess the associated injury incapacitation probabilities for soldiers; 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.		4.319	9.373
<b>Title:</b> Multi-Threat Armor Formulations and Designs  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Downselected the most promising multi-threat armor concepts and transition technology to TARDEC (PE 0602601A/project C05) for maturation; investigated advanced reactive and electromagnetic physics for defeat of multiple threat types to include development of algorithms that capture the symbiotic relationships between the mechanisms; developed multi-disciplinary		22.556	19.962
			10.041
			18.071

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>	<b>PROJECT</b> H80: <i>Survivability And Lethality Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
physics-based modeling tools that connect impacts on personal protection technologies to Soldier biologic insult and damage; and developed experimentally validated constitutive material mechanics models that capture high-rate human tissue mechanics.			
<b>FY 2013 Plans:</b> Determine physics mechanisms to explore potential efficiencies against very large improvised threats and investigate fusion of best mechanisms with known technologies for conventional threat defeat; validate and exercise algorithms that capture the multi-physics aspects of the determined mechanisms and begin transition to TARDEC (PE 0602601A/Project C05) technologies for defeat of very large improvised threats; and develop physics-based 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 (WIAMan) development effort.			
<b>FY 2014 Plans:</b> Will develop ceramic laminate technology, large improvised threat protection, second generation multi-threat protection and support transition to the United States Army Tank Automotive Research, Development and Engineering Center (TARDEC) (PE 0602601A/project C05); Will 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.			
<b>Title:</b> Ballistic and Blast Protection for Dismounted Soldiers <b>Description:</b> 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 TRL PPE concepts that are informed by the human effects during impact and blast events. <b>FY 2014 Plans:</b> Will develop techniques for understanding the response of biologic materials at high rates of loading that cause severe deformation and failure. Explore low TRL concepts for personnel protection equipment (PPE) that are based on computational simulations of the interaction of humans with the dynamic threat/PPE impact.		0.000	0.000
<b>Title:</b> Penetrator Lethality Applied Research <b>Description:</b> 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. <b>FY 2012 Accomplishments:</b>		4.269	6.864
			3.108
			3.847

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602618A: BALLISTICS TECHNOLOGY	PROJECT H80: Survivability And Lethality Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Proved benefit of novel penetrator technology at both ordnance and hyper-velocities and transition technology approaches to the Armament and Aviation and Missile RDECs for both gun and missile application; and validated concepts that overcome current propulsion technology limitation of muzzle pressure that enables use of next generation propellants.  <b>FY 2013 Plans:</b> Determine penetration efficiency of full scale novel penetrators; perform modeling and simulation to define a guided projectile with novel lethal mechanisms and conduct experiments that validate concept projectile(s) can withstand launch environment; conduct lethality analysis (probability of kill given a hit) of novel concepts across the velocity spectrum; and investigate light weight composite sabot technology for rifled barreled guns.  <b>FY 2014 Plans:</b> Will conduct lethality analysis (probability of kill given a target hit) across the velocity spectrum for novel penetrator concepts; will conceptualize variations in novel penetrator deployment schemes and conduct laboratory experiments to understand how deployment variations affect lethality performance; will incorporate an optimized multi-component/jacketed shearing composite penetrator into a large caliber cartridge to examine its lethality.				
<b>Title:</b> Soldier Lethality Technologies  <b>Description:</b> 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  <b>FY 2014 Plans:</b> Will investigate alternate approaches to increase long range precision and improve probability of incapacitation for sniper and small arms applications.		0.000	0.000	2.994
<b>Title:</b> Warrior Injury Assessment Manikin (WIAMan)  <b>Description:</b> This work develops an improved prototype 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. (This work effort was formerly described under the Survivability/ Lethality Analyses bullet.)  <b>FY 2014 Plans:</b> Will complete technical data package for the design concept for a first generation, prototype WIAMan; will award contract for fabrication of the first generation prototype WIAMan and initiate manufacturing and component testing; will initiate development		0.000	0.000	5.239

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A: <i>BALLISTICS TECHNOLOGY</i>		<b>PROJECT</b> H80: <i>Survivability And Lethality Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
of new methods for injury prediction and spin-out knowledge to benefit on-going Live Fire Test & Evaluation programs; will define concept for WIAMan data acquisition system.				
<b>Title:</b> Vulnerability Assessment of Current Technologies  <b>Description:</b> This effort applies state-of-the-art vulnerability assessment methodology across a broad spectrum of threats to selected emerging technologies in order to ascertain their potential robustness when implemented in Army systems. Research performed will support the both development of tools required to perform the assessments and conduct of selected assessments.  <b>FY 2014 Plans:</b> Will identify target set of current and emerging technologies based upon Army plans; will identify spectrum of threats for technologies identified; will develop and apply vulnerability assessment tools to be developmental technologies before they are implemented in Army systems.		0.000	0.000	3.500
<b>Accomplishments/Planned Programs Subtotals</b>		60.507	60.823	68.300
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army DATE: April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					PE 0602622A: Chemical, Smoke and Equipment Defeating Technology							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	4.753	4.465	4.490	-	4.490	3.968	3.889	3.945	4.016	Continuing	Continuing
552: SMOKE/NOVEL EFFECT MUN	-	4.753	4.465	4.490	-	4.490	3.968	3.889	3.945	4.016	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	4.869	4.465	4.490	-	4.490
Current President's Budget	4.753	4.465	4.490	-	4.490
Total Adjustments	-0.116	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.116	-			



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602622A: Chemical, Smoke and Equipment Defeating Technology				PROJECT 552: SMOKE/NOVEL EFFECT MUN			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
552: SMOKE/NOVEL EFFECT MUN	-	4.753	4.465	4.490	-	4.490	3.968	3.889	3.945	4.016	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 2012	FY 2013	FY 2014	
Title: Advanced Obscurants									1.367	1.411	1.451	
Description: This effort investigates new materials and compounds to enable safe, effective screening of personnel and equipment.												
FY 2012 Accomplishments: Evaluated optimized bispectral materials and initiated analysis of spectrally selective obscurant concepts.												
FY 2013 Plans:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602622A: Chemical, Smoke and Equipment Defeating Technology	PROJECT 552: SMOKE/NOVEL EFFECT MUN		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Begin small scale synthesis of spectrally selective materials and conduct characterization.				
FY 2014 Plans: Will 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.				
Title: Obscurant Enabling Technology Description: This effort investigates distribution technologies for various obscurants.		0.943	1.056	1.050
FY 2012 Accomplishments: Refined and optimized new visual low hazard obscurants.				
FY 2013 Plans: Conduct dissemination studies of new low hazard visual obscurants.				
FY 2014 Plans: Will continue dissemination studies of new low hazard visual obscurants for grenade applications; conduct novel modeling analysis of new low hazard obscurants for mortar/artillery applicationsdissemination studies.				
Title: Detection of Unknown Bulk Explosives Description: This effort develops an understanding of signatures required to provide improved point, proximity, and stand-off detection of explosives and precursor materials. Will transition technologies to PE (0603004A/Project L97 (Smoke and Obscurants Advanced Technology).		2.443	0.000	0.000
FY 2012 Accomplishments: Investigated improved signature information and novel algorithms and experimentally evaluated performance for explosives and precursor materials in existing chemical point and stand-off detection sensor systems.				
Title: Forensic Analysis of Explosives Description: This effort investigates forensics analytical methods for military explosives, homemade explosives (HME), HME precursors, and residue analysis for attribution.		0.000	1.998	1.989
FY 2013 Plans:				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602622A: <i>Chemical, Smoke and Equipment Defeating Technology</i>	<b>PROJECT</b> 552: <i>SMOKE/NOVEL EFFECT MUN</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Develop 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); demonstrate integrated biometric and chemical sensing for attribution using Raman chemical imaging.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		4.753	4.465
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

# UNCLASSIFIED

**Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army** **DATE:** April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602623A: <i>JOINT SERVICE SMALL ARMS PROGRAM</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	8.010	7.169	7.818	-	7.818	8.969	9.114	9.267	9.434	Continuing	Continuing
H21: <i>JT SVC SA PROG (JSSAP)</i>	-	8.010	7.169	7.818	-	7.818	8.969	9.114	9.267	9.434	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## 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 061102A (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>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO</b>	<b>FY 2014 Total</b>
Previous President's Budget	8.231	7.169	7.818	-	7.818
Current President's Budget	8.010	7.169	7.818	-	7.818
Total Adjustments	-0.221	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.221	-			

# UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602623A: JOINT SERVICE SMALL ARMS PROGRAM				PROJECT H21: JT SVC SA PROG (JSSAP)			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H21: JT SVC SA PROG (JSSAP)	-	8.010	7.169	7.818	-	7.818	8.969	9.114	9.267	9.434	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 2012	FY 2013	FY 2014	
Title: Advanced Small Unit (Squad) Small Arms Technology Concepts									3.545	3.801	3.750	
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 2012 Accomplishments: Investigated, designed and developed the next generation (2016 and beyond) small arms weapons platforms; investigated critical technologies and concepts that could be integrated into weapons system platforms to provide the Warfighter the next generation new small arms capabilities; conducted experiments to mature small arms component technologies in target engagement, target effectiveness, and power and energy requirements.												
FY 2013 Plans:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602623A: JOINT SERVICE SMALL ARMS PROGRAM	PROJECT H21: JT SVC SA PROG (JSSAP)		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
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. <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Small Arms Material and Process Technology <b>Description:</b> This effort addresses state of the art material substrates and surface coatings to improve reliability, reduce maintenance and improve weapon diagnostics through embedded technology. <b>FY 2012 Accomplishments:</b> Performed a detailed investigation of these new materials and techniques as applied to current and new weapon systems; matured past investments in lubricous weapon coatings, shot counters and other indicators to increase weapon life, improve durability and reduce weight. <b>FY 2013 Plans:</b> Investigate available state-of-the-art coatings materials and processes and the potential synergistic effects to weapon applications; design and conduct experiments at component level to determine validity of technology to small arms applications; use modeling and simulation to validate analytical predictions; formulate concept and application studies. <b>FY 2014 Plans:</b> Will 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.		4.244	3.368	4.068
<b>Title:</b> Small Business Innovative Research/Small Business Technology Transfer Program <b>Description:</b> Small Business Innovative Research/Small Business Technology Transfer Program <b>FY 2012 Accomplishments:</b> Business Innovative Research/Small Business Technology Transfer Program		0.221	0.000	0.000
Accomplishments/Planned Programs Subtotals		8.010	7.169	7.818

# UNCLASSIFIED

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602623A: <i>JOINT SERVICE SMALL ARMS PROGRAM</i>	<b>PROJECT</b> H21: <i>JT SVC SA PROG (JSSAP)</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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**Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army** **DATE:** April 2013

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>							
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	53.883	35.218	37.798	-	37.798	40.431	49.228	56.742	56.350	Continuing	Continuing
H18: <i>Weapons &amp; Munitions Technologies</i>	-	11.785	16.596	13.200	-	13.200	13.161	15.086	21.339	20.262	Continuing	Continuing
H19: <i>Asymmetric &amp; Counter Measure Technologies</i>	-	15.753	7.762	9.049	-	9.049	11.989	15.319	10.486	12.046	Continuing	Continuing
H1A: <i>WEAPONS &amp; MUNITIONS TECH PROGRAM INITIATIVE</i>	-	14.941	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H28: <i>Warheads/ Energetics Technologies</i>	-	11.404	10.860	15.549	-	15.549	15.281	18.823	24.917	24.042	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**Note**

FY14 funding increase for indirect fire weapons and tunable pyrotechnics.

**A. Mission Description and Budget Item Justification**

This program element (PE) investigates, designs and evaluates enabling technology 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),



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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army	<b>DATE:</b> April 2013
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>
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Fort 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>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2012</u></b>	<b><u>FY 2013</u></b>	<b><u>FY 2014 Base</u></b>	<b><u>FY 2014 OCO</u></b>	<b><u>FY 2014 Total</u></b>
Previous President's Budget	54.727	35.218	33.613	-	33.613
Current President's Budget	53.883	35.218	37.798	-	37.798
Total Adjustments	-0.844	0.000	4.185	-	4.185
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.809	-			
• Adjustments to Budget Years	-	-	4.185	-	4.185
• Other Adjustments 1	-0.035	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology				PROJECT H18: Weapons & Munitions Technologies			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H18: Weapons & Munitions Technologies	-	11.785	16.596	13.200	-	13.200	13.161	15.086	21.339	20.262	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 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 portfolio.												
Work in this project is related to, and fully coordinated with efforts in projects H19 and H28 (also in PE 0602624A), PE 0602105A (Materials Technology), PE 0602303A (Aviation Advanced Technology), PE 0602618A (Ballistics Technology), PE 0602782A (Command Control, Communication Technology), project 232 in PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).												
The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering 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 2012	FY 2013	FY 2014	
Title: Novel Propulsion Technology for the Future									3.029	4.035	3.521	
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 conduct experiments with these propellants to increase the range of artillery and mortars rocket assisted projectiles.												
FY 2012 Accomplishments:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology		PROJECT H18: Weapons & Munitions Technologies
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Modeled propulsion systems and conducted trade studies for candidate conventional and new chemical ingredients, formulations, and configurations to maximize the performance of chemical propellants while improving their insensitivity to unplanned stimuli; formulated promising propellants and evaluated them for performance and insensitivity. <b>FY 2013 Plans:</b> Investigate new propulsion ingredients for scale up of formulations to provide extended range; design, fabricate and evaluate new charge systems using coextrusion of multiple materials as well as coatings for burn rate modification. <b>FY 2014 Plans:</b> Will conduct experiments on rocket propulsion systems concepts to extend the range of 155mm artillery and 120mm mortar; will determine ballistic applications for co-extruded propellants; will leverage advancements in combustible cartridge case technologies to improve projectile propulsion; will design and develop optimal propellant configurations for specific applicable systems; will develop 120mm mortar propellant for 120mm systems for improved range and cost; will develop and optimize advanced propellant for 81mm extended range system compliant with automated direct/indirect fire mortar (ADIM).				
<b>Title:</b> Advanced Munition Payloads <b>Description:</b> This effort investigates novel payloads and related components for integration into gun-fired munitions and missiles to enable DoD cluster munition replacement policy. <b>FY 2012 Accomplishments:</b> Investigated environments that provided useful data for the development of components- setback, expulsion and impact; matured components and validated effectiveness and reliability through component and bench level testing. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/Project 232.		3.342	0.000	0.000
<b>Title:</b> Advanced Weapons Technology <b>Description:</b> 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. <b>FY 2012 Accomplishments:</b> Continued to mature most promising weapon technologies and evaluated for transition to advanced development; conducted additional small scale research into multiple novel weapon system candidate technologies. <b>FY 2013 Plans:</b>		2.214	3.178	2.297

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology	PROJECT H18: Weapons & Munitions Technologies		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Continue to mature hydrogen propellant ignition and remote automated gun firing in medium caliber weapons for transition to advanced development; conduct additional small scale research into multiple novel weapon system candidate technologies; develop precision technologies for extended/guided range applications.  <b>FY 2014 Plans:</b> Will 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; will evaluate for transition to advanced development; will 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.				
<b>Title:</b> Fire Control Target Recognition  <b>Description:</b> This effort designs and develops networked fire control hardware and software that can be integrated with existing command and control architectures.  <b>FY 2012 Accomplishments:</b> Modeled fire control hardware and fire control and target recognition algorithms and conducted trade studies for candidate technologies to maximize the performance of weapon systems, while maintaining commonality for future application to multiple weapon system calibers and configurations.  <b>FY 2013 Plans:</b> Design and investigate target data and weapon effects for improved mission planning planning; design and investigate weapon placement coordination; design weapons and effects database; investigate small unit fire control hardware; conduct experiments to validate design efforts.		1.120	2.300	0.000
<b>Title:</b> Line-of-Sight (LOS) Course Correction Munition Technology  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Designed and developed components for line-of-sight (LOS) course correction munitions, i.e. warhead, sensor, communication link and guidance/Control; investigated performance enhancements of a LOS Course correction munitions.  <b>FY 2013 Plans:</b> Integrate line-of-sight (LOS) course correction subsystem for ballistic testing; measure both structure and function of LOS course correction subsystem integrated into surrogate munition for performance and success.		2.080	2.800	0.000
<b>Title:</b> Precision Munition Technologies		0.000	4.283	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>	<b>PROJECT</b> H18: <i>Weapons &amp; Munitions Technologies</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Description:</b> 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.  <b>FY 2013 Plans:</b> Investigate sensor targeting algorithm solutions for all-weather operations (to include experiments with semi-active laser sensors and other suitable options); investigate and mature affordable control actuation system components; conduct high-g survivability experiments.			
<b>Title:</b> Novel Penetrator Designs  <b>Description:</b> 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.  <b>FY 2014 Plans:</b> Will optimize components for better function and launch survival; will design and modify non-DU kinetic energy (NexGen KE) functional projectile leading to the tech demo.		0.000	0.000
<b>Title:</b> Extended Range Projectile Technology  <b>Description:</b> 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.  <b>FY 2014 Plans:</b> Will 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.		0.000	0.000
<b>Title:</b> Affordable Precision Technologies  <b>Description:</b> This effort investigates technologies that provide affordable precision capabilities for projectiles fired into GPS denied environments.  <b>FY 2014 Plans:</b> Will 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		0.000	0.000
			1.691
			0.997
			1.695

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology		PROJECT H18: Weapons & Munitions Technologies		
B. Accomplishments/Planned Programs (\$ in Millions)				FY 2012	FY 2013	FY 2014
position within navigation grade accuracies; validate target recognition algorithms adapted for use with the imaging modalities selected.						
Title: Enabling Printed Explosives, Power Sources & Electronics for Munitions  Description: This effort develops and accelerates the state-of-the-art in materials printing, direct write, flexible electronics, and conformal systems for the warfighter.  FY 2014 Plans: Will 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.				0.000	0.000	0.704
Title: Air Dropped Guided Munition Technology  Description: This effort develops and integrates component technologies that will enable a precision delivery and function of a 81mm mortar to defeat moving targets of opportunity in complex terrain.  FY 2014 Plans: Will 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.				0.000	0.000	1.295
Title: Extended Range Indirect Fire Weapon Technology  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.  FY 2014 Plans: Will identify candidate technologies that can be used to facilitate hyper-velocity launch; will investigate viability of candidate technologies; will develop concepts utilizing the most promising technologies; will indentify the subcomponent technological gaps that need to be addressed early.				0.000	0.000	1.000
Accomplishments/Planned Programs Subtotals				11.785	16.596	13.200
C. Other Program Funding Summary (\$ in Millions)						
N/A						
Remarks						

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>	<b>PROJECT</b> H18: <i>Weapons &amp; Munitions Technologies</i>
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology				PROJECT H19: Asymmetric & Counter Measure Technologies			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H19: Asymmetric & Counter Measure Technologies	-	15.753	7.762	9.049	-	9.049	11.989	15.319	10.486	12.046	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 2012	FY 2013	FY 2014	
Title: Novel Battlefield Effectors									1.970	0.800	1.208	
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 2012 Accomplishments: Continued to develop most promising effector technologies and evaluate for transition to advanced development; conducted additional research into multiple novel battlefield effector candidate technologies.												
FY 2013 Plans: 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:												



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>	<b>PROJECT</b> H19: <i>Asymmetric &amp; Counter Measure Technologies</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will 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.					
<b>Title:</b> Active Denial Technologies  <b>Description:</b> This effort develops non-lethal, counter-personnel directed energy (DE) technology that can repel personnel up to 100 meters.  <b>FY 2012 Accomplishments:</b> Completed design and build of a palletized system to validate that solid state active denial technology could achieve desired range (100 meters); conducted experiments and determined personnel incapacitation or repel effects were achievable.  <b>FY 2013 Plans:</b> Complete integration and conduct experiments of the solid state active denial technology system to achieve the desired range of 100 meters.			3.160	1.761	0.000
<b>Title:</b> Counter Countermeasure (CCM) Technologies for weapons and munitions  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Continued to develop most promising CCM technologies and evaluate for transition to advanced development; conducted additional small scale research into multiple counter countermeasure candidate technologies.  <b>FY 2013 Plans:</b> Continue to investigate most promising CCM technologies and evaluate for transition to advanced development; conduct additional small scale research into multiple counter countermeasure candidate technologies; conduct various experiments to determine effectiveness against future threats.  <b>FY 2014 Plans:</b> Will design CCM systems to protect against known vulnerabilities and evaluate for transition to advanced development; will investigate multiple counter countermeasure candidate technologies; explore susceptibilities and remediation techniques for			4.268	2.241	0.907

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology	PROJECT H19: Asymmetric & Counter Measure Technologies		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
armament systems; conduct various experiments to measure effects of directed energy and develop modeling and simulation to understanding underlying physics.				
<b>Title:</b> Novel Penetrator Designs  <b>Description:</b> 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  <b>FY 2012 Accomplishments:</b> Designed and developed novel penetrator designs concepts and conduct penetration experiments against range targets.  <b>FY 2013 Plans:</b> Down select to one penetrator design based on FY12 penetrator experiments and integrate into projectile cartridge for functional testing; execute a ballistic test to validate range and penetration requirements that support system performance and lethality goals.		3.015	2.960	0.000
<b>Title:</b> Directed Energy (DE) Standoff Enabler  <b>Description:</b> This effort investigates the capability for stand-off neutralization technology of improvised explosive devices (IED) utilizing high power, DE sources.  <b>FY 2012 Accomplishments:</b> Designed and developed DE standoff improvised explosive device (IED) neutralization technology; conducted research on high voltage and RF coupling to laser induced plasma filaments; matured components required to achieve multi-mode anti-materiel DE effects		3.340	0.000	0.000
<b>Title:</b> Fire Control Target Recognition & Classification  <b>Description:</b> This effort incorporates the latest technologies, advanced algorithms, and fire control optical systems that will provide a target recognition and classification capability that currently does not exist.  <b>FY 2014 Plans:</b> Will 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.		0.000	0.000	2.014
<b>Title:</b> Recoil Reduction Disruptive Technologies		0.000	0.000	2.002

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>		<b>PROJECT</b> H19: <i>Asymmetric &amp; Counter Measure Technologies</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Description:</b> 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.  <b>FY 2014 Plans:</b> Will 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.					
<b>Title:</b> Improvised Explosive Device ( IED) Neutralization Technologies <b>Description:</b> 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.  <b>FY 2014 Plans:</b> Will 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.			0.000	0.000	2.014
<b>Title:</b> Integrated Decision Enhancing Capabilities for Fire Control <b>Description:</b> This effort develops target database and target management capability for company and below operations  <b>FY 2014 Plans:</b> Will 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.			0.000	0.000	0.904
<b>Accomplishments/Planned Programs Subtotals</b>			15.753	7.762	9.049
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>Remarks</b>					
<b>D. Acquisition Strategy</b> N/A					

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APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602624A: <i>Weapons and Munitions Technology</i>	PROJECT H19: <i>Asymmetric &amp; Counter Measure Technologies</i>

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army										<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>				<b>PROJECT</b> H1A: <i>WEAPONS &amp; MUNITIONS TECH PROGRAM INITIATIVE</i>			
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H1A: <i>WEAPONS &amp; MUNITIONS TECH PROGRAM INITIATIVE</i>	-	14.941	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Weapons and Munitions Technology applied research.												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>									<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>	
<b>Title:</b> Program Increase									14.941	0.000	0.000	
<b>Description:</b> This is a Congressional Interest Item.												
<b>FY 2012 Accomplishments:</b> This Congressional add funded multiple efforts in weapons and munitions System Concepts and Technology (SC&T), ARDEC core competencies, and efforts to support the Squad as a Strategic Formation.												
<b>Accomplishments/Planned Programs Subtotals</b>									14.941	0.000	0.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												
<b>Remarks</b>												
<b>D. Acquisition Strategy</b> N/A												
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology				PROJECT H28: Warheads/ Energetics Technologies			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H28: Warheads/ Energetics Technologies	-	11.404	10.860	15.549	-	15.549	15.281	18.823	24.917	24.042	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 portfolio.												
Work in this project is related to, and fully coordinated with efforts in projects H18 and H19 in this PE, PE 0602303 (Aviation Advanced Technology), PE 0602618A (Ballistics Technology), and project 232 in PE 0603004A (Weapons and Munitions 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												
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 2012	FY 2013	FY 2014	
Title: Scalable Warhead Technology									4.356	4.210	4.176	
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 2012 Accomplishments: Matured scalable and adaptive technology components for small to medium caliber munitions; determined levels of reduced collateral damage using scalable and adaptive technologies.												
FY 2013 Plans:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology	PROJECT H28: Warheads/ Energetics Technologies		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Design and test brassboard designs for shaped charge and explosively formed penetrator (EFP) with scaled up lethality; determine through modeling and simulation the range of lethal to less than lethal effects for scalable warheads.  <b>FY 2014 Plans:</b> Will design and conduct experiments for spin compensated shaped charges, enhanced fragmentation and multiple explosively formed penetrator (MEFP) warheads; will investigate scalable technologies as they relate to lethal to less than lethal effects; will develop designs for non-axisymmetric EFP warheads.				
<b>Title:</b> Energetic Materials and Warheads  <b>Description:</b> This effort designs energetic materials with controlled energy release for precision munition and counter-munition applications.  <b>FY 2012 Accomplishments:</b> Conducted scaled-up experiments with new pyrotechnic formulations, high efficiency energetics formulations and warheads with novel energetic material; validated the performance enhancements of new pyrotechnics, energetics and warheads. Also, modeled structural materials which exhibited potential for explosive characteristics and conducted trade studies for candidate conventional and new chemical ingredients, formulations, and configurations to maximize the performance of structural materials while improving their insensitivity to unplanned stimuli.  <b>FY 2013 Plans:</b> Continue to investigate most promising technologies like structural energetics, solventless propellants, and nanoinsensitive nitramines and evaluate them for transition to advanced development; conduct additional small scale research into multiple energetic materials and warheads candidate technologies for medium and large cal ammunition.  <b>FY 2014 Plans:</b> Will continue to investigate most promising technologies such as disruptive energetics, micro-thrusters and tailorable propellants,highly effective miniature lethal mechanisms, and nano insensitive nitramines; will also conduct evaluation for transition into novel swarming munitions, advanced warheads, medium and large cal ammunition; will seek new applications based on measured performance.		1.784	1.950	2.893
<b>Title:</b> Insensitive Munitions Multi-Scale Reactive Modeling (IM-MSRM)  <b>Description:</b> The IM-MSRM effort designs and investigates new M&S tools for the design and development of insensitive munitions.  <b>FY 2012 Accomplishments:</b>		0.700	0.700	0.000

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602624A: Weapons and Munitions Technology	PROJECT H28: Warheads/ Energetics Technologies		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Investigated and matured continuum models of thermal kinetics ignition based on meso and molecular/atomic level predictions. <b>FY 2013 Plans:</b> Continue to investigate and develop atom level computer code modifications to create material models; develop 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				
<b>Title:</b> Explosives Research <b>Description:</b> This effort develops high energy/high performance, multi-purpose insensitive munitions (IM) explosives. <b>FY 2012 Accomplishments:</b> Designed and develop new insensitive formulations using IM MSRM modeling and simulation tools; began to validate the models with experiments of new insensitive energetics ingredients; and investigated different caliber munitions for the application of the new energetics. <b>FY 2013 Plans:</b> Begin optimization and scale-up of promising ingredients formulations and tailored explosives for mixed-mode and combined effects; conduct baseline design and testing of novel components as well as structures based on nano-energetics, energetic fibers and reactive alloys, explosive inks, multipoint initiation. <b>FY 2014 Plans:</b> Will 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.		4.564	4.000	3.996
<b>Title:</b> Material Development for Water Purification <b>Description:</b> 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. <b>FY 2014 Plans:</b> Will 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.		0.000	0.000	0.499
<b>Title:</b> Explosives Safety for Automated Base Camp Planning		0.000	0.000	0.300



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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A: <i>Weapons and Munitions Technology</i>	<b>PROJECT</b> H28: <i>Warheads/ Energetics Technologies</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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 Technology Enabled Capability Demonstration 1.a, Force Protection - Basing.</p> <p><b>FY 2014 Plans:</b> Will 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><b>Title:</b> Tunable Pyrotechnics</p> <p><b>Description:</b> 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><b>FY 2014 Plans:</b> Will investigate ultraviolet countermeasure (UVCN) flare reformulation with modeling &amp; simulation and validate in scale up experiments; will develop and validate laser beam rider countermeasure (LBRCN) designs with functional experiments; will design &amp; develop image seeking countermeasure (ISCN) flare configurations;. will mature and validate white illumination hand held signal designs.</p>		0.000	0.000
<b>Accomplishments/Planned Programs Subtotals</b>		11.404	10.860
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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**Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army** **DATE:** April 2013

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>							
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	74.518	60.300	59.021	-	59.021	56.711	60.593	62.078	60.097	Continuing	Continuing
EM4: <i>Electric Component Technologies (CA)</i>	-	12.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
EM8: <i>High Power And Energy Component Technology</i>	-	15.174	15.116	14.927	-	14.927	14.233	14.257	14.398	14.657	Continuing	Continuing
H11: <i>Tactical And Component Power Technology</i>	-	11.174	10.022	11.691	-	11.691	11.736	14.980	15.102	12.840	Continuing	Continuing
H17: <i>Flexible Display Center</i>	-	7.271	6.629	2.704	-	2.704	0.854	0.854	1.866	1.882	Continuing	Continuing
H94: <i>Elec &amp; Electronic Dev</i>	-	28.399	28.533	29.699	-	29.699	29.888	30.502	30.712	30.718	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**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).

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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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army	<b>DATE:</b> April 2013
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>
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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>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2012</u></b>	<b><u>FY 2013</u></b>	<b><u>FY 2014 Base</u></b>	<b><u>FY 2014 OCO</u></b>	<b><u>FY 2014 Total</u></b>
Previous President's Budget	62.862	60.300	55.721	-	55.721
Current President's Budget	74.518	60.300	59.021	-	59.021
Total Adjustments	11.656	0.000	3.300	-	3.300
• Congressional General Reductions	-0.100	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	12.500	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.073	-			
• Adjustments to Budget Years	-	-	3.300	-	3.300
• Other Adjustments 1	0.329	-	-	-	-

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>				<b>PROJECT</b> EM4: <i>Electric Component Technologies (CA)</i>			
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EM4: <i>Electric Component Technologies (CA)</i>	-	12.500	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
<b>Note</b> Not applicable for this item.												
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Electronic Component applied research.												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>										<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Silicon Carbide Research										12.500	0.000	0.000
<b>Description:</b> This is a Congressional Interest Item.												
<b>FY 2012 Accomplishments:</b> This is a Congressional Interest Item.												
<b>Accomplishments/Planned Programs Subtotals</b>										12.500	0.000	0.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												
<b>Remarks</b>												
<b>D. Acquisition Strategy</b> N/A												
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.												

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES				PROJECT EM8: High Power And Energy Component Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
EM8: High Power And Energy Component Technology	-	15.174	15.116	14.927	-	14.927	14.233	14.257	14.398	14.657	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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.</p> <p>This project sustains Army science and technology efforts supporting the Ground and Soldier portfolio.</p> <p>The work in this project is coordinated with the Tank and Automotive Research, Development, and Engineering Center (TARDEC PE 063005, project 441); Armaments Research, Development, and Engineering Center (ARDEC) PE063004, project 232; Aviation and Missile Research, Development, and Engineering Center (AMRDEC) PE 063313, project G03; and Communications-Electronics Research, Development, and Engineering Center (CERDEC) PE 062705, project H11. These efforts were previously funded in PE 0602120A (Sensors and Electronic Survivability).</p> <p>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.</p> <p>Work on this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: High Power and Energy Technologies									1.322	1.200	1.296	
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												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>		<b>PROJECT</b> EM8: <i>High Power And Energy Component Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
grid protection, and other pulsed-power systems. Special emphasis is on components operating at high voltages - greater than (>) 10 kilovolts (kV).					
<b>FY 2012 Accomplishments:</b> Investigated advanced wide band gap materials for use in high voltage pulse applications (>10kV).					
<b>FY 2013 Plans:</b> Investigate and conduct 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; identify and assess wide band-gap semiconductors (such as aluminum nitride) that allow higher voltage (>25kV) operation for expanded power control in survivability and lethality applications.					
<b>FY 2014 Plans:</b> 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; evaluate high voltage packaging needs and identify packaging research; initiate research into wide band-gap semiconductors identified in FY13.					
<b>Title:</b> High Energy Laser Technology			2.449	2.541	2.544
<b>Description:</b> 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.					
<b>FY 2012 Accomplishments:</b> Investigated scalability and efficiency potential of resonantly-pumped, eye-safe, lasers in a 2-2.1 micrometer atmospherically transparent spectral domain based on Holmium (Ho)-doped crystals and ceramics.					
<b>FY 2013 Plans:</b> Investigate 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.					
<b>FY 2014 Plans:</b> Will experimentally validate feasibility of a fiber laser, based on fully-crystalline, rare-earth-doped, double clad fibers, which will provide significantly improved thermal management in order to achieve advanced power scalability (>10X) with good beam quality					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> EM8: <i>High Power And Energy Component Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
out of single-aperture laser. Will scale chirped diode laser seed technique to obtain multi kW power output from a 1060 nm fiber amplifier.					
<b>Title:</b> Directed Energy/Electromagnetic Environments (EME) Technologies  <b>Description:</b> 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. In FY13 and FY14 this effort supports Technology Enabled Capability Demonstration 4a, Sustainability/Logistics-Basing [Directed Energy/Electromagnetic Environments (EME) Technologies].  <b>FY 2012 Accomplishments:</b> Continued the development of counter electronic systems and electronic warfare (EW) technology for CERDEC; continued susceptibility investigations of a variety of targets; transitioned effects data to applicable Research Development and Engineering Centers (RDECs).  <b>FY 2013 Plans:</b> Investigate 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; design and experimentally validate 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; investigate the effect of Digital Radio Frequency Memory (DRFM) technology (one of the top concerns in EW across the DoD) on US sensors and receivers and transition data to ARDEC, CERDEC, Army Test and Evaluation Center (ATEC), and program managers as appropriate.  <b>FY 2014 Plans:</b> Will characterize the susceptibility of emerging Improvised Explosive Device (IED) threats to identify their unique susceptibilities/ vulnerabilities. Design neutralization waveforms and techniques based on their vulnerabilities. Develop and evaluate smart RF waveforms to create countermeasures to affect electronic devices.			2.115	2.270	2.218
<b>Title:</b> Electronic Components and Materials Research  <b>Description:</b> 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. In FY13-14, this efforts supports Technology Enabled Capability Demonstration 4a, [Sustainability/Logistics-Basing Operational & Organizational Concept & Plan].  <b>FY 2012 Accomplishments:</b>			4.502	4.435	4.442

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES	PROJECT EM8: High Power And Energy Component Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Evaluated small, high efficiency wide band-gap power modules and circuits utilizing high power component technologies as well as high performance passive components operating at a coolant temperature of 100 °C. <b>FY 2013 Plans:</b> Investigate advanced wide band gap modules developed in FY12 for use in vehicle and micro-grid applications that potentially provide improved fault tolerant operation and efficiency; conduct applied research on next-generation wide band-gap materials and devices to provide high temperature, voltage, and current conversion for micro-grid applications. <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Power System Components Integration and Control Research <b>Description:</b> 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. In FY13-14, this effort supports Technology Enabled Capability Demonstration 4a, [Sustainability/Logistics-Basing Operational & Organizational Concept & Plan]. <b>FY 2012 Accomplishments:</b> Researched control techniques and the use of advance passive devices to provide <60kW high-temperature (110 C) converters; and investigated advanced power conversion techniques for directed energy applications. <b>FY 2013 Plans:</b> Conduct applied research in designing advanced control techniques, such as smart switches, to provide more efficient, robust, and reliable power delivery for vehicle power applications; conduct investigations at the system and circuit levels to evaluate micro-grid topology effectiveness. <b>FY 2014 Plans:</b> Will 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 microgrid power applications; research intelligent control methodologies for microgrids and other power distribution systems; investigate bi directional power conversion circuits for platform and microgrids.		3.528	3.650	3.687
<b>Title:</b> Pulsed-Power Components and Systems Research		1.258	1.020	0.740



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> EM8: <i>High Power And Energy Component Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Investigated silicon carbide (SiC) pulse switch die at 6 kA with fast rate-of-current-rise; and experimentally validated a compact power converter for self-contained battery module concept that allows advanced high power systems to be used on current force and next-generation vehicles.</p> <p><b>FY 2013 Plans:</b> Experimentally characterize and validate the FY12 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 design 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><b>FY 2014 Plans:</b> Will 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. 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		15.174	15.116
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES				PROJECT H11: Tactical And Component Power Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H11: Tactical And Component Power Technology	-	11.174	10.022	11.691	-	11.691	11.736	14.980	15.102	12.840	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 researchs electrochemistry, energy conversion, and signature suppression for primary batteries, rechargeable battery hybrids, fuel cells, power management, and components for electromechanical power generation. This project also researches power sources that are smaller and more fuel-efficient, advanced cooling systems that enable tactical sustainability and survivability, and investigates novel power management methods through low power design tools and dynamic power management software.												
This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Soldier and Ground 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, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Soldier Hybrid Power and Smart Chargers									7.144	5.124	7.721	
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. Work in this effort includes research in Soldier-borne external combustion power generation, fuel cells and batteries, as well as experimenting with chemicals and other material to improve battery components such as electrolyte additives, ceramic membranes, and new cathode materials. In FY13 and FY14 this effort supports Technology Enabled Capability Demonstration 2a Overburdened – Physical Burden.												
FY 2012 Accomplishments:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> H11: <i>Tactical And Component Power Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Developed a lower cost membrane for protected lithium anode portion of lithium air (Li/Air) battery; optimized solid electrolyte membrane to prevent lithium metal corrosion; investigated and developed lower cost processes capable of high volume manufacturing of Li/Air battery; experimented with packaged battery having >800 watt hours per kilogram (Wh/kg) energy density; validated safety characteristics of disposable Soldier battery (Li/Air); experimented with disposable Soldier battery (Li/Air) in an operational environment; assessed balance of plant (controls, fans, heat transfer coatings, etc.) that will help improve efficiency for portable squad power source/charger and reduce weight of hybrid power source; experimented with hybrid power source in a relevant environment.					
<b>FY 2013 Plans:</b> Fabricate higher rate lithium ion conducting membranes and air electrode catalysts for advanced Li/Air disposable battery; validate bio-inspired cathode coatings for rechargeable lithium ion cells to improve and exhibit battery safety characteristics and cell performance in a representative environment; further enhance rechargeable Li/Air battery to achieve and exhibit greater cell energy density in laboratory environment; validate a rechargeable Soldier hybrid power source (external combustion or fuel cell) with greater energy density and extended run time in a laboratory environment; optimize electro-catalyst and alkaline membrane electrolyte performance with different fuels; improve sulfur tolerant catalysts to promote longer system life.					
<b>FY 2014 Plans:</b> Will 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.					
<b>Title:</b> Silent Mobile Power  <b>Description:</b> 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)-2 kilowatts (kW) range, towable generator sets up to 100 kW and renewable energy components and power management systems up to 5 kW. In FY13 and FY14 this effort supports Technology Enabled Capability Demonstration 4a Sustainability/Logistics Basing.			4.030	4.898	3.970
<b>FY 2012 Accomplishments:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> H11: <i>Tactical And Component Power Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>Conducted studies to identify emerging nanomaterials for applications to power electronics and fuel processing subsystems for 250 W to 2 kW applications; advanced and incorporated a new generation of materials (like catalysts for processing jet propellant-8 (JP-8) for use in gasoline engines, ceramic nanocoatings applied to key electromechanical components to enhance durability/life/power-output of current generator sets, and nanotubes applied to develop thermoelectric materials with high electrical but low thermal conductivity) to augment performance of emerging and military power systems in the less than 2 kW range.</p> <p><b>FY 2013 Plans:</b> Fabricate and validate 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; design and fabricate 3 to 5 kWh 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; design and fabricate integrated components and code software for power management of a smart power grid scalable from brigade to installation power levels; fabricate and conduct 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><b>FY 2014 Plans:</b> Will 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		11.174	10.022
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	PROJECT H11: <i>Tactical And Component Power Technology</i>

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES				PROJECT H17: Flexible Display Center			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H17: Flexible Display Center	-	7.271	6.629	2.704	-	2.704	0.854	0.854	1.866	1.882	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## A. Mission Description and Budget Item Justification

This project fabricates and evaluates flexible display components emerging from the Army's Flexible Display Center (FDC) at the Arizona State University. The FDC conducts applied research on flexible display technologies that would make them inherently rugged (no glass), light weight, conformal, potentially low cost, and low power. The resultant display technology would enable enhanced and new capabilities across a broad spectrum of Army applications (such as hands-free/wrist mounted situational awareness devices, flexible hand-held control devices, and monitors in vehicles).

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 Army Research Laboratory (ARL), Adelphi, MD.

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

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Flexible Display Center (FDC) and Flexible Electronics development	5.358	6.629	2.704
<b>Description:</b> The Flexible Display Center is developing high resolution flexible reflective (electrophoretic) and emissive (organic light emitting diodes) displays.			
<b>FY 2012 Accomplishments:</b> The FDC continued to integrate color reflective displays and transition displays to integration efforts to include further development of emissive displays with size and resolution optimized to fulfill needs and requirements.			
<b>FY 2013 Plans:</b> Continue to design full color light emitting displays and the related flexible electronics for soldier applications.			
<b>FY 2014 Plans:</b> Will develop flexible electronic sensor devices for Army applications to include radiation sensors (visible to x-ray) and particle detection.			
<b>Title:</b> FlexTech Alliance (FTA)	1.913	0.000	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> H17: <i>Flexible Display Center</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Description:</b> Flexible display partnerships funded through the FTA for development of tools, processes, and materials that directly support the FDC mission for the Army.  <b>FY 2012 Accomplishments:</b> The FTA supported the goals of the FDC and has direct impact on the development of reflective and emissive displays that will transition into a number of ongoing efforts. Toolsets necessary for further display and flexible electronics development are being supported.			
<b>Accomplishments/Planned Programs Subtotals</b>		7.271	6.629
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					R-1 ITEM NOMENCLATURE PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>				PROJECT H94: <i>Elec &amp; Electronic Dev</i>			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H94: <i>Elec &amp; Electronic Dev</i>	-	28.399	28.533	29.699	-	29.699	29.888	30.502	30.712	30.718	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 Army Research Laboratory (ARL), Adelphi, MD.

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

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Antennas and Millimeter Wave Imaging	3.410	3.400	4.574
<b>Description:</b> 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.			
<b>FY 2012 Accomplishments:</b>			



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>		<b>PROJECT</b> H94: <i>Elec &amp; Electronic Dev</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Developed and fabricated new antenna material structures.					
<b>FY 2013 Plans:</b> Develop low-profile antennas suitable for conformal and embedded platform applications; develop and assess 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.					
<b>FY 2014 Plans:</b> Will develop new terahertz detector for covert surveillance; continue millimeter wave antenna development; develop and evaluate carbon nanotube based antenna structures as well as low-profile metaferriite based, for potential integration into soldier uniforms; design and develop antenna components to allow interoperability of and reduce interference between electronic warfare and communications functions on a single antenna system; validate performance of antenna components in laboratory experiments.					
<b>Title:</b> Advanced Micro and Nano Devices			4.105	3.553	2.637
<b>Description:</b> 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.					
<b>FY 2012 Accomplishments:</b> Determined cycle reliability in packaged Piezo-microelectromechanical systems (piezo-MEMS) switches targeted lifetimes in excess of 1 Billion Cycles; developed switch technologies with extremely low on state resistances (<0.5 Ohm); developed switchable filter technology spanning low MHz to low GHz; and investigated Piezo-MEMS devices for operation near or above 100 GHz.					
<b>FY 2013 Plans:</b> Validate mechanical microcontroller for integrated control of electronically-scanned antennas; develop methods to extend autonomous jumping microrobot to multiple jumps > 5cm for increased mobility; design and evaluate MEMS based, low power rotational acceleration switch arrays for detection of potential traumatic brain injury-causing events; evaluate carbon based devices and develop circuits for future amplifiers and frequency doublers; grow, characterize and fabricate graphene materials and structure for future high performance and low power Army electronic applications.					
<b>FY 2014 Plans:</b> Will develop, synthesize and evaluate conformal and transparent graphene based electronics, and super-capacitors for high energy and power density; develop MEMS 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 the MEMS					

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES		PROJECT H94: Elec & Electronic Dev
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
acceleration switch arrays and the electronics to reduce power consumption; investigate MEMS-based magnetic permeability sensing hardware for reading and writing non-erasable magnetic memory.				
Title: Millimeter Wave Components and Architectures for Advanced Electronic Systems		3.651	3.841	4.207
Description: This effort researches, designs and evaluates component materials, structures, devices, and the electromagnetic issues of millimeter wave components and active devices. The goal is to develop components that can enable advanced systems that combine multiple RF functionalities.				
FY 2012 Accomplishments: Designed highly integrated silicon based technology for multi-channel, multi-function RF Integrated Circuits (ICs); developed emerging III-V devices for heterogeneous integration of millimeter wave to terahertz subsystems.				
FY 2013 Plans: Design high density RF circuit with reduced size, weight and power (SWaP) for radar, communications, and electronic warfare applications; refine millimeter wave power amplifier linearization design to optimize efficiency and output power for improved data throughput and reduced SWaP in SATCOM applications; design, fabricate and experimentally validate radio receiver components that can sense, identify and exploit RF threat signatures for improved standoff threat signal identification.				
FY 2014 Plans: Will investigate and evaluate RF component integration techniques and build and test antennas and amplifiers capable of receiving inherently weak wideband threat signatures; design and fabricate a circuit that digitizes signals at millimeter wave frequencies to enable architectures for SATCOM with smaller form factors.				
Title: Imaging Laser Radar (LADAR) and Vision Protection		2.591	2.296	2.715
Description: This effort develops and assesses eye-safe three dimensional (3-D) 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.				
FY 2012 Accomplishments: Performed skin-based phenomenology measurements for development of long-range uncooperative biometric identification; integrated LADAR onto additional small-robotic platforms and performed relevant-environment experiments; experimentally validated multi-element electro-optic shutter array.				
FY 2013 Plans:				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES		PROJECT H94: Elec & Electronic Dev
B. Accomplishments/Planned Programs (\$ in Millions)				
Assess skin-based, long-range biometric identification phenomenology for uncooperative subjects; complete assessment of LADAR on small-robotic platforms to validate perception performance under realistic conditions.		FY 2012	FY 2013	FY 2014
FY 2014 Plans: Will 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; design and develop miniaturized components for high resolution active imaging systems (ladar and holographic) for higher range and angular resolution.				
Title: Photonics and Opto-Electronic devices 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.		1.576	1.901	2.316
FY 2012 Accomplishments: Investigated active and passive optical fuzes; down-selected laser pulse-shaping excitation scheme for further investigations of energetic materials detection; down-selected and developed photoacoustics method with most potential for trace energetic detection using currently maturing infrared laser diodes sources; investigated construction of advanced peptide recognition elements using iterative process involving computational modeling coupled with experimental characterization.				
FY 2013 Plans: Investigate active optical fuses to advance target detection device performance; evaluate laser spectroscopic phenomenology to determine inherent specificity and sensitivity for detection of hazardous or suspicious materials at several ranges; examine trace detection capability of infrared photoacoustic spectroscopy for detecting energetic materials as well as electromagnetic signatures to enhance detection of hostile threats.				
FY 2014 Plans: Will 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; simulate, fabricate, and characterize advanced silicon photonic devices for improved sensing and processing.				
Title: Power and Thermal Management for Small Systems 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.		3.140	3.917	3.972
FY 2012 Accomplishments:				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602705A: ELECTRONICS AND ELECTRONIC DEVICES	PROJECT H94: Elec & Electronic Dev		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014	
Matured a milliwatt scale battery to actuator power converter component for micro robotic systems. <b>FY 2013 Plans:</b> Design and evaluate compact thermal management components utilizing phase change materials to improve heat rejection capabilities, increase cooling capacity, and reduce volume; fabricate efficient high power density, multifunctional components and sub-systems for capturing, transforming, and delivering power to emerging Microsystems; develop and experimentally validate combustion models for JP-8 and alternative fuels and integrate into the design of catalytic liquid fueled energy converters; characterize catalysts for fuel conversion and fuel synthesis to identify mechanisms for efficient alternative fuels production. <b>FY 2014 Plans:</b> Will 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; 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.					
<b>Title:</b> Prognostics and Diagnostics (P&D) <b>Description:</b> This effort investigates and evaluates prognostics and diagnostics algorithms; designs, fabricates, and evaluates MEMS and other sensors to enable early detection of mechanical failure and hence reduce maintenance costs; designs models and evaluates databases for integration into decision systems to extend sensor rationalization and minimize downtime via condition-based maintenance. <b>FY 2012 Accomplishments:</b> Implemented and conducted experiments of P&D on a vehicle electronic system. <b>FY 2013 Plans:</b> Assess and evaluate digital source collectors for use in the areas of structural health, usage monitoring, and integrated prognosis; apply prognostics and diagnostics methodologies for built-in self test of RF integrated circuits; evaluate algorithms to assess current health and predict the remaining useful life of wide bandgap (WBG) RF power devices and circuits; explore diagnostic sensing with non-traditional semiconductors that are potentially extremely low cost, very robust, and conformable. <b>FY 2014 Plans:</b>		2.979	1.973	1.769	

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>		<b>PROJECT</b> H94: <i>Elec &amp; Electronic Dev</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will develop and design built-in self test of high speed integrated circuits; determine figures of merit for power electronics devices and circuits and apply prognostic and diagnostic strategies to microgrid energy & power applications.					
<b>Title:</b> Infrared (IR) Imaging  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Experimentally validated an improvement in superlattice minority carrier lifetimes and progressed towards 2K x 2K quantum well infrared focal plane arrays.  <b>FY 2013 Plans:</b> Experimentally validate optimized HgCdTe devices on alternate substrates to provide a more sensitive large format and higher resolution LWIR and MWIR C-QWIP FPA; design voltage tunable two color C-QWIP FPAs that results in increased resolution and higher operating temperatures for more efficient operation and robust target detection.  <b>FY 2014 Plans:</b> Will 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; develop Mercury Cadmium (Telluride, Selenide) based infrared sensing materials and devices; use thermal cycle annealing to reduce dislocations propagating in the active region, which currently limits operability.			2.639	2.480	2.410
<b>Title:</b> Power and Energy  <b>Description:</b> 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. This effort supports Technology Enabled Capability Demonstration 4.a: Sustainability/Logistics-Basing.  <b>FY 2012 Accomplishments:</b>			4.308	5.172	5.099

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A: <i>ELECTRONICS AND ELECTRONIC DEVICES</i>	<b>PROJECT</b> H94: <i>Elec &amp; Electronic Dev</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Investigated high-temperature (110-120 C) high-frequency SiC power modules with integrated sense and gate drive for use in compact high-efficiency power conversion modules; investigated stable high voltage anode, cathode and electrolyte components for Lithium (Li) ion batteries; incorporated Si anode materials in Li ion cells; developed improved alkaline fuel cell membranes; as well as evaluated lifetime and rise time of thin film batteries.			
<b>FY 2013 Plans:</b> Design and evaluate thin film battery devices for munitions; evaluate advanced alkaline membranes and catalysts with improved efficiency for alkaline fuel cells; evaluate catalyzed Li-air battery reactions for faster charging and high current discharge; investigate and evaluate processes for synthetically generating energy through photosynthesis; evaluate device physics reliability issues (i.e. material defects, interface impedances) of wide bandgap devices; investigate and characterize high frequency operation of wide bandgap devices and for new device material implementation in vehicle motor drives and pulse power applications.			
<b>FY 2014 Plans:</b> Will 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 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; investigate and characterize high frequency operation of silicon carbide devices for new device material implementation in vehicle motor drives and pulse power applications.			
<b>Accomplishments/Planned Programs Subtotals</b>		28.399	28.533
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army DATE: April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					PE 0602709A: NIGHT VISION TECHNOLOGY							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	54.002	53.244	43.426	-	43.426	38.199	38.550	39.733	40.257	Continuing	Continuing
H95: Night Vision and Electro-Optic Technology	-	54.002	53.244	43.426	-	43.426	38.199	38.550	39.733	40.257	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## 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 (Countermeasure Technology) and PE 0603710A (Night Vision Advanced Technology).

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

Work in this PE is performed by the Army Research, Development and Engineering Command (RDECOM)/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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602709A: NIGHT VISION TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	55.116	53.244	43.426	-	43.426
Current President's Budget	54.002	53.244	43.426	-	43.426
Total Adjustments	-1.114	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.114	-			



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602709A: NIGHT VISION TECHNOLOGY				PROJECT H95: Night Vision and Electro-Optic Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H95: Night Vision and Electro-Optic Technology	-	54.002	53.244	43.426	-	43.426	38.199	38.550	39.733	40.257	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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.</p> <p>This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Soldier, Ground and Air portfolios.</p> <p>Work in this project is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermines Technology) and PE 0603710A (Night Vision Advanced Technology).</p> <p>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.</p> <p>Work in this PE is performed by the 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.</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence									1.296	1.533	1.821	
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)												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>	<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
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.			
<p><b>FY 2012 Accomplishments:</b> Investigated the Aided Target Recognition (AiTR) algorithm evaluation process for multiple sensor modalities including threat explosive detection; evaluated AiTR algorithms in order to quantify performance against established figures of merit using real data of threat explosives in urban environments to differentiate threat explosives from clutter; evaluated AiTR algorithms using real world scenario data including urban environments, threat explosive targets and hard targets in order to further populate AiTR algorithm performance databases.</p> <p><b>FY 2013 Plans:</b> Investigate and evaluate adaptable target tracking algorithms for their ability to perform target handoff/distribution from one sensor system to another without losing a target; investigate 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><b>FY 2014 Plans:</b> Will 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><b>Title:</b> Sensor Modeling and Simulation Technology</p> <p><b>Description:</b> This effort investigates, verifies and validates engineering models, measurement techniques and realistic simulations concurrently with the development and transition of core sensor technologies. The goals 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><b>FY 2012 Accomplishments:</b> Refined and completed development and validation of complex search and persistent surveillance models and simulations incorporating the next generation cooled Infrared (IR) technology; incorporated the ability to effectively model and simulate moving targets and platforms in a spherical sensor simulation; continued development of next generation sensor simulations to support wargames and engineering tradeoff studies.</p> <p><b>FY 2013 Plans:</b></p>		4.984	5.242
			5.228

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>		<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Incorporate, research and validate an integrated engineering sensor model that includes 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; refine and complete development of a capability to more accurately assess combatant/non-combatant sensor performance criteria.					
<b>FY 2014 Plans:</b> Will 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 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 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 EO/IR bands and 3D displays.					
<b>Title:</b> Advanced Multifunction Laser Technology  <b>Description:</b> 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.			3.839	3.257	4.277
<b>FY 2012 Accomplishments:</b> Investigated laser output (pulse energies, wavelength, beam divergence) to support the laser capabilities for designation, range finding, daytime pointing and explosive detection; evaluated laser modules to perform size, weight and power trade-offs for assessment of platform transition opportunities; assembled breadboard laser modules capable of generating the required energy or power to produce three or more wavelengths in selectable modes.					
<b>FY 2013 Plans:</b> Investigate and validate novel breadboard multi-wavelength laser modules for output energy, beam divergence and boresight over MIL-SPEC temperature range; increase the laser efficiency by optimizing the laser resonator configurations and increasing the laser diode pumping efficiency; improve operation over wide operating range; design a breadboard laser with the goal of minimizing laser SWaP for applications such as designation/marketing, LRF and illumination.					
<b>FY 2014 Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>		<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will 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.					
<b>Title:</b> High Performance Small Pixel Uncooled Focal Plane Array (FPA)  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Developed pixel material processing of the LWIR FPA with associated Read Out Integrated Circuits (ROICs); developed a novel approach (increase number of pixels from 640 to 1920 pixels) to achieve High Definition (HD) to optimize wafer die size based for performance; investigated and evaluated the identification range performance of the large format LWIR/SWIR FPA electronic system; designed and developed the brass-board optics for SWIR hyperspectral imaging; researched new low noise ROIC that supports HD format clocking and timing; established multiple design lots to prove out the performance of the HD detector and ROIC; investigated camera electronics that support 60Hz HD video (>276MB/sec data rate) in order to support the testing and video analysis of the HD FPA.  <b>FY 2013 Plans:</b> Improve 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; fabricate and evaluate multiple lots to validate performance; design, fabricate and test a brassboard camera system including support electronics to operate at higher frame rates; design a high performance uncooled hyperspectral SWIR camera with multiple bands using low noise SWIR camera electronics and a reduced pixel size.  <b>FY 2014 Plans:</b> Will 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.			6.730	7.485	3.007
<b>Title:</b> Advanced Structures for Cooled Infrared (IR) Sensors  <b>Description:</b> 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.			3.517	3.727	4.767

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>		<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>FY 2012 Accomplishments:</b> Validated the proof of concept of 2-color 256x256 pixel Longwave Infrared (LWIR) and 640x480 pixel Midwave Infrared/Longwave Infrared (MWIR/LWIR) performance; investigated and validated new techniques for Focal Plane Array (FPA) development of very large (2000 x 2000 pixels) FPA grown on low cost substrates with less than 0.5% pixel defects.					
<b>FY 2013 Plans:</b> Develop an advanced imprint technology to deposit small indium bumps suitable for high definition format FPAs; typify performance of emerging III-V and HgCdTe on alternate substrate FPAs; experiment with novel techniques for steep sidewalled plasma etching and passivation thus enabling megapixel III-V and II-VI FPAs.					
<b>FY 2014 Plans:</b> Will 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.					
<b>Title:</b> Digital Readout Integrated Circuit (ROIC)			7.000	6.500	2.609
<b>Description:</b> 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, contributing to the ability of the U.S. to ensure its historical night vision battlefield advantage.					
<b>FY 2012 Accomplishments:</b> Fabricated 640x480 pixel digital ROIC implementing innovative on-chip signal processing designs with reduced pitch unit cell; measured dynamic range and signal/noise performance; conducted analysis allowing correlation of digital ROIC sampling noise and parasitic capacitances to signal/noise data; conducted design of ROIC for the 640x480 pixel FPA with reduced pitch unit cell while maintaining performance.					
<b>FY 2013 Plans:</b> Fabricate and evaluate high definition, 1280x720 pixel, digital-in-pixel ROIC implementing innovative on-chip signal processing designs with 20 micron pitch unit cell; characterize performance to include dynamic range and signal/noise; conduct 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.					
<b>FY 2014 Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>		<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will 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.					
<b>Title:</b> Enhanced IR Detector ("nBn") Technology			9.980	9.300	7.869
<b>Description:</b> 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. This effort contributes to the U.S. ability to ensure its historical night vision advantage.					
<b>FY 2012 Accomplishments:</b> Fabricated 1-2 Mega pixel (Mpix) FPA implementing successes from design of experiments on dopant level, type and thickness of individual semi-conductors material layers; further investigated growth of semi-conductor material layers (nBn) on larger diameter (approximately 4-6 inches) Gallium Antimonide (GaSb) and Gallium Arsenide (GaAs) wafers to reduce defects of the FPA and determine cause of defects; designed 5Mpix FPA incorporating feedback from the results of the 1-2Mpix FPA design process.					
<b>FY 2013 Plans:</b> Fabricate 2000x2500 pixel FPA with a 10 micron pitch implementing successes from design studies of a variety of potential manufacturing methodologies; evaluate resulting FPA structure and investigate techniques to increase yield by reducing defect formation; continue investigation of growth of semi-conductor material layers (nBn) on larger diameter (approximately 4-6 inches) GaSb and GaAs wafers.					
<b>FY 2014 Plans:</b> Will 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.					
<b>Title:</b> Strained Layer Superlattices (SLS) Technology			11.133	10.700	5.369
<b>Description:</b> 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					

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army			DATE: April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>		<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> (Mercury Cadmium Telluride) and can leverage commercial product research and production lines, including cell phone chips, to improve uniformity related to performance. This effort contributes to the U.S. ability to ensure its historical night vision advantage.			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>FY 2012 Accomplishments:</b> Fabricated 640x480 pixel, dual band, midwave infrared/longwave infrared (MWIR/LWIR) FPA utilizing results of design of experiments involving passivation material and techniques, diode architectures and lithography; designed 640x480 small pixel (15/20 micrometer) dual band MWIR/LWIR FPA on alternate substrates, incorporating feedback from the results of experiments involving passivation material and techniques, diode architectures and lithography; correlated material performance of growth on Gallium Antimonide (GaSb) versus Gallium Arsenide (GaAs); converted detector fabrication processes from 3 inches to 5 inches diameter GaSb wafer capability.					
<b>FY 2013 Plans:</b> Validate design of 1280x720 pixel with reduced pixel pitch, 12 micron, dual band MWIR/LWIR FPAs on alternate substrates; evaluate and fabricate these FPAs using analog ROICs; establish new growth processes on alternative Gallium Arsenide (GaAs) substrates to reduce defects in the SLS FPA; correlate material performance of growth on GaSb versus GaAs allowing reduction in lattice mismatch defects which increases yield and reduces FPA costs.					
<b>FY 2014 Plans:</b> Will 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.					
<b>Title:</b> Wide Field of View Displays and Processing for Head Mounted Display Systems  <b>Description:</b> 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/ project K86.			3.328	5.500	5.308
<b>FY 2012 Accomplishments:</b> Investigated and evaluated techniques for the development of foveated (pitted) pixel architecture sensors and displays for ultra high resolution without trading field of view or low power.					
<b>FY 2013 Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>	<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Investigate and design state-of-the-art technology alternatives for large format waveguide based color heads-up displays; investigate and design light weight waveguide head mounted displays; investigate and design high definition, sparse color, low light image sensor/color filter architectures and color image processing algorithms. Validate operation of low latency/power color processing algorithms on dedicated processing hardware platform; perform laboratory based proof-of-concept validation of key performance metrics with clear path for SWaP scalability.  <b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Solid State Low Light Imaging  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Researched, investigated and assessed the power, cost and low light sensitivity trade-offs for employing pixel enhanced quantum efficiency silicon material; evaluated pixel designed architecture for in-pixel gain and ultra-low noise readout circuits.  <b>FY 2014 Plans:</b> Will 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.		2.195	0.000
<b>Accomplishments/Planned Programs Subtotals</b>		54.002	53.244
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A: <i>NIGHT VISION TECHNOLOGY</i>	<b>PROJECT</b> H95: <i>Night Vision and Electro-Optic Technology</i>
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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**Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army** **DATE:** April 2013

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A: <i>Countermines Systems</i>							
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	32.226	18.850	20.574	-	20.574	21.542	25.247	26.659	27.011	Continuing	Continuing
H24: <i>Countermines Tech</i>	-	16.893	15.834	17.508	-	17.508	18.431	21.585	22.944	23.238	Continuing	Continuing
H35: <i>Camouflage &amp; Counter-Recon Tech</i>	-	2.853	3.016	3.066	-	3.066	3.111	3.662	3.715	3.773	Continuing	Continuing
HB2: <i>COUNTERMINE COMPONENT TECHNOLOGY (CA)</i>	-	12.480	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**A. Mission Description and Budget Item Justification**

This program element (PE) investigates, designs, and evaluates technologies to improve countermines, 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 Engineering, Research and Development Center (ERDC), examines countermines phenomenology of surface and buried mines, and explosive threats. Project H24 advances state of the art Countermines 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), PE 0603710A (Night Vision Advanced Technology).

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

Work in this PE is performed by the Army Research, Development and Engineering Command (RDECOM), Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Belvoir, VA.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602712A: Countermine Systems			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	32.728	18.850	20.574	-	20.574
Current President's Budget	32.226	18.850	20.574	-	20.574
Total Adjustments	-0.502	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.502	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602712A: Countermine Systems				PROJECT H24: Countermine Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H24: Countermine Tech	-	16.893	15.834	17.508	-	17.508	18.431	21.585	22.944	23.238	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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. Work in this Project 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), 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 project is performed by the Army Research, Development and Engineering Command (RDECOM)/Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Belvoir, VA.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Department of Defense Unexploded Ordnance (UXO) Center of Excellence (UXOCOE)									0.480	0.487	0.453	
Description: The Army serves as executive agent of the Unexploded Ordnance (UXO) Center of Excellence (COE), which provides for the coordination of UXO across the Department of Defense (DoD) Army, Navy, Air Force and Marine Corps programs. The UXOCOE 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.												
FY 2012 Accomplishments: Researched and evaluated the UXO RDT&E detection and clearance information and coordinated across the DoD.												
FY 2013 Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A: <i>Countermining Systems</i>	<b>PROJECT</b> H24: <i>Countermining Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Investigate various UXO detection sensors, perform field data collections against UXO surrogates and real targets in realistic background environments and update signature database.			
<b>FY 2014 Plans:</b> Will research a high power laser neutralization source that enables safe standoff removal of wire obstacles while on the move.			
<b>Title:</b> Standoff Mine/Defeat Neutralization Technology		3.466	0.000
<b>Description:</b> This effort investigates and evaluates the ability to pre-detonate and neutralize mines, improvised explosive devices (IEDs) and emerging explosive threats at tactically relevant standoff ranges with munition and laser-based technologies. Starting in FY12, technical efforts will focus on enabling controllable neutralization effects, primarily with lasers. With the technology transition of the munition-based technology for continued 6.3 developments, funding levels are reduced and commensurate with pursuing laser-based approaches. Achieving low/high order neutralization, including deflagration, effects will be the principal objective of the effort.			
<b>FY 2012 Accomplishments:</b> Investigated and integrated diode based laser pump technology into a neutralization brassboard; evaluated the power and energy output with regards to requirements to defeat mine and threat explosives.			
<b>Title:</b> Standoff Explosive Compound Detection Technology		3.635	0.000
<b>Description:</b> This effort investigates ground based detection and confirmation technologies of explosives compounds from tactically relevant standoff distances. The effort is complimentary to the work being accomplished under PE 0602622A/project 552.			
<b>FY 2012 Accomplishments:</b> Conducted data collection of domestic and foreign explosive compounds in order to populate and categorize signatures and utilize the data in conjunction with algorithm development; researched potential to increase detection sensitivity with newly designed algorithms versus the sensitivity of current technology; investigated explosive detection sensors that have potential to reduce false alarms in high clutter areas.			
<b>Title:</b> Advanced Electro-Magnetic (EM) and Electro Optic (EO) Sensors for Detection of Emerging Threat Devices		4.601	7.695
<b>Description:</b> This effort investigates all-terrain standoff detection using novel detection sensor and detection algorithm approaches in order to locate mine and other emerging explosive hazard threat devices with minimal false alarms. This effort also investigates detection of emerging explosive hazards at deeper burial depths (up to 1.5 meters deep).			
<b>FY 2012 Accomplishments:</b>			

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A: <i>Countermining Systems</i>		<b>PROJECT</b> H24: <i>Countermining Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Designed and developed a brassboard with data collection capabilities incorporating EM , Electromagnetic Interference (EMI) and EO advancements; evaluated EO sensing and EM detection concepts for detection of emerging threats; integrated and combined emerging Defense Advanced Research Projects Agency standoff vibration detection technology with the EM, EMI and EO based sensors and with a downward looking active EO laser and/or Laser Detection and Ranging (for ground surface profiling) technology. <b>FY 2013 Plans:</b> Design and fabricate a multi-band ground penetrating radar (GPR) demonstrator integrating both downward looking and forward projecting antennas; begin field data collections and evaluations using GPR demonstrator and based on the results, refine hardware and improve software target recognition algorithms to improve probability of detection and lower false alarm rates. Investigate phenomenological standoff vibration technology in combination with the EM, EMI and EO based sensors for detection of shallow and more deeply buried explosive hazards; improve software to automatically adapt to available sensor inputs in real time. <b>FY 2014 Plans:</b> Will 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 of 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.			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Detection of Home Made Explosive (HME) Production Facilities and Threats <b>Description:</b> 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. <b>FY 2012 Accomplishments:</b> Investigated short wave infrared and long wave infrared hyperspectral imaging techniques for detecting homemade explosive threats; determined and analyzed concentrations of HME required for reliable detection in different air and ground scenarios (e.g., production and drying facilities, spill sights, residue on vehicles and other objects); researched algorithm techniques for separation of HME signatures from background clutter leading to algorithms for automated HME detection. <b>FY 2013 Plans:</b> Investigate and validate emerging technologies capable of detecting explosive related threats including HME production facilities; conduct technical experiments in technologies for HME detection to include Ultraviolet (UV) laser-based Raman spectroscopy			4.711	4.907	6.000

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
to exploit conventional and HME signatures in complex backgrounds and polymer-based sensors to exploit residues and vapors at ultra trace amounts; investigate and validate point confirmation technologies that exploit conventional and HME residues and vapors at ultra-trace amounts for classification and identification purposes.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Short Range Man Portable Explosive Hazard Detector Technology		0.000	2.745
<b>Description:</b> 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.			3.487
<b>FY 2013 Plans:</b> Investigate emerging electromagnetically-based sensor technology and novel helmet-mounted electro-optical sensors; explore 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; leverage 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.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		16.893	15.834
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602712A: <i>Countermining Systems</i>	PROJECT H24: <i>Countermining Tech</i>
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		



# UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602712A: Countermine Systems				PROJECT H35: Camouflage & Counter-Recon Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H35: Camouflage & Counter-Recon Tech	-	2.853	3.016	3.066	-	3.066	3.111	3.662	3.715	3.773	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 Army Research, Development and Engineering Command (RDECOM)/Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Belvoir, VA.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Camouflage and Counter-Reconnaissance Technology for Advanced Spectral Sensors:									2.853	3.016	3.066	
Description: This effort investigates and advances new techniques to reduce electro-optical susceptibility of sensors and camouflage. The two primary objectives are (1) to reduce the optical cross section of currently fielded and emerging electro-optical and infrared (EOIR) sensors and (2) investigate technologies that will enable enhanced spectral signature reduction for next generation camouflage.												
FY 2012 Accomplishments: Continued investigation of the susceptibility of foreign and friendly systems to hyperspectral detection methods; conducted experiments and evaluated multiple technologies to ensure signature reduction was achieved and incorporated results into sensor models for advanced characterization; collaborated with industry to develop near-term improvements to camouflage paints, coatings and systems in both the visible and other wavelength regions.												
FY 2013 Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A: <i>Countermining Systems</i>	<b>PROJECT</b> H35: <i>Camouflage &amp; Counter-Recon Tech</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Leverage 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 infrared (IR), shortwave IR, thermal and uncooled longwave IR; conduct thermal signature studies for future development of IR signature reduction techniques, approaches include modified optics, computational imaging, polarization control and antireflection coatings. Investigate two sided camouflage netting for the Ultra Lightweight Camouflage and Netting System program; perform laboratory and field evaluations from FY12 developed prototypes and develop specifications for the next generation Army netting.  <b>FY 2014 Plans:</b> Will continue development of solutions to reduce optical cross section of large format electro-optical (EO) and infrared (IR) arrays; develop and investigate hardware/software, filters and coatings for currently fielded large format EO and uncooled IR sensors; camouflage effort will focus on implementation of thermal signature reduction coatings and methodologies suitable for nets and uniforms.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		2.853	3.016	3.066
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602712A: Countermine Systems				PROJECT HB2: COUNTERMINE COMPONENT TECHNOLOGY (CA)			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
HB2: COUNTERMINE COMPONENT TECHNOLOGY (CA)	-	12.480	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 2012	FY 2013	FY 2014
<b>Title:</b> Unexploded Ordinance and Landmine Detection Research  <b>Description:</b> This is a Congressional Interest Item. This effort 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. This effort also 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.  <b>FY 2012 Accomplishments:</b> Congressional add funding for Unexploded Ordinance and Landmine Detection Research. Investigated incorporation of wire detection and sensor positioning information in support of Short Range Man Portable Explosive Hazard Detector Technology through in-house laboratory work; conducted in-house investigation of comprehensive display technology for helmet mounted display for Short Range Man Portable Explosive Hazard Detector Technology; researched video rate 2D Hyperspectral Imager for extended SWIR band for homemade explosive (HME) and UXO detection at standoff distances; designed novel optical technology and delivered a video rate 2D Hyperspectral Imager for high resolution LWIR band for HME/UXO false alarm reduction at standoff distances; provided test site support and facility development for the University of Rhode Island for investigation of standoff explosive sensors at long ranges; investigated Quantum Cascade Laser (QCL) technologies as potential sources to reduce SWaP and false alarms in LWIR band of spectrum.										12.480	0.000	0.000
										Accomplishments/Planned Programs Subtotals		
C. Other Program Funding Summary (\$ in Millions)												
N/A												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A: <i>Countermines Systems</i>	<b>PROJECT</b> HB2: <i>COUNTERMINE COMPONENT TECHNOLOGY (CA)</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b> <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army DATE: April 2013

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	21.540	19.872	21.339	-	21.339	20.988	20.912	21.081	21.460	Continuing	Continuing
H70: HUMAN FACT ENG SYS DEV	-	21.540	19.872	21.339	-	21.339	20.988	20.912	21.081	21.460	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## 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 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 Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	21.767	19.872	21.339	-	21.339
Current President's Budget	21.540	19.872	21.339	-	21.339
Total Adjustments	-0.227	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.227	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY				PROJECT H70: HUMAN FACT ENG SYS DEV			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H70: HUMAN FACT ENG SYS DEV	-	21.540	19.872	21.339	-	21.339	20.988	20.912	21.081	21.460	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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, intervention methods and identifies and quantifies 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.

Work in this project 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). 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 Army Research Laboratory (ARL), Aberdeen, MD.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY	PROJECT H70: HUMAN FACT ENG SYS DEV		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>Title:</b> Interfaces for Collaboration and Decision Making (previously titled Adaptive Learning Methods and Strategies)</p> <p><b>Description:</b> 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 nature of the project. This effort identifies areas where innovative training methods can be used to reduce mismatches between Soldier performance and technological capabilities as well as identifies adaptive learning tools and assessment measures which have the potential to improve decision quality for leaders and teams.</p> <p><b>FY 2012 Accomplishments:</b> Validated Soldier-organization-information modeling in laboratory and field research; further matured and validated tools and methods developed to train, improve, assess information sharing, decision making as well as collaboration in network-enabled operations that support decision making.</p> <p><b>FY 2013 Plans:</b> Continue to focus efforts on the data rich environment of C2 planning and execution; enhance FY12 methods/tools by investigating mission context data aggregation and alert capabilities; investigate and design user personalization alternatives and techniques for decision-specific queries, summarization, and extraction; refine human-in-the-loop evaluation methods and establish initial evaluation criteria for human decision making and collaboration.</p> <p><b>FY 2014 Plans:</b> Will 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, C3TRACE, and Chemical Warfare Agents) of the evolving mission command work domain; support Mission Command Battle Lab network simulation exercises.</p>		2.750	3.308	3.359
<p><b>Title:</b> Human Performance Modeling</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b></p>		3.473	3.490	3.531



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY	PROJECT H70: HUMAN FACT ENG SYS DEV		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Evaluated empirical data on the effects of Soldier load on physical and cognitive performance to enhance models; created and distributed a protected web-based repository of human performance models used in Manpower and Personnel Integration (MANPRINT) analyses. <b>FY 2013 Plans:</b> Assess a theory-based decision quality metric for the Command, Control, and Communications module for future evaluations of decision effectiveness. <b>FY 2014 Plans:</b> Will collect and analyze empirical data on human perception (vision and hearing) 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; will investigate Soldier load physical and cognitive algorithms developed in FY13 and their application to the human performance models;examine human performance as a function of cognitive stress, weapon system dynamics, load distribution, etc.				
<b>Title:</b> Interfaces for Vehicle and Mobility Systems (previously titled Vehicle Mobility Systems) <b>Description:</b> Beginning in FY14, this effort is renamed from Vehicle Mobility Systems to Interfaces for Vehicle and Mobility Systems to more accurately reflect the nature of the project. Investigate intelligent, indirect-vision-based vehicle mobility; advanced crew stations; 360/90 degree situational awareness systems; crew and dismount scalable interfaces; and neurophysiologically as well as behavior-based technologies. Implement guidelines for: sensor and data handling; algorithms for characterizing Soldier brain activity in operational contexts; real-time techniques to integrate neurally-based information into systems designs. <b>FY 2012 Accomplishments:</b> Assessed and extended cognitive state modeling and simulation efforts to enhance operational relevance of experimental scenarios and real-time, state-based technologies for improving Soldier-system performance. <b>FY 2013 Plans:</b> Utilize 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. <b>FY 2014 Plans:</b> Will 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.		2.100	3.808	3.669
<b>Title:</b> Dismounted Soldier Performance (previously title Improved Man-Machine Interfaces)		5.800	3.889	5.360

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY	PROJECT H70: HUMAN FACT ENG SYS DEV		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>Description:</b> Beginning in FY14, this effort is renamed from Improved Man Machine Interfaces to Dismounted Soldier Performance (The new title more accurately reflects 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. In FY13-14, this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection – Soldier/Small Unit [Human Factors for Dismounted Operations].</p> <p><b>FY 2012 Accomplishments:</b> Examined effects and impact of rifle and optic remedies for shooting performance decrements associated with full facial protection; conducted research and analysis on the effects of Soldier Load on Soldier physical and cognitive performance.</p> <p><b>FY 2013 Plans:</b> Examine measures and methods to assess the effects and impact of recoil and recoil mitigation devices on Soldier shooting performance; 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.</p> <p><b>FY 2014 Plans:</b> Will 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. Will continue to characterize effects of weapon recoil on shooting performance by refining multivariate techniques/analyses regarding marksmanship performance. Transition results to Army Marksmanship Unit.</p>				
<p><b>Title:</b> Human-Robot Interaction (HRI)</p> <p><b>Description:</b> Design requirements and technologies for supervision and Soldier intervention for multiple semi-autonomous unmanned vehicles (UVs) in urban and unstructured environments. In FY13-14, this effort will support Technology Enabled Capability Demonstration 2.a., Overburdened – Physical Burden (Distributed Soldier Load Through Robotics).</p> <p><b>FY 2012 Accomplishments:</b> Supported evaluation of soldier monitoring crew station design as well as developed experimental designs and supported final capstone field experiments to evaluate local situational awareness, operator aids and interfaces, assisted mobility, and soldier monitoring technologies.</p> <p><b>FY 2013 Plans:</b> Support FY13 capstone field assessments by designing experiments to measure and assess local situational awareness for assisted mobility and Soldier monitoring technologies; conduct modeling and simulation studies to examine manned-unmanned</p>		5.600	3.158	3.188

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602716A: HUMAN FACTORS ENGINEERING TECHNOLOGY	PROJECT H70: HUMAN FACT ENG SYS DEV		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
teaming concepts to create measures and methods for assessing current and future technology capabilities needed to provide manned-unmanned teaming capabilities.				
FY 2014 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. This work is complementary to and coordinated with PE 62784/T41 Socio-Cultural Modeling and PE 62785/790 Leader Development.		1.817	1.219	1.232
FY 2012 Accomplishments: Continued to develop cognitive framework and models depicting influence of socio-cultural factors on Soldier/Commander decision making and communication.				
FY 2013 Plans: Assess the potential impact to Soldier/Commander decision making and communication by using the FY12 developed cognitive framework and begin validation and verification of models.				
FY 2014 Plans: Will 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.				
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.		0.000	1.000	1.000
FY 2013 Plans: Develop methodologies (e.g., predictive, modeling-based methods and 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. Apply promising methodologies to test case scenarios for selected acquisition programs. Develop measures to assess the return on investment (ROI) for applying chosen methodologies earlier in the acquisition process.				
FY 2014 Plans:				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A: <i>HUMAN FACTORS ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> H70: <i>HUMAN FACT ENG SYS DEV</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Will apply promising methodologies to test case scenarios for selected acquisition programs; calculate the return on investment (ROI) realized by incorporating MANPRINT considerations early in the acquisition process.			
<b>Accomplishments/Planned Programs Subtotals</b>		21.540	21.339
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602720A: <i>Environmental Quality Technology</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	20.389	20.095	20.316	-	20.316	20.616	24.420	23.468	24.231	Continuing	Continuing
048: <i>Ind Oper Poll Ctrl Tec</i>	-	2.629	2.173	2.124	-	2.124	2.219	3.080	3.050	3.105	Continuing	Continuing
835: <i>Mil Med Environ Crit</i>	-	5.996	6.160	6.228	-	6.228	6.309	7.539	7.953	8.178	Continuing	Continuing
895: <i>Pollution Prevention</i>	-	3.829	4.070	4.144	-	4.144	4.207	4.679	4.338	4.678	Continuing	Continuing
896: <i>Base Fac Environ Qual</i>	-	7.935	7.692	7.820	-	7.820	7.881	9.122	8.127	8.270	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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) investigates and evaluates enabling tools and methodologies that support the long-term sustainment of Army training and testing activities. 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 to decontaminate or neutralize Army-unique hazardous and toxic wastes at sites containing waste ammunition, explosives, heavy metals, propellants, smokes, chemical munitions, and other organic contaminants, as well as technology to avoid the potential for future hazardous waste problems. Project 895 focuses on reducing hazardous waste generation through process modification and control, materials recycling and substitution as well as 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 facilities, 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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602720A: Environmental Quality Technology			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	20.804	20.095	20.216	-	20.216
Current President's Budget	20.389	20.095	20.316	-	20.316
Total Adjustments	-0.415	0.000	0.100	-	0.100
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.415	-			
• Adjustments to Budget Years	-	-	0.100	-	0.100

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602720A: Environmental Quality Technology				PROJECT 048: Ind Oper Poll Ctrl Tec			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
048: Ind Oper Poll Ctrl Tec	-	2.629	2.173	2.124	-	2.124	2.219	3.080	3.050	3.105	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 industrial 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. Additional work is focused on ecosystem vulnerability assessment, and ecosystem analysis, modeling, mitigation and monitoring technologies for installations associated with air quality and endangered species management.

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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Sustainable Ranges and Lands	2.629	2.173	2.124
<b>Description:</b> 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.			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>	<b>PROJECT</b> 048: <i>Ind Oper Poll Ctrl Tec</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b><i>FY 2012 Accomplishments:</i></b> Designed and developed models to project vegetation response to wild and prescribed fire regimes for best land management practices; designed and developed methods to integrate simulation capability for efficient and effective management of base camp infrastructure.</p> <p><b><i>FY 2013 Plans:</i></b> Continue 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; complete mechanistic models of the role of multiple stressors in governing plant physiological responses to fire; begin 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><b><i>FY 2014 Plans:</i></b> Will 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		2.629	2.173
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			



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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602720A: Environmental Quality Technology				PROJECT 835: Mil Med Environ Crit			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
835: Mil Med Environ Crit	-	5.996	6.160	6.228	-	6.228	6.309	7.539	7.953	8.178	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 and human health effects resulting from exposure to explosives, propellants, smokes and products containing nanomaterials and new and emerging compounds and materials produced or used in Army industrial, field and battlefield operations or disposed of through past activities. This research provides the basis for tools and methods to maintain sustainable lands and ranges and to protect the health of the Soldier and the extended Army community. The specific end results of this research include: determination of acceptable contaminant concentration levels for residual munitions constituents (MCs) and munitions and explosives of concern that minimize adverse effects on the environment and human health and the development of methods that guide the design of nanomaterials and other new and emerging materials such that adverse effects on human health or the environment are minimized in their designed state and when they enter the environment where they may break down. Performing research in genomics analysis, nanomaterial technologies, computational/molecular modeling tools for toxicity and exposure assessment; impacts of climate change on chemical and biological processes; and attributes of sustainable energy production further reduces the uncertainty associated with both the probability of exposure and the ultimate effect if exposed. Results of this research will be integrated into the life cycle analysis process. Interim products are US Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. The Army uses these criteria during negotiations with regulatory officials to set scientifically and economically appropriate cleanup and discharge limits at Army installations.

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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Military Materials in the Environment	2.587	2.647	2.721

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>		<b>PROJECT</b> 835: <i>Mil Med Environ Crit</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<p><b>Description:</b> 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.</p> <p><b>FY 2012 Accomplishments:</b> Constructed a comprehensive data set for the binding properties of MCs and emerging contaminants in biological/physiological networks to predict impacts to ecological receptors. The effort in this program associated with computational chemistry of contaminant behavior in the environment will move to 0602720A Project 896 in FY12.</p> <p><b>FY 2013 Plans:</b> Begin 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><b>FY 2014 Plans:</b> Will complete development of a web-based visualization tool that provides a framework for assessing multi-stressor climate change impacts to current military installations management objectives; further 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><b>Title:</b> Nanotechnology-Environmental Effects</p> <p><b>Description:</b> 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 the design of nanomaterials based on such factors as adverse effects on human health or the environment. The goal of the tools is to influence the design of nanomaterials in such a way that when the nanomaterials enter the environment the impact will be minimalized.</p> <p><b>FY 2012 Accomplishments:</b> Investigated and developed quantitative relationships to characterize role of surface chemistry in the fate and transport of nanoaluminum and nanosilver with environmental media to allow for development of predictive algorithms for potential extrapolation to environmental fate and effects of other nanomaterials.</p> <p><b>FY 2013 Plans:</b></p>			2.431	2.473	2.472

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>	<b>PROJECT</b> 835: <i>Mil Med Environ Crit</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Complete quantitative models for fate and uptake of select military relevant nanomaterials to predict impacts and inform decision analysis techniques; begin 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.			
<b>FY 2014 Plans:</b> Will initiate development of a risk-based process to quantitatively assess benefit and impact of nanomaterial-based Army products in the environment as well as computational approaches for the smart design of functional nanomaterials. Results of this research will inform nanomaterial remediation technologies.			
<b>Title:</b> Green Remediation Technologies		0.978	1.040
<b>Description:</b> This effort enables the Army to understand the fate and transport of contaminants (e.g., depleted uranium, explosives, propellants) which improves the capability to control, remediate, and detect. This effort also enables reductions in the volume of waste while minimizing energy usage.			1.035
<b>FY 2012 Accomplishments:</b> Investigated novel methods to control and remediate Army relevant contaminants while minimizing energy usage, transpiration requirements and volume of waste; researched new methods for detection and remediation of depleted uranium on Army lands.			
<b>FY 2013 Plans:</b> Investigate technologies/methods for the cost effective & environmentally protective stabilization, containment and management of depleted Uranium and residues on test and training ranges; develop 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.			
<b>FY 2014 Plans:</b> Will complete benchscale studies for 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; initiate development of standardized protocols and analytical methods to generate high quality environmental, biological and chemical risk values for acquisition decision processes.			
<b>Accomplishments/Planned Programs Subtotals</b>		5.996	6.160
			6.228
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602720A: <i>Environmental Quality Technology</i>	PROJECT 835: <i>Mil Med Environ Crit</i>
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602720A: Environmental Quality Technology				PROJECT 895: Pollution Prevention			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
895: Pollution Prevention	-	3.829	4.070	4.144	-	4.144	4.207	4.679	4.338	4.678	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>	<b>PROJECT</b> 895: <i>Pollution Prevention</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Title:</b> Pollution Prevention Technologies		3.829	4.070
<b>Description:</b> 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.			
<b>FY 2012 Accomplishments:</b> Conventional Ammunition: scaled up novel explosive compositions to kilogram quantities and conduct limited performance evaluation; Pyrotechnics: evaluated feasibility of using novel, environmentally benign high-nitrogen molecules in next generation pyrotechnic compositions; Heavy Metal Reduction: matured hexavalent chromium-free stripping agents and surface activation technologies for demonstration on aircraft components and assemblies; Zero Footprint Camp: investigated feasibility of novel water vapor reclamation concepts for use in overseas contingency operations.			
<b>FY 2013 Plans:</b> Conventional Ammunition: will develop model for binder interaction and performance in energetic formulations; Pyrotechnics: conduct limited performance evaluation of environmentally sustainable white smoke; Toxic Metal Reduction: evaluate hexavalent chromium-free pretreatments in a laboratory environment for use on mixed metal substrates; Zero Footprint Camp: evaluate promising approaches to reducing water demand and wastewater generation in contingency bases, including demand reduction options, wastewater reuse options and wastewater treatment options.			
<b>FY 2014 Plans:</b> Conventional Ammunition: will conduct limited performance evaluation of novel lead-free primer formulations; Rocket and Missile Propellants: will explore lead-free alternatives for minimum signature applications; Toxic Metal Reduction: will evaluate emerging hexavalent chromium-free processes for generating wear resistant surface coatings.			
<b>Accomplishments/Planned Programs Subtotals</b>		3.829	4.070
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602720A: Environmental Quality Technology				PROJECT 896: Base Fac Environ Qual			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
896: Base Fac Environ Qual	-	7.935	7.692	7.820	-	7.820	7.881	9.122	8.127	8.270	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 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 restore lands damaged during training activities and allow sustained use of installation facilities and training land resources. The project supports readiness and full use of training lands through development of 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 invasive species and 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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Sustainable Ranges and Lands	4.178	3.969	4.251
<b>Description:</b> 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			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>	<b>PROJECT</b> 896: <i>Base Fac Environ Qual</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
(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.				
<b>FY 2012 Accomplishments:</b> Determined impact of different training regimes on natural resources in terms of frequency, duration, and intensity of land use across multiple landscape scales, this information will lead to more informed and accurate predictive capabilities for impacts of training and land use.				
<b>FY 2013 Plans:</b> Demonstrate optimal allocation of land for training and non-training uses for rapid analysis and quantification of impacts of natural resources; transition technologies through Army's Integrated Training Area Management (ITAM) and the Army Training and Testing Area Carrying Capacity (ATTACC) programs; complete development of a preliminary network model for analysis of potential ecological response to changing weather intensity and climate. Network model will incorporate high priority Army land management issues including Threatened and Endangered Species (TES), Species at Risk (SAR), and invasive species.				
<b>FY 2014 Plans:</b> Will complete predictive models and analytical approaches for natural infrastructure response and installation adaptation planning to climate change; investigate using 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.				
<b>Title:</b> Military Materials in the Environment			3.757	3.723
<b>Description:</b> 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.				3.569
<b>FY 2012 Accomplishments:</b> Investigated Army relevant chemical interactions with simple surfaces, silicon and carbon, to include prediction and measurement of adsorption properties and kinetics of adsorption, partition and diffusion coefficients and trans-cellular transport in order to better understand and more accurately predict chemical behavior in variable environmental settings. This effort was formerly under PE 0602720A Project 835.				
<b>FY 2013 Plans:</b>				



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A: <i>Environmental Quality Technology</i>	<b>PROJECT</b> 896: <i>Base Fac Environ Qual</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Complete 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; begin expansion of predictive models for complex surfaces such as typical mineral and soil particles.  <b>FY 2014 Plans:</b> Will initiate development of new technologies to predict the environmental fate and transport of contaminants on complex surfaces to improve operational intelligence; begin effort to 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.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		7.935	7.692	7.820
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602782A: Command, Control, Communications Technology							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	25.703	28.852	34.209	-	34.209	36.580	38.177	39.896	40.092	Continuing	Continuing
779: Command, Control And Platform Electronics Tech	-	10.617	13.086	13.714	-	13.714	15.823	16.107	17.421	17.745	Continuing	Continuing
H92: Communications Technology	-	15.086	15.766	20.495	-	20.495	20.757	22.070	22.475	22.347	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
Note												
FY14 increase for Wireless Personal Area Network research												
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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602782A: Command, Control, Communications Technology			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	26.075	28.852	29.171	-	29.171
Current President's Budget	25.703	28.852	34.209	-	34.209
Total Adjustments	-0.372	0.000	5.038	-	5.038
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.372	-			
• Adjustments to Budget Years	-	-	5.038	-	5.038

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602782A: Command, Control, Communications Technology				PROJECT 779: Command, Control And Platform Electronics Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
779: Command, Control And Platform Electronics Tech	-	10.617	13.086	13.714	-	13.714	15.823	16.107	17.421	17.745	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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 from potentially anywhere on the battlefield. Emphasis is on data management and automated analysis to provide course-of-action determination, mission planning and rehearsal, mission execution monitoring and re-planning, and precision positioning (pos) and navigation (nav). 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, service oriented architecture (SOA), language translation, and integration concepts which contribute to more efficient mobile operations.</p> <p>This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence Portfolio.</p> <p>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.</p> <p>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.</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Battle Space Awareness and Positioning									2.125	2.223	3.757	
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 2012 Accomplishments: Developed sensor integration algorithms to combine the selected pos/nav sensors in radios both with and without radio based nav technologies; began assessing brassboard sensor/radio system/suite in a laboratory environment.												
FY 2013 Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>		<b>PROJECT</b> 779: <i>Command, Control And Platform Electronics Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Investigate and identify sources of error impacting the performance of the integrated radio and sensor navigation brassboard demonstrator, code advanced algorithms to perform navigation error mitigation in the demonstrator; investigate alternative/ 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  <b>FY 2014 Plans:</b> Will 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 M Code capable GPS chips.					
<b>Title:</b> Command and Control (C2) On-The-Move (OTM) Enabling Technologies  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Refined how human understanding can be measured and improved; refined how large and differing amounts of information can be presented to best align with human processing; continued to improve technologies to enable collaborative mission execution and mission command for near-autonomous and autonomous unmanned systems; investigated and devised techniques to automate portions of the governance and accreditation process for edge-enabled applications; coded and integrated intelligent agent technology for language translation services, which provided automated intelligent reasoning of foreign language data.  <b>FY 2013 Plans:</b> Investigate software and algorithms to enable complex interactions between UAS, UGV and manned platforms to facilitate collaborative mission execution, increase efficiency of simultaneous use of multiple unmanned systems and reduce cognitive burden on Soldiers while managing multiple unmanned assets; research fundamental human centered design principles to reduce information overload in Army mission command software; assess the cognitive impact on Soldiers of software applications operating on different computing platforms (e.g. viewing maps on computers, tablets, and smart phones); investigate 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; investigate the advantages of cloud technology (e.g. centralized management of distributed computing resources) in the disadvantaged, intermittent and low bandwidth tactical mission area; develop 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; investigate software applications that facilitate execution of C2 and distribution of intelligence information to			8.492	10.863	9.957

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>	<b>PROJECT</b> 779: <i>Command, Control And Platform Electronics Tech</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Soldiers in small units using hand held devices; investigate architectures and techniques for storage and distribution of software applications for tactical handheld devices.  <b>FY 2014 Plans:</b> Will investigate software and develop algorithms to increase unmanned platform autonomy and improve multi-platform autonomous collision avoidance; design and refine mission command (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, larger display form factors, 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.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		10.617	13.086	13.714
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602782A: Command, Control, Communications Technology				PROJECT H92: Communications Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H92: Communications Technology	-	15.086	15.766	20.495	-	20.495	20.757	22.070	22.475	22.347	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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 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.</p> <p>This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence portfolio.</p> <p>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.</p> <p>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.</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Antenna Technologies									6.275	5.734	6.700	
Description: This effort fabricates and assesses low cost, power efficient, conformal and directional antenna technologies for terrestrial, airborne, and tactical satellite ground terminals to enable them to operate OTM over multiple frequency bands, and further investigates armor embedded antenna 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												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>	<b>PROJECT</b> H92: <i>Communications Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
being accomplished under PE 0602270A/project 906, PE 0603008A/project TR1, and PE 0603270A/project K15 compliments this effort.				
<b><i>FY 2012 Accomplishments:</i></b> Completed integrated K/Ka/Q band low profile electronically steered SATCOM antenna; integrated single package Ka/Q band integrated power amplifier into the K/Ka/Q band SATCOM antenna; completed development of blue force tracking (BFT) SATCOM antenna and modem; developed wafer scale and distributed antenna components and architecture for very small profile on-the-move SATCOM antennas; assessed the Ku Band Simple Manufacturing Array Technology (SMArT) card antenna on an unmanned aerial system; executed antenna performance and ballistic assessment on armor embedded antenna candidates.				
<b><i>FY 2013 Plans:</i></b> Design wafer scale/smart card antenna for low profile SATCOM OTM and unmanned aerial system antennas; adjust embedded antenna designs to improve performance observed from ballistic assessments; investigate new metamaterials for broadband low profile antennas and nanotechnology for low visual signature armor and ballistic glass embedded transparent antennas; design antenna modifications for interference mitigation to reduce radio frequency (RF) communications and electronic warfare (EW) cosite interference between EW and blue force communication systems.				
<b><i>FY 2014 Plans:</i></b> Will 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.				
<b><i>Title:</i></b> Wireless Information Assurance (IA)		3.280	2.771	9.437
<b><i>Description:</i></b> 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.				
<b><i>FY 2012 Accomplishments:</i></b> Researched and coded intrusion detection system (IDS) technology to proactively ascertain local threats on tactical host systems and networks using minimal system resources; coded technologies to automatically self-inoculate these systems to limit impact and contain spread of malicious activity; devised suitable IDS agent collaboration schemes to ensure that trusted decisions are made in response to malicious behavior; configured IDS agents to share actionable security information with sustaining				



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>	<b>PROJECT</b> H92: <i>Communications Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
base assets for further analysis while still allowing the Warfighter to maintain mission focus and continuity while operating at the resource-constrained tactical edge.			
<b>FY 2013 Plans:</b> Research different types of frameworks upon which future cyber security can be developed to remove redundancies and conflicts between disparate software tools and techniques; design and develop communications architecture that standardizes how cyber-security tools and applications should share information (e.g., messages, protocols, cryptography, concealing communications); investigate 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.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Cognitive Networking		3.924	4.143
<b>Description:</b> This effort investigates, evaluates and creates 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.			0.908
<b>FY 2012 Accomplishments:</b> Exercised the Cognitive Network Engineering Design Analytic Toolset (CNEDAT) with 10 cognitive radios in a coordinated fashion through a set of assessments; used the CNEDAT to design a cognitive network to meet a set of performance goals or requirements (such as robustness to node or link outage); implemented these designs in the radio hardware/software, and under the same set of traffic loads; compared the measured network parameters (i.e., throughput, delay, loss, etc) with those predicted by the design tool; conducted specific experiments in total applied traffic load, and/or various traffic mixes (voice, video, data,			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>	<b>PROJECT</b> H92: <i>Communications Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>
imagery, chat) as well as different mobility rates, mobility patterns, and different node/link outages due to simulated jamming and/or node destruction.				
<b>FY 2013 Plans:</b> Research 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 wireless communications networks to change behavior, network topology and traffic flow based on changing RF environments and network congestion; design and code new software algorithms that increase the efficiency of current internet protocols; analyze the potential performance improvements using the CNEDAT toolset.				
<b>FY 2014 Plans:</b> Will research software for self initiating and managing 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.				
<b>Title:</b> Dynamic Spectrum and Network Technologies			1.607	3.118
<b>Description:</b> 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 radio frequency modulation techniques, devices and software. Work being accomplished under PE 0603008A/project TR1 compliments this effort.				3.450
<b>FY 2012 Accomplishments:</b> Coded dynamic spectrum access (DSA) software and algorithms and added them to the automatic frequency channel sensing and selection capabilities of cellular base stations in order to assist the network planners to set the frequencies for mobile base station setup.				
<b>FY 2013 Plans:</b> Research new software and algorithms to visualize/present and alert Soldiers to the operational state of wireless networks at the company, battalion and brigade levels; use 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; investigate new SATCOM waveforms to increase communications capacity and improve anti-jam performance.				
<b>FY 2014 Plans:</b> Will 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, DSA and interference cancellation algorithms to support				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A: <i>Command, Control, Communications Technology</i>	<b>PROJECT</b> H92: <i>Communications Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
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.			
<b>Accomplishments/Planned Programs Subtotals</b>		15.086	20.495
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602783A: COMPUTER AND SOFTWARE TECHNOLOGY							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	8.433	9.830	10.439	-	10.439	10.501	10.411	11.065	11.155	Continuing	Continuing
Y10: COMPUTER/INFO SCI/TECH	-	8.433	9.830	10.439	-	10.439	10.501	10.411	11.065	11.155	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 OCO Request will be submitted at a later date												
<b>Note</b> FY14 increase for language translation efforts.												
<b>A. Mission Description and Budget Item Justification</b> 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 Army Research Laboratory (ARL) at the Adelphi and Aberdeen Proving Ground, MD locations.												

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602783A: COMPUTER AND SOFTWARE TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	8.577	9.830	8.939	-	8.939
Current President's Budget	8.433	9.830	10.439	-	10.439
Total Adjustments	-0.144	0.000	1.500	-	1.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.144	-			
• Adjustments to Budget Years	-	-	1.500	-	1.500

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602783A: COMPUTER AND SOFTWARE TECHNOLOGY				PROJECT Y10: COMPUTER/INFO SCI TECH			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Y10: COMPUTER/INFO SCI TECH	-	8.433	9.830	10.439	-	10.439	10.501	10.411	11.065	11.155	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 results in enable enhanced understanding of many information sources and for accelerating 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 Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Ground, MD.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Information Processing									1.293	1.222	1.237	
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 2012 Accomplishments:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602783A: COMPUTER AND SOFTWARE TECHNOLOGY		PROJECT Y10: COMPUTER/INFO SCI TECH
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Extended network analysis tools, interfaces, and visualization routines for Army intelligence to parallel architectures/algorithms and evaluated them in relevant tactical exercises, like Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) On-the-Move. <b>FY 2013 Plans:</b> Continue to develop scalable decision support and social network analysis algorithms; evaluate network and information visualization software for cellular wireless environments. <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Information Assurance <b>Description:</b> 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. <b>FY 2012 Accomplishments:</b> Evaluated techniques for trading off intrusion detection system (IDS) system performance and overall network performance in terms of network security metrics. <b>FY 2013 Plans:</b> Design and evaluate new software algorithms and architectures, along with predictive models, for distributed intrusion detection of cyber attacks in bandwidth-constrained environments. <b>FY 2014 Plans:</b> Will evaluate experimental implementation of intrusion detection software algorithms and architectures; develop and analyze predictive models for distributed intrusion detection of cyber attacks in bandwidth-constrained environments, efforts will improve our ability to detect and defeat malicious activities on Army networks and hosts.		0.982	1.166	1.180
<b>Title:</b> Information Exchange <b>Description:</b> 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. <b>FY 2012 Accomplishments:</b>		1.177	1.249	1.264

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602783A: COMPUTER AND SOFTWARE TECHNOLOGY		PROJECT Y10: COMPUTER/INFO SCI TECH
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Extended experiments to social network analysis, fusion and collection techniques in a wireless distributed fusion environment, and developed metrics for assessing their overall effectiveness within the DCGS-A Cloud architecture.  <b>FY 2013 Plans:</b> Develop and assess fusion and information exchange software to reduce network bandwidth necessary to transmit information; evaluate the software using tactically realistic equipment and text/video data.  <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Language Translation  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Integrated additional tools to automate development of new optical character recognition and machine translation (OCR/MT) rapidly from prepared data and developed and evaluated use of mobile applications for language translation functions.  <b>FY 2013 Plans:</b> Develop and evaluate adaptive OCR/MT workflow analysis software to improve the quality of automated reasoning techniques when applied to human intelligence documents (both foreign and English).  <b>FY 2014 Plans:</b> Will 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 pocket litter and other materials commonly encountered in the field to facilitate the rapid transition of promising candidate technologies.		0.579	1.631	2.134
<b>Title:</b> Network Theory  <b>Description:</b> 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		1.851	1.865	1.887



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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>				
networks in spite of disruptive effects such as task reorganization, mobility of friendly forces, and adversarial attacks on friendly networks.				
<b>FY 2012 Accomplishments:</b> Investigated and evaluated techniques for controlling the behavior of hybrid networks using a measure of information quality to enhance the overall network performance for improved decision making.				
<b>FY 2013 Plans:</b> Continue to investigate and evaluate algorithms to improve delivery time and quality of information in unreliable tactical mobile networks; investigate and evaluate software algorithms that exploit network user movement and usage to improve communication and information delivery.				
<b>FY 2014 Plans:</b> Will 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 (i.e. optical and Ultra Violet) to provide alternative means of communications in RF-challenged environments; investigate techniques for using mobile infrastructure and user movement to improve communication networks and information delivery in hybrid (wired & wireless) networks.				
<b>Title:</b> Heterogeneous Computing and Computational Sciences		0.980	1.033	1.045
<b>Description:</b> 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.				
<b>FY 2012 Accomplishments:</b> Investigated scalable interface algorithms on heterogeneous computing systems for battlefield and biometric applications.				
<b>FY 2013 Plans:</b> Develop and evaluate scalable algorithms for battle command applications, such as modeling electromagnetic propagation in urban areas on a HPC cloud hybrid computing platform; evaluate algorithm performance and accuracy for developing high fidelity models of complex battlefield scenarios.				
<b>FY 2014 Plans:</b> Will 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				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
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 on standard battle command benchmark problems.			
<b>Title:</b> Material Modeling-Force Protection  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Explored innovative approaches in developing a parallel computational framework for next generation petaflop high-performance computers (both cluster and hybrid computers) to study coupled nonlinear multi-scale material problems on a massive scale.  <b>FY 2013 Plans:</b> Design new parallel computational science environment architecture, as well as theory and implementation strategies for coupling multi-physics modeling software; Evaluate new data models and formats for using petascale data from multi-physics applications to enable higher resolution/fidelity simulations.  <b>FY 2014 Plans:</b> Will develop parallel computational common software environment on emerging multi-core petaflop HPC computing systems; implement interface algorithm, data models and formats to solve multi-scale/multi-physics software developed for coupling between molecular dynamics and finite element methods.		1.571	1.664
<b>Accomplishments/Planned Programs Subtotals</b>		8.433	9.830
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b>			
N/A			
<b>E. Performance Metrics</b>			
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	75.465	70.693	70.064	-	70.064	73.011	72.148	72.900	74.673	Continuing	Continuing
855: <i>Topographical, Image Intel &amp; Space</i>	-	17.165	15.486	17.747	-	17.747	18.589	19.151	20.021	20.845	Continuing	Continuing
H71: <i>Meteorological Research For Battle Command</i>	-	6.127	6.298	6.361	-	6.361	6.441	6.468	6.492	6.609	Continuing	Continuing
T40: <i>Mob/Wpns Eff Tech</i>	-	36.408	34.166	31.214	-	31.214	31.043	30.574	30.249	30.721	Continuing	Continuing
T41: <i>Mil Facilities Eng Tec</i>	-	7.375	6.433	6.366	-	6.366	7.484	6.566	6.694	6.800	Continuing	Continuing
T42: <i>Terrestrial Science Applied Research</i>	-	5.210	5.101	5.142	-	5.142	5.190	5.167	5.167	5.362	Continuing	Continuing
T45: <i>Energy Tec Apl Mil Fac</i>	-	3.180	3.209	3.234	-	3.234	4.264	4.222	4.277	4.336	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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) investigates, evaluates, and advances technologies, techniques and tools for depiction and representation of the physical and human environment for use in military 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. Projects 855 and H71 support the materiel development, testing, and operations communities in evaluating the impacts of weather, terrain, 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. 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

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>
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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>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2012</u></b>	<b><u>FY 2013</u></b>	<b><u>FY 2014 Base</u></b>	<b><u>FY 2014 OCO</u></b>	<b><u>FY 2014 Total</u></b>
Previous President's Budget	80.190	70.693	66.914	-	66.914
Current President's Budget	75.465	70.693	70.064	-	70.064
Total Adjustments	-4.725	0.000	3.150	-	3.150
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-3.691	-			
• SBIR/STTR Transfer	-1.034	-			
• Adjustments to Budget Years	-	-	3.150	-	3.150

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT 855: Topographical, Image Intel & Space			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
855: Topographical, Image Intel & Space	-	17.165	15.486	17.747	-	17.747	18.589	19.151	20.021	20.845	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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. The Army is defining and implementing the Army Geospatial Enterprise (AGE). The AGE provides map and geospatial data, information and software services seamlessly to the total force. This project explores and advances components and methods that optimize the utility of the AGE to the total Army.												
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 2012	FY 2013	FY 2014	
Title: Terrain Analysis for Signal and Sensor Phenomenology									2.808	0.750	3.751	
Description: This effort develops means to create, structure, and represent detailed data, information and effects of the physical and human terrain on military ground operations. The research focuses on tactical, rather than national or commercial, remote sensing of physical terrain data to achieve the fidelity required for current and future operations. Research includes methods												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY		PROJECT 855: Topographical, Image Intel & Space
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>				
for radical, effective active remote sensing to 'tag' features, items and people of interest; these capabilities are based upon full waveform light detection and ranging (LiDAR) sensor systems and an array of other sensor phenomenology for optimal data detection, identification and classification.		FY 2012	FY 2013	FY 2014
<b>FY 2012 Accomplishments:</b> Developed data collection and processing algorithms for novel and advanced full waveform Geiger-mode light detection and ranging (LIDAR) data output for improved terrain analysis.				
<b>FY 2013 Plans:</b> Evolve an Army Geospatial Enterprise capability supporting mission and battle command functions and processes.				
<b>FY 2014 Plans:</b> Will investigate LiDAR detectable, engineered optical materials to perform adversary tagging, physical location, disturbance, and tracking for area and point operations; investigate 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; develop geospatial display layers for digital maps that depict sensor performance and associated sensor uncertainties.				
<b>Title:</b> Imagery and GeoData Sciences		3.846	3.220	2.976
<b>Description:</b> This effort designs and develops human terrain, environment, and analysis to support the Warfighter. It further advances map creation and content through non-traditional methods that exploit existing open source text, multi-media and cartographic materials addressing social, cultural and economic geography.				
<b>FY 2012 Accomplishments:</b> Developed new feature extraction workflows that combine multi-source high-resolution imagery with elevation data to address tactical data gaps; provided capability to evolve and transition an Army Geospatial Enterprise supporting mission and battle command functions and processes.				
<b>FY 2013 Plans:</b> Apply and evaluate non-traditional mapping methods to representative data holdings for Afghanistan and Pacific Command (PACOM) for verification and improvements; design and evaluate utility of socio-cultural Wiki in unclassified and secret modes to take advantage of existing open source materials addressing social, cultural and economic geography.				
<b>FY 2014 Plans:</b>				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY		PROJECT 855: Topographical, Image Intel & Space
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Will 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.				
<b>Title:</b> Geospatial Reasoning  <b>Description:</b> 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. In FY14 this effort supports Technology Enabled Capability Demonstrations 3a, Surprise/Tactical Intelligence Mission Command, and 3b, Surprise/Tactical Intelligence Actionable Intelligence.  <b>FY 2012 Accomplishments:</b> Developed rapid, field-accessible terrain analysis tools for urban and complex environments; developed urban and complex environment sensor placement decision support tools; created an integrated game-board of landscapes and relationships supporting Intelligence Preperation of the Battlefield (IPB) for Civil Military Operations (CMO).  <b>FY 2013 Plans:</b> Develop and implement 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.  <b>FY 2014 Plans:</b> Will 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.		3.007	3.528	3.663
<b>Title:</b> Geospatial and Temporal Information Structure and Framework  <b>Description:</b> 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. Success in meeting these objectives advances the Army's ability to network the force to achieve information dominance. In FY14 this effort supports Technology Enabled Capability Demonstrations 3a, Surprise/Tactical Intelligence Mission Command, and 3b, Surprise/Tactical Intelligence Actionable Intelligence.  <b>FY 2012 Accomplishments:</b>		6.115	7.988	3.373

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APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY	PROJECT 855: Topographical, Image Intel & Space		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Developed feature linkage tools to identify common features across databases, opposing force movement index-based on suppression and interdiction capabilities, and data mining algorithms to support detection of important events. <b>FY 2013 Plans:</b> Develop a more structured analysis and decision framework capable of describing causal relationships and the effects of operational decisions in security and sustainment operations; develop new feature extraction methodologies and techniques that combine multi-source high-resolution imagery with elevation data to address tactical data gaps; evolve and transition an Army Geospatial Enterprise capability supporting mission and battle command functions and processes. <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Geo-Enabled Mission Command Enterprise <b>Description:</b> This effort explores and advances components and methods that optimize the utility of the Army Geospatial Enterprise (AGE) to the total Army. In FY14 this effort supports Technology Enhanced Capability Demonstration 4b, Sustainability Logistics Transportation and Distribution Management. <b>FY 2012 Accomplishments:</b> Develop a geospatial architecture allowing input of user-generated content into the information system to enhance the decision-making battle command process. <b>FY 2014 Plans:</b> Will 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; conduct research and experiments to develop standoff detection and early warning capability of threats to critical infrastructure in extreme environments by innovative fiber optic sensing technology; define and establish technology and processes supporting the Army Geospatial Enterprise for sharing and transforming geospatial products between and among the defined Computing Environments that make up the Common Operating Environment; design and develop optimized processes, methods, and infrastructure to enable the reduction of cycle-time and manpower requirements required for the analysis, exploitation, and visualization of geospatial data.		1.389	0.000	3.984
Accomplishments/Planned Programs Subtotals		17.165	15.486	17.747



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013
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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>Remarks</b>		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT H71: Meteorological Research For Battle Command			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H71: Meteorological Research For Battle Command	-	6.127	6.298	6.361	-	6.361	6.441	6.468	6.492	6.609	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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 Army Research Laboratory located at Adelphi, MD and White Sands Missile Range, NM.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Atmospheric Modeling									2.390	2.460	2.530	

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> H71: <i>Meteorological Research For Battle Command</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> This effort develops high resolution, short-range forecasting and high resolution atmospheric modeling capabilities for mountainous, urban and forest complex terrain.</p> <p><b>FY 2012 Accomplishments:</b> Developed computational optimization methods for the Atmospheric Boundary Layer Environment (ABLE) model using advances in high performance computing to produce a very high resolution meteorological model for use in urban and complex terrain; and improved the WRE-N model at kilometer and sub-kilometer scales validated with the data resulted from the model accuracy assessment studies.</p> <p><b>FY 2013 Plans:</b> Verify the improved ABLE model against measurements to quantify its performance and accuracy in extreme terrain applications; develop 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; develop modeling and post-processing techniques to enhance meteorological accuracy for artillery applications.</p> <p><b>FY 2014 Plans:</b> Will investigate and verify ABLE modeled microscale wind, temperature, and moisture dynamics for more realistic and accurate prediction of derived features such as turbulence, jets, convective eddies and gusts; investigate and verify the sub-kilometer WRE-N (with tailored 4-D Data Assimilation) for complex terrain and implement version to supply data for actionable weather impact decision aids; evaluate modeling post-processing methods for enhancement of meteorological accuracy for artillery applications.</p>			
<p><b>Title:</b> Atmospheric Diagnostics</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Developed weather effects application models for the improved design of emerging technologies such as Terahertz spectroscopy and imaging systems, continuous solid state high energy laser weapons, and passive short wave infrared imaging systems; and developed analysis tools to fuse thermal and infrared polarimetric images, so as to achieve increased target detection.</p> <p><b>FY 2013 Plans:</b></p>		1.891	1.942
			1.939

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY		PROJECT H71: Meteorological Research For Battle Command
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Investigate 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; evaluate the utility of next generation (dual-band) infrared polarimetric imaging systems for use on the battlefield for increased target detection, classification, and identification; collect and analyze signatures from international infrasound events/experiments for improved situational awareness and force protection for Military Intelligence and Army Operations; will develop 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.  <b>FY 2014 Plans:</b> Will 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 that exploits the latest improved theory of short exposure imaging through optical turbulence for its ability to reduce short exposure turbulence blur as it captures images; investigate mobile handheld technology applications that determine atmospheric impacts on Soldiers and autonomous systems to enhance mission effectiveness at the lowest echelons.				
<b>Title:</b> Atmospheric Prediction for Local Areas  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Integrated real time networked environmental sensors and produce optimized sensor placement recommendations from the Local Rapid Evaluation of Atmospheric Conditions (L-REAC) system; and complete accuracy studies of coupled microscale wind model with Weather Running Estimate-Nowcast (WRE-N) for transition to DCGS-A.  <b>FY 2013 Plans:</b> Develop microscale and fine resolution mesoscale model capabilities for analysis and short term forecasting for target areas to enhance mission performance; develop initial application of ensemble model probabilistic forecast grids for weather Nowcasts and decision support tools.  <b>FY 2014 Plans:</b> Will investigate techniques for integrating probabilistic forecast grids into weather impacts decision support tools; research, develop, and verify impact magnitude gradation enhancements to decision support tools to improve the characterization of local		1.846	1.896	1.892

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>		<b>PROJECT</b> H71: <i>Meteorological Research For Battle Command</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
atmospheric impacts on operations and couple meteorological data with aerosol sampling data to support source identification of aerosol particles.				
<b>Accomplishments/Planned Programs Subtotals</b>		6.127	6.298	6.361
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT T40: Mob/Wpns Eff Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
T40: Mob/Wpns Eff Tech	-	36.408	34.166	31.214	-	31.214	31.043	30.574	30.249	30.721	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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)**

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Adaptive Protection	7.436	6.623	7.600
<b>Description:</b> This effort develops new analytical techniques, advanced materials, and integrated protection systems to support the protection of critical assets on the battlefield. In FY12-14 this effort supports Technology Enabled Capability Demonstration 1c, Occupant Centric Platform, and in FY13-14 this effort supports Technology Enabled Capability Demonstration 1a, Force Protection Basing.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY		PROJECT T40: Mob/Wpns Eff Tech
B. Accomplishments/Planned Programs (\$ in Millions)				
<b>FY 2012 Accomplishments:</b> Investigated and validated novel layered protective systems to include overhead protection from direct and indirect fire that must defeat multiple threats; matured the numerical modeling capability of ground vehicle protective schemes against surface and buried threats by improving coupling between the blast events, vehicles, and occupants. This work is performed in collaboration with PE 0603005A/221 and activities in PE 0602618A and PE 0602105A.  <b>FY 2013 Plans:</b> Provide force protection and assessment technologies for structures located in contingency-based environments for 300 to 6000 person camps; design comprehensive model of improvised explosive device (IED) detonation in soils to accurately predict blast pressure and fragmentation of IEDs on ground vehicle systems over a wide range of operational environments; begin 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.  <b>FY 2014 Plans:</b> Will 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.		FY 2012	FY 2013	FY 2014
<b>Title:</b> Austere Entry and Maneuver  <b>Description:</b> This effort investigates, designs, and creates tools and technologies that address theater access, tactical logistics resupply, and tactical maneuver of small units In FY13-14 this effort supports Technology Enabled Capability Demonstration 2a, Overburdened Physical Burden.  <b>FY 2012 Accomplishments:</b> Designed and began development of a sea-land intermodal mobility bridge for ship to shore transit of heavy military equipment and ground vehicles as well as heavy-lift expedient landing platforms and surfaces for aircraft.  <b>FY 2013 Plans:</b> Create physics-based, multi-scale wave, current, and water-depth forecasting capability; create algorithms to predict the impact of the environment on the transport of military equipment and personnel into austere entry points; investigate 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.  <b>FY 2014 Plans:</b>		1.932	7.543	11.564

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>		<b>PROJECT</b> T40: <i>Mob/Wpns Eff Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Will 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.					
<b>Title:</b> Scalable Weapons Effects  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Investigated the performance of the shoulder launched wall breaching system against multiple targets. This work will be performed in collaboration with PE 0602618A/H80, PE 0602105A/H84, PE 0602624A/H18/AH28, PE0603004A/232, PE 06022303A/214.  <b>FY 2013 Plans:</b> Begin to create an integrated modeling and simulation capability to predict the penetration and damage effects from threat weapons. This will enable 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.			0.779	2.959	0.000
<b>Title:</b> Environmental Impacts on Sensor Performance  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Provided high fidelity models to predict and improve the performance of current and future force sensor systems operating in multiple sensor modalities within complex geo-environmental settings; completed new perception algorithms of terrain to enable adaptive tactical behavior technologies for unmanned ground vehicles; investigated technologies and methods leading			10.019	3.014	2.000



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T40: <i>Mob/Wpns Eff Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
to use of sensors above the soil surface with equivalent sensitivity as buried sensors thus allowing for adaptive use in variable environments; researched methodologies for characterizing sensor performance in areas where there is limited ground truth data. <b>FY 2013 Plans:</b> 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. <b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> NORAD-NORTHCOM Surveillance Research <b>Description:</b> This effort develops a physics-based, multi-scaled numerical testbed that provides an enriched virtual environment for evaluating, fusing, and simulating the interaction of local sensors with environmental factors; this effort would also develop high fidelity models to predict and improve performance of current and future force sensor systems for surface, near-surface, and sub-surface target detection within complex geo-environmental settings (solar, weather, soil, vegetation, clutter, etc.). <b>FY 2012 Accomplishments:</b> Will continue additional experiments of integrated technologies and sensor fusion capabilities to characterize tunnel features; will develop a physics-based, multi-scaled numerical testbed that provides an enriched virtual environment for evaluating, fusing, and simulating the interaction of local sensors with environmental factors to provide the ability to detect, deny, and aggressively alert Warfighters to clandestine subsurface approaches.		2.012	0.000
<b>Title:</b> Deployable Force Protection <b>Description:</b> 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.		13.248	8.900

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T40: <i>Mob/Wpns Eff Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b><i>FY 2012 Accomplishments:</i></b>            Performed research to address high priority capability gaps in force protection needs for smaller bases operating in remote areas or integrated with local communities; continued research on previously selected passive protection technologies that included perimeter protection, overhead protection, and mortar pits; improved the design of sensor systems to be low logistics; created algorithms for better identifying/assessing hostile intent from sensor readings; designed and began development of an integrated system architecture for interoperability between disparate sensors; designed and began development of an integrated simulation tool for technology exploration and to provide decision support for identifying system improvements. This work is done in collaboration with PE 0603784A, PE 0603125A, PE 0603313A and PE 0602786A. This work is performed in PE 0602784/T41 in FY 11.</p> <p><b><i>FY 2013 Plans:</i></b>            Develop significantly improved 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; research and develop low-logistics, on-demand structural components for exterior and interior protection of existing structures; integrate and evaluate capabilities to detect, particularly via non-line-of-sight, accurately locate, and suppress hostiles across a range of environments; identify extensions for integrated simulation tool and decision support tools for identifying system improvements; continue 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><b><i>FY 2014 Plans:</i></b>            Will continue 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; will develop second-generation, low-logistics structural components for exterior and interior protection of indigenous structures; continue 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 power requirements. User assessment and feedback gathered from deployable force protection experiments will be used to improve technical performance, logistics, and user factors associated with deployable force protection for the activities described above.</p>			
<b>Title:</b> Materials Modeling		0.982	1.065
		1.150	

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T40: <i>Mob/Wpns Eff Tech</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Continued to develop foundational knowledge of nano- and macro-scale physical, chemical, and mechanical properties of materials for improved performance through computational modeling and laboratory experimental research with focus on composite and bio-inspired materials with exceptional properties such as tensile strength and resistance to cracking and penetration. This work is a continuation of work performed in 0602784/T41 in FY 11, Materials Modeling and is coordinated with ongoing activities in PE 0602720A/835, Nanotechnology - Environmental Effects.</p> <p><b>FY 2013 Plans:</b> Create 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><b>FY 2014 Plans:</b> Will create 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>			
<b>Accomplishments/Planned Programs Subtotals</b>		36.408	34.166
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT T41: Mil Facilities Eng Tec			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
T41: Mil Facilities Eng Tec	-	7.375	6.433	6.366	-	6.366	7.484	6.566	6.694	6.800	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Multi-functional materials in support of Defeat of Emerging Adaptive Threats (DEFEAT)	0.931	0.000	0.000
<b>Description:</b> This effort assesses and develops self healing technologies for building materials; evaluates protective systems; and assesses the use of novel materials in multi-functional structural protection.			
<b>FY 2012 Accomplishments:</b>			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY		PROJECT T41: Mil Facilities Eng Tec
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>				
Completed laboratory assessment of material self healing technologies and optimal design methods for composite plates; integrate use of novel materials into multi-functional structural protection systems. These products transitioned to PE 0603734A project T08 supporting Army Technology Objective DEFEAT.		FY 2012	FY 2013	FY 2014
<b>Title:</b> Adaptive and Resilient Installations  <b>Description:</b> This effort develops sustainable, cost efficient and effective facilities; and provides technologies and techniques for achieving resilient and sustainable installation and base operations. In FY13-14 this effort supports Technology Enabled Capability Demonstration 4a Sustainability/Logistics – Basing.  <b>FY 2012 Accomplishments:</b> Designed and developed a computational framework for expanding to net-centric regional management of facilities with emerging resiliency concepts; designed computer models to facilitate assessment of forward operating base operations to increase effectiveness and efficiency. This effort is coordinated with efforts in PE 0602720A/T48 and PE 0602786A/VT4 and VT5.  <b>FY 2013 Plans:</b> Develop and validate algorithms and models that represent the complex adaptive systems for energy, water, waste, and protection impacting forward operating base operations; initiate development of interface component models for water, solid waste, and green house gas and integrate them into the net-zero energy (NZE) framework to produce a capability for Installations and regional scale analysis and optimization.  <b>FY 2014 Plans:</b> Will continue development and begin to integrate sustainment, restoration and modernization decision models to support planning and analysis of high performance buildings; complete development and validation of adaptive system algorithms and relationships, and models for power, water, waste and protection to reflect the dynamics at forward operating bases.		3.463	3.400	3.408
<b>Title:</b> Social/Cultural Behavior  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Extended the development of dynamic socio-cultural models for estimating host population response to military operations; developed information framework linking socio-cultural data to Army tasks.  <b>FY 2013 Plans:</b>		2.981	3.033	2.958

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T41: <i>Mil Facilities Eng Tec</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Provide 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.  <b>FY 2014 Plans:</b> Will complete development of 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.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		7.375	6.433	6.366
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT T42: Terrestrial Science Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
T42: Terrestrial Science Applied Research	-	5.210	5.101	5.142	-	5.142	5.190	5.167	5.167	5.362	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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 the condition and changes to the physical environment brought about by natural and manmade causes, especially those affecting military operations. Further, the investigations identify and quantify the physical environment's effect on personnel, platforms, sensors, and systems in order to develop improved tactics, techniques, procedures, and plans that ensure information superiority, situational awareness, and force projection. To achieve this, both empirical and theoretical approaches seek to forecast terrain properties and processes through various modeling approaches, and link them to planning and decision aids forming new capabilities for the Army.  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 2012	FY 2013	FY 2014	
Title: Analysis for Signal & Signature Phenomenology (Previously titled - Terrain State)									2.006	2.053	2.433	
Description: This effort investigates the dynamics of electromagnetic, acoustic, and seismic signatures in response to changing terrain state and complex terrain features and geometry. It also improves numerical modeling of key terrain properties and exploits them for tactical advantage in terms of mission planning and tactical decision aids. The goal is to provide Soldiers with an accurate and timely understanding of the battlefield environment's effect on their intended operation.												
FY 2012 Accomplishments: Incorporated an optimal sensor placement and selection model including stationary and moving surveillance platforms into the Environmental Awareness for Sensor and Emitter Employment (EASEE) model supporting integration of many different sensors												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T42: <i>Terrestrial Science Applied Research</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
in the battlespace; developed a framework to achieve effective persistent monitoring of targets of interest, ground and airborne, providing timely knowledge of multi-modality sensor performance in dynamic complex weather-affected terrain and adverse weather conditions.			
<b>FY 2013 Plans:</b> Develop 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; investigate combined terrain-atmosphere modeling and image analysis techniques to remotely establish aircraft landing potential in denied areas.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Title:</b> Geospatial Reasoning (Previously titled - Signature Physics)		3.204	3.048
<b>Description:</b> 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.			2.709
<b>FY 2012 Accomplishments:</b> Designed and developed random sampling approaches for uncertainties across multiple sensing modalities and established quantifiable approaches for the value of increased terrain and weather resolution on signal propagation predictive skill; developed an adequate definition of the soil biology as a function of prevailing conditions, such as soil-water potential and temperature that can be predicted or measured using stand-off techniques supporting emerging developments of bio-inspired persistent standoff sensing capabilities.			
<b>FY 2013 Plans:</b> Develop mission planning tools for combat outpost applications incorporating infrared, visible, and radar multi-modal terrain signature models incorporating weather impacts; develop and evaluate methods for enhanced bio-sensing surveillance capability applying sensor-vegetation characterization and quantification for bio-affected sensor performance mission planning.			
<b>FY 2014 Plans:</b>			



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T42: <i>Terrestrial Science Applied Research</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Will complete decision support tool for combat outpost applications optimizing human and physical terrain surveillance by matching sensor modalities to mission, terrain complexity, and predicted weather effects; investigate and mature components of a sensor coverage and management framework for integrating ground and air surveillance assets based upon site specific terrain and 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.		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Accomplishments/Planned Programs Subtotals</b>		5.210	5.101	5.142
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A <b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

# UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602784A: MILITARY ENGINEERING TECHNOLOGY				PROJECT T45: Energy Tec Apl Mil Fac			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
T45: Energy Tec Apl Mil Fac	-	3.180	3.209	3.234	-	3.234	4.264	4.222	4.277	4.336	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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, energy efficient, sustainable military installations, emphasizing energy and utility systems protection in response to evolving needs. Energy 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 energy generation and use including integration of renewable energy resources and approaches for the reduction of carbon footprint. In addition, technologies from this work provide a better understanding of critical infrastructure interdependencies.  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 2012	FY 2013	FY 2014	
Title: Adaptive and Resilient Installations									3.180	3.209	3.234	
Description: This effort investigates and develops technologies necessary for energy efficient and sustainable military installations, emphasizing energy and utility systems. In FY13-14 this effort supports Technology Enabled Capability Demonstration 4a, Sustainability/Logistics - Basing.												
FY 2012 Accomplishments: Matured operational user assessment of installations energy systems with a decision support concept; began design on a model for assessment and mitigation of energy losses.												
FY 2013 Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A: <i>MILITARY ENGINEERING TECHNOLOGY</i>	<b>PROJECT</b> T45: <i>Energy Tec Apl Mil Fac</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Validate thermal models and long term thermal performance prediction of phase change materials and emerging materials for mitigation of energy losses in building envelopes; provide to installation planners an operational user assessment decision support tool capability for integrated energy analysis and optimization in support of Net Zero Energy Installations.  <b>FY 2014 Plans:</b> Will continue development 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.				
<b>Accomplishments/Planned Programs Subtotals</b>		3.180	3.209	3.234
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					PE 0602785A: Manpower/Personnel/Training Technology							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	18.623	17.781	17.654	-	17.654	18.513	22.263	23.619	24.472	Continuing	Continuing
790: Personnel Performance & Training Technology	-	18.623	17.781	17.654	-	17.654	18.513	22.263	23.619	24.472	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 OCO Request will be submitted at a later date												
<b>Note</b> Not applicable for this item.												
<b>A. Mission Description and Budget Item Justification</b> 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.  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 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602785A: Manpower/Personnel/Training Technology			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	18.917	17.781	18.007	-	18.007
Current President's Budget	18.623	17.781	17.654	-	17.654
Total Adjustments	-0.294	0.000	-0.353	-	-0.353
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.294	-			
• Adjustments to Budget Years	-	-	-0.353	-	-0.353

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602785A: Manpower/Personnel/ Training Technology				PROJECT 790: Personnel Performance & Training Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
790: Personnel Performance & Training Technology	-	18.623	17.781	17.654	-	17.654	18.513	22.263	23.619	24.472	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 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 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 mission command skills; 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.  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.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Personnel									5.421	5.415	5.485	
Description: Conduct applied research that will enable the Army to select Soldiers and officers who are predicted to perform well in future assignments that better match their skills and abilities as well as maintain an effective career force through improved retention strategies and behavioral incentives.												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602785A: Manpower/Personnel/ Training Technology	PROJECT 790: Personnel Performance & Training Technology		
B. Accomplishments/Planned Programs (\$ in Millions)			FY 2012	FY 2013	FY 2014
<b>FY 2012 Accomplishments:</b> Developed non-cognitive measures to identify potential successful Officers (e.g., awarding ROTC scholarships).					
<b>FY 2013 Plans:</b> Continue longitudinal research that validates the predictive quality of non-cognitive measures that can be used to improve selection efficiency; identify and validate predictors of junior officer performance.					
<b>FY 2014 Plans:</b> Will initiate research program on the use of non-cognitive measures to improve the officer classification process; complete multi-year validation of selection efficiency research; determine higher-order skill sets required for enlisted performance assessment across multiple clusters of job types to improve classification process and personnel/job matching. Will initiate research on new measures to improve the selection of cyber personnel.					
<b>Title:</b> Training			9.108	8.045	8.524
<b>Description:</b> Investigate and develop training methods and tools based on the science of learning; develop innovative training strategies for complex battle skills; and design innovative training tools and methods to improve Soldiers training.					
<b>FY 2012 Accomplishments:</b> Developed training performance measurement techniques for large scale-distributed training environments and for units training at home station; identified strategies to create training tailored to the individual Soldier needs.					
<b>FY 2013 Plans:</b> Create training that adapts to the needs of the trainee and tools that effectively deliver and assess training within technology enabled learning environments; develop training approaches and tools (e.g., diagnostic tools, collective training groups, pedagogical interventions) that improve units' ability to develop and manage training.					
<b>FY 2014 Plans:</b> Will develop automated assessment tool for trainee performance to enable the Army Learning Model (i.e., accelerating learning and increasing adaptation to changing operational requirements); develop innovative training framework and methods for collective training of units that must perform exceptionally well in complex operational environments.					
<b>Title:</b> Leader Development			4.094	4.321	3.645
<b>Description:</b> Investigate and develop leader development tools and strategies which can accelerate the leader development process and better prepare leaders for uncertain, rapidly changing operational environments.					
<b>FY 2012 Accomplishments:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602785A: <i>Manpower/Personnel/ Training Technology</i>	<b>PROJECT</b> 790: <i>Personnel Performance &amp; Training Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Developed innovative methods to train skills to operate across a variety of cultures; identified emerging battle command and staff skills for full spectrum operations.			
<b>FY 2013 Plans:</b> Create methods and strategies to develop leader skills (e.g., cross-cultural competency, strategic thinking for mission command) needed in complex environments and design assessment and training tools for leader development skills.			
<b>FY 2014 Plans:</b> Will investigate strategic decision-making of leaders to inform a comprehensive design guide for commanders and staff; investigate 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		18.623	17.781
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			



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<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2014 Army</b>	<b>DATE:</b> April 2013
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>
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COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	46.864	28.281	31.546	-	31.546	32.171	31.181	31.953	33.481	Continuing	Continuing
283: <i>Airdrop Adv Tech</i>	-	2.357	2.140	2.365	-	2.365	2.385	2.405	2.716	2.765	Continuing	Continuing
E01: <i>Warfighter Technology Initiatives (CA)</i>	-	16.474	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H98: <i>Clothing &amp; Equipm Tech</i>	-	19.234	18.892	21.801	-	21.801	22.256	21.084	21.500	22.840	Continuing	Continuing
H99: <i>Joint Service Combat Feeding Technology</i>	-	6.453	5.748	5.802	-	5.802	5.860	5.921	5.936	6.043	Continuing	Continuing
VT4: <i>Expeditionary Mobile Base Camp Technology</i>	-	2.346	1.501	1.578	-	1.578	1.670	1.771	1.801	1.833	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**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 assesses 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 eye wear) (project H98) and 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)

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.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE				
2040: Research, Development, Test & Evaluation, Army		PE 0602786A: Warfighter Technology				
BA 2: Applied Research						
B. Program Change Summary (\$ in Millions)		FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget		46.261	28.281	29.146	-	29.146
Current President's Budget		46.864	28.281	31.546	-	31.546
Total Adjustments		0.603	0.000	2.400	-	2.400
• Congressional General Reductions		-	-			
• Congressional Directed Reductions		-	-			
• Congressional Rescissions		-	-			
• Congressional Adds		-	-			
• Congressional Directed Transfers		-	-			
• Reprogrammings		1.122	-			
• SBIR/STTR Transfer		-0.519	-			
• Adjustments to Budget Years		-	-	2.400	-	2.400

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602786A: Warfighter Technology				PROJECT 283: Airdrop Adv Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
283: Airdrop Adv Tech	-	2.357	2.140	2.365	-	2.365	2.385	2.405	2.716	2.765	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
This project researches, investigates and evaluates 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 led, performed and/or managed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Airdrop/Aerial Delivery Research and Technology									2.357	2.140	2.365	
Description: Beginning in FY13, this effort is renamed from Precision Aerial Delivery Enhancements to Airdrop/Aerial Delivery Research and Technology. The effort merges with the Enabling Airdrop Research and Technologies to provide complementary investigations of technologies for enhanced payload extraction and subsequent gliding capabilities, improves delivery accuracy of varying load weights, and investigates technologies for improved insertion safety and security for airborne personnel.												
FY 2012 Accomplishments: Explored aerial delivery concepts from rotary wing Army aircraft to provide a wider range of resupply capabilities to include automatic helicopter sling load (SL) hook up/drop-off, analyze human systems performance limits and injury mechanisms during SL and Military Free Fall (MFF) operations; completed assessment of oxygen requirements for extended range, high altitude MFF operations; developed a medium fidelity engineering model of the Army's new T11 parachute system steady state descent.												
FY 2013 Plans:												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	
		<b>PROJECT</b> 283: <i>Airdrop Adv Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b> Evaluate decelerator design refinements and application of advanced sensors to decrease serious injuries and fatalities during mass tactical aerial insertion; conduct preliminary investigation of parafoil shape while in-flight to increase performance parameters.  <b>FY 2014 Plans:</b> Will 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 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.		FY 2012	FY 2013
<b>Accomplishments/Planned Programs Subtotals</b>		2.357	2.140
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army										<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>				<b>PROJECT</b> E01: <i>Warfighter Technology Initiatives (CA)</i>			
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
E01: <i>Warfighter Technology Initiatives (CA)</i>	-	16.474	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Warfighter Technology Applied Research.												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>										<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Power Generation Research										16.474	0.000	0.000
<b>Description:</b> This is a Congressional Interest Item.												
<b>FY 2012 Accomplishments:</b> Researched state-of-the-art photovoltaic efficiency improvement concepts, fiber connection methods and novel energy harvesting; researched novel materials for efficiency improvements in photovoltaic cells, super capacitors, thermovoltaic cells, and batteries.												
<b>Accomplishments/Planned Programs Subtotals</b>										16.474	0.000	0.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												
<b>Remarks</b>												
<b>D. Acquisition Strategy</b> N/A												
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602786A: Warfighter Technology				PROJECT H98: Clothing & Equipm Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H98: Clothing & Equipm Tech	-	19.234	18.892	21.801	-	21.801	22.256	21.084	21.500	22.840	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## A. Mission Description and Budget Item Justification

This project investigates and evaluates components and materials that may enhance Soldier survivability from combat threats (flame and thermal threats, blast and ballistic threats, and lasers) and the field environment (e.g., cold, heat, wet) to increase operational effectiveness while decreasing the Soldier's cognitive and physical burden. Included are technologies and novel materials related to personnel armor, helmets, hearing protection, eyewear, and protective inserts for shelters. 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)

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> Soldier Blast and Ballistic Protection	7.000	6.533	4.884
<b>Description:</b> Beginning in FY13, this effort is 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 0602787/Project FH2, Project VB3, Project 874 (Medical Technology), PE 061618/H80, 62105/H84, and 62716/H70 (ARL) and PE 63001.J50. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection Soldier & Small Unit and Technology Enabled Capability Demonstration 2a, Overburden Physical Burden.			
<b>FY 2012 Accomplishments:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	<b>PROJECT</b> H98: <i>Clothing &amp; Equipm Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>Developed methodology to characterize multidirectional bending/ flexing behavior of multi-layer armor material systems, applied human flexure findings to digital human models and investigated advanced armor material and configurations to accommodate body flexure; developed reduced weight material concepts for head and face protection and researched emerging ballistic and blast protective materials for application to shelter systems; conducted research to increase fundamental understanding of blast effects on humans, Personal Protective Equipment design factors effecting exposure limits, scope of future threats and the potential impact to Ground Soldiers.</p> <p><b>FY 2013 Plans:</b> Investigate and assess specific material parameters as well as novel assembling approaches for lightweight shelter and personal protective system applications; further design methodologies, processes, tests methods, and analytical tools that optimize ballistic and blast protective equipment for human performance (mobility and comfort) and survivability; investigate improved methods of assessing behind-armor blunt trauma.</p> <p><b>FY 2014 Plans:</b> Will develop and evaluate ballistic and blast component concepts that fully delineate weight, performance, and mobility trade space using modeling and casualty assessment tools as well as ergonomic and ballistic test methods; investigate new ballistic fiber and composite material to increase strength and toughness while decreasing component weight; develop relevant criteria and advance concepts for assessing behind armor blunt trauma; investigate and apply advanced techniques for multiscale analysis of factors that affect ballistic performance (yarn deniers, surface treatments, material configuration, fiber properties) to develop predictive model(s) for assessing armor systems; develop methods for assessing environmental stability and durability of high performance fibers and composites that enhance Soldier protection in various operational environments.</p>			
<p><b>Title:</b> Soldier Vision Protection and Enhancement</p> <p><b>Description:</b> This effort focuses on technologies which provide eye protection from battlefield threats. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection Soldier &amp; Small Unit and Technology Enabled Capability Demonstration 2a, Overburden Physical Burden.</p> <p><b>FY 2012 Accomplishments:</b> Began integration of eye protection and variable transmission technologies into a single lens design with multiple levels of light transmission control.</p> <p><b>FY 2013 Plans:</b> Mature agile laser eye protection components for variable transmission and anti-fog capabilities as well as determine feasibility of adding these capabilities into a ballistic fragmentation protective lens design for improved Soldier vision protection.</p> <p><b>FY 2014 Plans:</b></p>		2.500	2.611
			3.395

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	<b>PROJECT</b> H98: <i>Clothing &amp; Equipm Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Will investigate and design a vision enhancement lens concept that manipulates the visible electromagnetic spectrum to improve dismounted Soldiers ability to identify combatants and increases the multi-protective capability (e.g. ballistic, laser, environmental) of the baseline eyewear; conduct human research studies to explore how vision protection technologies enhance or detract from Soldier situational awareness.			
<b>Title:</b> Soldier and Small Unit Modeling and Analysis		1.384	0.000
<b>Description:</b> Beginning in FY13, this effort will be captured in the Measurement, Prediction and Improvement of Soldier Performance technology effort. This effort will focus on Small Unit (SU) modeling and analysis to provide critical data and the rationale necessary for making technology decisions for the Soldier and Small Units. This effort is fully coordinated with PE 0602716A/Project H70 (Human Factors Engineering Technology) and PE 0602784A/Project H71 (Military Engineering Technology.)			
<b>FY 2012 Accomplishments:</b> Analyzed the utility of tailorable/modular/scalable body armor and recommended optimal configurations to ensure the proper balance of protection and Soldier load for any given missions and scenario; continued to conduct analyses to support Expeditionary Mobile Base Camps as Combat Outposts (COPs) that will allow SCUs to sustain themselves in austere environments.			
<b>Title:</b> Measurement, Prediction and Improvement of Soldier Performance		2.900	4.212
<b>Description:</b> Beginning in FY13, Soldier and Small Unit Modeling and Analysis efforts are 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 0602787. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 1.b, Force Protection Soldier & Small Unit and Technology Enabled Capability Demonstration 2a, Overburden Physical Burden.			5.585
<b>FY 2012 Accomplishments:</b> Matured and validated cognitive metrics for quantifying and evaluating Soldier performance affected by contextual variables; conducted human research to identify mitigation strategies for performance decrements; provided anthropometric specifications for 3D digital human models representing body size/proportional variations for males and females and link individual Soldier physical task simulations to better predict and model the effect of equipment loads on Soldier performance.			
<b>FY 2013 Plans:</b>			



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>		<b>PROJECT</b> H98: <i>Clothing &amp; Equipm Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Evaluate mitigation techniques that support spatial memory and navigation such as adaptive display technologies, resilience training, and nutritional intervention; investigate the interactive effects of individual differences (e.g., spatial cognitive performance and working memory capacity) and mission context on Soldier cognitive processes; conduct operational human performance effectiveness modeling and simulation analyses for optimal body armor/load configurations for individual Soldiers and Small Units.  <b>FY 2014 Plans:</b> Will 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 the effectiveness of 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.					
<b>Title:</b> Advancements in Fibers, Textiles and Materials for Soldier Protection  <b>Description:</b> 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 and Technology Enabled Capability Demonstration 2a, Overburden Physical Burden.  <b>FY 2012 Accomplishments:</b> Assessed multifunctional fiber technologies for key flame and thermal protection capabilities, cut and abrasion resistance, concealment and electronic/electrical properties as well as fiber composite toughness enhancement improvement for multiple Soldier items; integrated selected novel FR protective materials into fibers and researched new FR characterization methodologies and modeling of layered FR materials to determine the physical properties controlling FR performance; determined the effect of enhanced process control on electrospun materials, and evaluated performance for a wide range of operational conditions; and investigated textile properties effecting signature reduction and performance evaluation techniques for a wide range of operational conditions and sensors.  <b>FY 2013 Plans:</b> Evaluate properties of novel bi- and tri-component fibers for Electro Magnetic Imaging (EMI) shielding, friend/foe identification and signature management; investigate environmentally benign coatings, surface treatments and other novel deposition techniques			5.450	5.536	7.937

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	<b>PROJECT</b> H98: <i>Clothing &amp; Equipm Tech</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
for flame and thermal protection; investigate 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.  <b>FY 2014 Plans:</b> Will 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.				
<b>Accomplishments/Planned Programs Subtotals</b>		19.234	18.892	21.801
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602786A: Warfighter Technology				PROJECT H99: Joint Service Combat Feeding Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
H99: Joint Service Combat Feeding Technology	-	6.453	5.748	5.802	-	5.802	5.860	5.921	5.936	6.043	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 <sup>##</sup> The FY 2014 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 enhances 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 0602787 (Medical Technology) Project 869.												
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 2012	FY 2013	FY 2014	
Title: Joint Combat Feeding Equipment Technologies									2.610	2.321	2.343	
Description: Beginning in FY13, this effort is renamed from Combat Feeding Equipment Technologies to Joint Combat Feeding Equipment Technologies. This effort investigates equipment and energy technologies to enhance effectiveness and reduce logistics footprint of Joint Services field feeding operations in a wide range of environmental and operational contexts. In FY12, 13 and 14, this effort supports Technology Enabled Capability Demonstration 4a, Sustainability and Logistics-Basing.												
FY 2012 Accomplishments: Investigated innovative mission-specific, man portable feeding technologies; evaluated high efficiency thermoelectric powered appliances to reduce reliance on JP8 and other power sources to operate kitchen appliances; investigated novel												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army			<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>		<b>PROJECT</b> H99: <i>Joint Service Combat Feeding Technology</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>			<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
heating technologies that will allow the Warfighter to self heat a wider range of rations, including group rations, in a variety of environmental conditions without kitchen equipment.					
<b>FY 2013 Plans:</b> Explore 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.					
<b>FY 2014 Plans:</b> Will investigate greywater 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.					
<b>Title:</b> Ration Stabilization, Packaging, Novel Nutrient Delivery, and Food Safety Technologies			1.910	3.427	3.459
<b>Description:</b> Beginning in FY13, this effort is renamed from Ration Stabilization and Novel Nutrient Delivery Technologies and combines with Ration Packaging and Food Safety Technologies to form Ration Stabilization, Packaging, Novel Nutrient Delivery and Food Safety Technologies to provide investigation of complementary food technologies. This effort identifies and develops nutrient compositions to maximize Soldier cognitive and physical performance on the battlefield and minimizes nutritional degradation to protect the Warfighter from food borne illnesses. In FY12, 13 and 14, this effort supports Technology Enabled Capability Demonstration 2a, Overburdened - Physical Burden.					
<b>FY 2012 Accomplishments:</b> Explored the integration of antioxidants into various ration components to improve the overall health of the Warfighter; developed new baked food items that will increase the variety of baked goods available in military rations; developed ration components that increase the Warfighter appetite satisfaction rate relative to ration size to support Soldier mental and physical performance.					
<b>FY 2013 Plans:</b> Explore novel drying process to produce shelf stable, nutritionally dense carriers for performance optimizing ingredients; explore efficient food sample preparation/clean-up methods to improve accuracy of biosensor detection technologies for preventing food borne illnesses; investigate simulated digestion model to measure human absorption of bio-active nutrients.					
<b>FY 2014 Plans:</b> Will 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					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	<b>PROJECT</b> H99: <i>Joint Service Combat Feeding Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
of new bio-based packaging solutions within ration platforms to meet shelf-stability requirements extending ration life-cycle and reducing cost.				
<b>Title:</b> Ration Packaging and Food Safety Technologies  <b>Description:</b> Beginning in FY13, this effort merged into Ration Stabilization, Packaging, Novel Nutrient Delivery and Food Safety Technologies. This effort investigates biosensors models and designs for food products and novel ration packaging technologies to minimize nutritional degradation and protect the Warfighter from food borne illnesses.  <b>FY 2012 Accomplishments:</b> Conducted exploratory research on bioactive packaging materials which can detect and kill pathogens present in a food product to protect the Warfighter's health; evaluated ration packaging microencapsulation technologies that enhance barrier protection and packaging integrity resulting in higher ration quality and reduced waste.		1.933	0.000	0.000
<b>Accomplishments/Planned Programs Subtotals</b>		6.453	5.748	5.802
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602786A: Warfighter Technology				PROJECT VT4: Expeditionary Mobile Base Camp Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
VT4: Expeditionary Mobile Base Camp Technology	-	2.346	1.501	1.578	-	1.578	1.670	1.771	1.801	1.833	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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 optimized manpower requirements, improve situational awareness, increase 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 handing support. This project integrates mature technologies to create mission specific lab demonstrators and evaluates the performance capabilities using metrics and methodologies developed under PE 0602786//Project VT4.</p> <p>Efforts in this program element support the Army science and technology Soldier portfolio.</p> <p>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.</p> <p>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).</p>												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Expeditionary Base Camp Component Technologies									2.346	1.501	1.578	
Description: Identify and improve component interoperability and mature and scale component technologies for an integrated holistic base camp concept. In FY13 and FY14, this effort supports Technology Enabled Capability Demonstration 4a, Basing Sustainment and Logistics.												
FY 2012 Accomplishments:												
Developed a database of physical measurements (size, weight, volume), human metrics (manpower, cognitive load), interfaces (power, network), and assess technical performance and maturity of technologies (i.e., level of ballistic, environmental and/or												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A: <i>Warfighter Technology</i>	<b>PROJECT</b> VT4: <i>Expeditionary Mobile Base Camp Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
chem-bio protection); captured key data regarding mission planning from deploying units and component limitations from returning Soldiers; investigated data and prioritize critical new or improved capabilities through simulations and war-gaming, developed test protocols for technology assessment, and defined design and technical performance criteria for achievable capability sets.			
<b>FY 2013 Plans:</b> Evaluate technology approaches to address the performance criteria and capability sets identified in FY12; investigate technologies which can increase capabilities to project the force, sustain the force and/or protect the base without increasing manpower requirements; conduct experiments to measure protection, power and other sustainment technologies performance using test protocols developed in FY12.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		2.346	1.501
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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**Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army** **DATE:** April 2013

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>					<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>							
<b>COST (\$ in Millions)</b>	<b>All Prior Years</b>	<b>FY 2012</b>	<b>FY 2013<sup>#</sup></b>	<b>FY 2014 Base</b>	<b>FY 2014 OCO <sup>##</sup></b>	<b>FY 2014 Total</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	104.190	107.891	93.340	-	93.340	83.115	81.902	85.694	89.953	Continuing	Continuing
869: <i>Warfighter Health Prot &amp; Perf Stnds</i>	-	37.910	38.907	34.728	-	34.728	33.230	30.317	30.656	31.482	Continuing	Continuing
870: <i>Dod Med Def Ag Inf Dis</i>	-	16.842	18.987	19.072	-	19.072	20.828	22.500	23.725	25.618	Continuing	Continuing
873: <i>HIV Exploratory Rsch</i>	-	9.117	8.986	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
874: <i>Cbt Casualty Care Tech</i>	-	16.837	19.821	18.271	-	18.271	16.829	17.693	18.788	20.119	Continuing	Continuing
FH2: <i>Force Health Protection - Applied Research</i>	-	8.888	6.279	6.316	-	6.316	7.436	6.523	7.568	7.686	Continuing	Continuing
VB4: <i>System Biology And Network Science Technology</i>	-	4.596	4.802	4.839	-	4.839	4.792	4.869	4.957	5.048	Continuing	Continuing
VJ4: <i>Suicide Prevention/ Mitigation</i>	-	10.000	10.109	10.114	-	10.114	0.000	0.000	0.000	0.000	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

**Note**

FY14 decrease attributed to transfer of HIV research funding from RDT&E,Army to RDT&E Defense-wide and other realignments to fund higher priority efforts.

**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, including human immunodeficiency virus (HIV); Clinical and Rehabilitative Medicine; and Systems Biology/Network Sciences. Research is funded in seven 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.

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.



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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>
<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.</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 over a planned 5-year period the mental and behavioral health of Soldiers to counter suicidal behavior. This work will focus 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 Research). 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> <p>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 Biome</p>		

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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Army				DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602787A: MEDICAL TECHNOLOGY			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	105.762	107.891	106.338	-	106.338
Current President's Budget	104.190	107.891	93.340	-	93.340
Total Adjustments	-1.572	0.000	-12.998	-	-12.998
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.342	-			
• SBIR/STTR Transfer	-1.914	-			
• Adjustments to Budget Years	-	-	-12.998	-	-12.998

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT 869: Warfighter Health Prot & Perf Stnds			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
869: Warfighter Health Prot & Perf Stnds	-	37.910	38.907	34.728	-	34.728	33.230	30.317	30.656	31.482	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 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												
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 WRAIR, Silver Spring, MD; USARIEM, Natick, MA; U.S. Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and 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 2012	FY 2013	FY 2014	
Title: Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments									3.496	2.038	1.930	
Description: This effort evaluates remote monitoring of Soldier physiological status and mitigating/eliminating the effects of heat, cold, altitude, and other environmental stressors on Soldier performance. This effort supports Technology-Enabled Capability												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY		PROJECT 869: Warfighter Health Prot & Perf Stnds
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Demonstration 1.b, Force Protection--Soldier and Small Unit in FY2013-2014, and also supports Technology-Enabled Capability Demonstration 2.a, Overburdened Physical Burden in FY 2013-2014.				
FY 2012 Accomplishments: Developed altitude acclimatization and work performance models for altitudes between 7,000 and 14,000 feet. Acquired data that will aid in the development of a model of Military performance to reflect the effects of heat stress and hydration.				
FY 2013 Plans: Conduct laboratory studies to determine effects of hypoxia (oxygen depletion) on peripheral blood flow during cold exposure. These results will 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.				
FY 2014 Plans: Will conduct studies to determine whether physiological fatigue in cold environments increases susceptibility to non-freezing cold injury and hypothermia and will develop screening procedures to determine those Warriors most at risk for non-freezing cold injury. These studies will determine the impact of hypoxia (oxygen depletion) on peripheral blood flow responses and susceptibility to non-freezing cold injury				
Title: Physiological Health - Nutritional Sustainment and Fatigue Interventions		3.597	6.086	6.103
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.				
FY 2012 Accomplishments: Investigated whether there is any association between disturbances in nutritional health and the prevalence of Warfighter psychological disorders; determined the impact of weight status on risk of musculoskeletal injury and defined the effect of a high protein diet on musculoskeletal health; defined the muscle metabolic responses to energy deficit for development of treatment interventions; demonstrated effectiveness of a non-prescription medication for promoting fat loss in overweight Warriors.				
FY 2013 Plans: Determine 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; define the effects of metabolic energy availability on cognitive performance; determine whether nutritional interventions can facilitate bone remodeling in response to military training; incorporate a mathematical model of caffeine effects during chronic sleep restriction into the sleep performance model; and refine a cognitive (mental processing) model to predict differential rates of recovery following various chronic sleep restriction operational scenarios. These results increase predictive capability against the effects of fatigue; determine the effects of physiological (human				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
mechanical, physical and biochemical functions) factors, such as genetic makeup, sleep history, and personality on individual differences in physiological resiliency.			
<b>FY 2014 Plans:</b> Will establish the nutritional requirements for optimizing Soldier re-fueling; will establish Military Dining Facility serving practices that promote healthy food choices; will establish the nutritional requirements for optimizing bone health; and will develop dietary support interventions that accelerate cognitive recovery after operational stress. These interventions will optimize Soldier recovery from demanding missions through nutrition; will develop mathematical models and algorithms for prediction of cognitive resilience based on physiological factors determined from laboratory studies, which will allow resilience training to be personally optimized; will 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; will 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.			
<b>Title:</b> Injury Prevention and Reduction - Neurosensory Injury Prevention		7.033	8.824
<b>Description:</b> 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.			8.184
<b>FY 2012 Accomplishments:</b> Determined thresholds of operationally relevant blunt head injury; completed additional eye injury dose-response modeling for the instrumented headform system; assessed effectiveness of existing hearing protection in continuous high-noise training environments using otoacoustic emissions (sound generated within the inner ear, which can be used as a measure of inner ear health); developed biomedically based injury mechanism criteria to define auditory risk potential; and examined both biophysical and animal models of blast to characterize the nature and extent of effects on the eye.			
<b>FY 2013 Plans:</b> Refine standard methodology for the evaluation of vision and ocular sensitivity during rapid transitions between light and dark operational conditions; refine methodology to evaluate blunt facial protection strategies; refine a model that assess the effectiveness of existing and newly developed hearing protection/enhancement strategies during continuous and impulse noise combat operations that predicts the effects of hearing loss in an operational environment; determine additive effects of laser pulses to enable the safe use of military laser systems and provides biomedical data to assess eye protection devices; and assess			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
military ocular (eye) trauma from blast or lasers and outcomes that leads to the prevention and effective mitigation of battlefield eye injuries.  <b>FY 2014 Plans:</b> Will develop improved eye protection standards and ophthalmic (pertaining to the eye) guidelines for protective eyewear that serves the various Warrior occupations and will develop hearing protection strategies for optimized active noise-reduction protection.			
<b>Title:</b> Injury Prevention and Reduction - Musculoskeletal Injury Prevention  <b>Description:</b> 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, and also supports Technology-Enabled Capability Demonstration 2.a, Overburdened Physical Burden in FY2013-2014.  <b>FY 2012 Accomplishments:</b> Developed and validated a model that identified relationships among multi-sensory and musculoskeletal injuries; developed and implemented an injury risk methodology for remediation and prevention in an effort to mitigate lost duty-time due to musculoskeletal injury; and developed strategies to evaluate predictions and generalizations of musculoskeletal injuries.  <b>FY 2013 Plans:</b> Refine a mounted Soldier injury performance assessment battery and assess the physical performance requirements and determine minimal acceptable standards for muscle/skeletal injury for the dismounted Soldier. These results provide data for an improved injury risk analysis capability for the Soldier.  <b>FY 2014 Plans:</b> Will develop a quantitative computational model that can predict physical performance and risk of injury of individual Soldiers and will develop training strategies and/or dietary interventions to improve recovery following intense physical exercise.		5.108	6.937
<b>Title:</b> Injury Prevention and Reduction - Injury Return to Duty Standards:  <b>Description:</b> This effort evaluates current methods for rapid return-to-duty standards and establishes improved medical assessment methods with the goal of more rapid return to duty of Soldiers following injury.  <b>FY 2012 Accomplishments:</b>		2.546	3.752
			2.676

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>Developed strategies to validate whether hearing following blast or blunt trauma is a predictor of mild Traumatic Brain Injury (mTBI) and evaluated the human vestibular system (system that contributed to sense of balance and spatial orientation) as a predictor of mTBI from blast and blunt trauma.</p> <p><b>FY 2013 Plans:</b> Evaluate impulse noise measurement techniques to assess the potential for acoustic (hearing) injury to Soldiers. These results provide an increased predictive capability for acoustic trauma. Determine 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 prevents impaired Soldiers from being prematurely returned to duty.</p> <p><b>FY 2014 Plans:</b> Will 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; will develop models that predict and prevent auditory (process of hearing) injury; and will develop criteria to improve hearing conservation and guide development of hearing protection equipment for Warriors.</p>			
<p><b>Title:</b> Psychological Health - Psychological Resilience</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Established key targeted skills that leaders employed to effectively build resilience and handle behavioral health issues in their units; developed training content for these leader skills; conducted studies to assess effectiveness of new advanced resilience training modules post-deployment and delivered validated training; validated enhanced resilience training techniques and assessed optimal training delivery strategies; assessed post-deployment reintegration strategies; developed and assessed effectiveness of spouse resilience training to enhance mental health and reintegration; and provided evidence-based guidance for adequate resourcing of mental health services for military families.</p> <p><b>FY 2013 Plans:</b> Finalize assessment of post-deployment reintegration strategies; conduct studies to show the effectiveness of behavioral health and resiliency skills for leaders; and conduct studies to evaluate the effectiveness of behavioral health and resiliency skills for</p>		10.629	6.566
			8.436

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p>leaders. These results are used to refine preventive and treatment interventions to enhance the psychological resilience of the Warfighter.</p> <p><b>FY 2014 Plans:</b> Will 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; will benchmark emerging behavioral health trends through rapid fielding assessment teams to inform resilience training modifications; This effort will ensure rapid response to Warfighter needs and will determine evidence-based recommendations for Soldier reintegration strategies into their units and society; will develop and refine evidence-based resilience training strategies for the deployment cycle; will develop best practice recommendations based on research findings to facilitate Warfighters receiving the best possible training and provider care; and will 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 will work toward facilitating confidence in the Warfighter and provider that the Warfighter is psychologically fit to return to duty.</p>			
<p><b>Title:</b> Psychological Health &amp; Resilience - Suicide Prevention and Treatment of PTSD</p> <p><b>Description:</b> This effort supports investigation of methods to treat PTSD in a military population and identifies causative and preventive factors in military suicides.</p> <p><b>FY 2012 Accomplishments:</b> Conducted assessments to identify long-term effects of deployment (multiple and prolonged deployments, dwell time, and combat intensity) related to mental health symptoms (PTSD, etc.) and other illnesses (respiratory, hearing, functional, and cognitive) and assessed effectiveness of increasing suicide awareness training with decreasing suicide-related behaviors and intentions.</p> <p><b>FY 2013 Plans:</b> Refine specific interventions for the most effective means of treating deployment-related PTSD, including medications, psychotherapy, and complementary alternative medicine approaches and refine valid screening and assessment measures for the Soldier at risk of suicide. These early intervention strategies will be used to reduce suicide rates among Service members. Determine effectiveness of suicide prevention training for increasing suicide awareness and decreasing suicide-related behaviors and intent. These results will help increase psychological resilience and mitigate the potential for suicide. Additionally, these results complement work in 6.3 Project MM3 and related DHP programs.</p> <p><b>FY 2014 Plans:</b> Will test the effectiveness of a brief, telephone-based intervention to increase behavioral health treatment-seeking among Service members at high risk of suicide; will learn about the type and range of decisions made by behavioral healthcare providers,</p>		3.839	3.270
			1.014



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
chaplains, and leaders to address suicide-related events that occur during deployment, the process for making these decisions, and the lessons learned; will assess how suicide-related events were managed and what could be improved; and will develop guidelines and decision aids for use in deployed settings when suicide-related events occur.				
<b>Title:</b> Psychological Health & Resilience - Concussion/Mild Traumatic Brain Injury (mTBI) Interventions  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Determined whether concussion/mTBI-related neurocognitive performance deficits predict other objective neurophysiological indicators of functional capability and assessed impact of neurocognitive measures for tracking/monitoring recovery rate and for providing guidance for the determination of return-to-duty status.  <b>FY 2013 Plans:</b> Refine an evidence (data)-based comparative analysis of the foremost neurocognitive (functions of the brain) tests for assessment of mTBI in Soldiers; conduct 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.  <b>FY 2014 Plans:</b> Will conduct research to evaluate the utility of magnetoencephalography (MEG), a cutting-edge imaging technique for the brain, as a tool for differentiating PTSD from the brain injury following a post-concussion event; will compare two imaging techniques (MEG and functional magnetic resonance imaging) for effectively assessing brain injury following a post-concussion event; These efforts will lead to more effective assessment of Warriors brain injury post-concussion and will facilitate appropriate care.		1.662	1.434	1.226
<b>Accomplishments/Planned Programs Subtotals</b>		37.910	38.907	34.728
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	PROJECT 869: <i>Warfighter Health Prot &amp; Perf Stnds</i>

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT 870: Dod Med Def Ag Inf Dis			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
870: Dod Med Def Ag Inf Dis	-	16.842	18.987	19.072	-	19.072	20.828	22.500	23.725	25.618	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 (living in or on another organism) 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, and effectiveness, and are necessary to provide evidence to the 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 NMRC. The Army is responsible for programming and funding all DoD naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY	PROJECT 870: Dod Med Def Ag Inf Dis		
<p>Promising medical countermeasures identified in this project are further matured under PE 0603002A, project 810.</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>Work in this project is performed by the WRAIR, Silver Spring, MD, and its overseas laboratories; USAMRIID, Fort Detrick, MD; and NMRC, Silver Spring, MD, and its overseas laboratories.</p>				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<p><b>Title:</b> Drugs to Prevent/Treat Parasitic Diseases (harmful effects on host by an infecting organism)</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b> Undertook preclinical effectiveness and toxicity evaluations of selected antiparasitic compounds, both in vitro (outside the body) and in vivo (within a living organism), in rat/nonhuman primates and down-selected for advancement to clinical studies in humans.</p> <p><b>FY 2013 Plans:</b> Evaluate selected compounds for anti-parasitic effectiveness in animal models to further down-select for human trials and validate new malaria and leishmania models for predicting drug effectiveness and toxicity for future drug testing.</p> <p><b>FY 2014 Plans:</b> Will test new refined compounds in animal models for drug safety and effectiveness to evaluate anti- malarial and anti-leishmania activities of these compounds.</p>		3.925	4.337	4.463
<p><b>Title:</b> Vaccines for Prevention of Malaria</p> <p><b>Description:</b> 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><b>FY 2012 Accomplishments:</b></p>		4.634	4.522	4.199

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY	PROJECT 870: Dod Med Def Ag Inf Dis		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
Selected candidate antigens (substance that when introduced into the body stimulates the production of an antibody) for further evaluation in preclinical testing and advanced those candidates demonstrating effectiveness in primate testing toward further development. <b>FY 2013 Plans:</b> Optimize 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. <b>FY 2014 Plans:</b> Will 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.				
<b>Title:</b> Diagnostics and Disease Transmission Control:  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Developed and optimized a multi-drug resistant organism diagnostic tool in collaboration with a commercial partner; transitioned the dengue virus diagnostic test for the Joint Biological Agent Identification System (JBAIDS) platform to Advanced Development following preclinical trials; and determined the next group of pathogens (infectious agents) for which to develop rapid diagnostic tools with commercial partnership.  <b>FY 2013 Plans:</b> Refine diagnostic tools that provide on-the-spot identification of biting insects/tick/mites and their human/animal pathogen (infectious agent) infection status; evaluate new non-pesticidal technologies for insect population control; refine data package to obtain FDA clearance on the dengue JBAIDS assay; and evaluate next-generation diagnostic system platforms.  <b>FY 2014 Plans:</b> Will 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 will complete the dengue assay for use on testing mosquitoes to see if they carry the pathogen (infectious agent) of interest to Warfighters.		1.709	1.949	2.040
<b>Title:</b> Viral Threats Research		2.989	3.726	3.771

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 870: <i>Dod Med Def Ag Inf Dis</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<p><b>Description:</b> This effort designs and laboratory tests new vaccine candidates against HIV, dengue and other hemorrhagic fever viruses such as hantaviruses (cause of Korean hemorrhagic fever) and other lethal viruses (i.e., Lassa fever and Crimean-Congo hemorrhagic fever), and assesses other non-vaccine technologies to protect against such lethal viral diseases. Efforts also include establishment and maintenance of clinical trial sites worldwide.</p> <p><b>FY 2012 Accomplishments:</b> Continued to develop proof-of-concept molecular vaccines for viruses of military importance; conducted effectiveness studies to develop and/or maintain vaccine test site infrastructure; refined and validated assays in animal studies for future testing of dengue fever vaccine trials; and established partnerships with industry for pre-clinical and clinical evaluation of medical countermeasures.</p> <p><b>FY 2013 Plans:</b> Refine vaccines for viruses of military importance; conduct effectiveness studies to refine and/or maintain vaccine test site infrastructure; refine and validate assays in animal studies for future testing of dengue fever vaccine trials; establish partnerships with industry for pre-clinical and clinical evaluation of medical countermeasures; investigate the feasibility of combining vaccines against different agents into single-label, multi-agent vaccines; identify and characterize new populations who are at high risk of being infected with HIV for clinical evaluation of potential vaccine candidates at overseas sites; and produce vaccines for various HIV subtypes and complete evaluation in animals.</p> <p><b>FY 2014 Plans:</b> Will 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><b>Title:</b> Bacterial Threats</p> <p><b>Description:</b> This effort conducts studies to refine antibacterial countermeasures, including vaccine candidates, to prevent diarrhea (a common disease in deployed troops caused by E. coli, Campylobacter, and Shigella), meningitis (a threat to trainees, deployed troops, and military families), wound infection, and scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics).</p> <p><b>FY 2012 Accomplishments:</b> Determined level of protection of alternative E. coli vaccine in animal challenge studies (animal vaccinated and challenged with bacteria causing diarrhea); performed animal and toxicology studies on alternative (Invaplex-AR) Shigella vaccine; Campylobacter vaccine have been delayed until FY14 due to technical and funding issues; and performed animal wound infection studies on</p>		3.585	4.453
			4.599

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 870: <i>Dod Med Def Ag Inf Dis</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
several candidate products to prevent wound infection and biofilm (thin resistant layer of microorganisms that helps bacteria survive in wounds) formation.  <b>FY 2013 Plans:</b> Scale-up vaccine formulation process and conduct toxicity testing on additional E. coli vaccine candidates to ensure adequate safety and vaccine protection coverage; conduct preclinical animal studies to determine safety and immune response to live-attenuated Shigella bivalent (two types) vaccine; and perform 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.  <b>FY 2014 Plans:</b> Will continue to evaluate new vaccine candidates against three diarrheal pathogens (infectious agents) (Shigella, Campylobacter, and E. coli) in animal models and will 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.				
<b>Accomplishments/Planned Programs Subtotals</b>		16.842	18.987	19.072
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT 873: HIV Exploratory Rsch			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
873: HIV Exploratory Rsch	-	9.117	8.986	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date

## **A. Mission Description and Budget Item Justification**

This project conducts research on HIV, which causes 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 program is jointly managed through an Interagency Agreement between USAMRMC and the National Institute of Allergy and Infectious Diseases of the National Institutes of Health. 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 WRAIR and NMRC, Silver Spring, MD, and their overseas laboratories. The Henry M. Jackson Foundation (HMJF), located in Rockville, MD provides support for 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)**

	<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
<b>Title:</b> HIV Research Program	9.117	8.986	0.000
<b>Description:</b> This effort assesses new HIV vaccine candidates and worldwide vaccine test sites, tracks HIV disease outbreaks, and analyzes the genetic attributes of HIV threat.			
<b>FY 2012 Accomplishments:</b> Characterized and developed new populations at high risk of being infected with HIV for clinical evaluation of potential vaccine candidates at overseas sites; studied the impact of human genetics on HIV vaccine development, disease acquisition, and			



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 873: <i>HIV Exploratory Rsch</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
disease progression; manufactured vaccines for various HIV subtypes present worldwide and completed testing in animals; and evaluated and implemented methods of disease prevention through clinical research.			
<b>FY 2013 Plans:</b> Identify, refine, and maintain new clinical trial sites in Africa and Asia; manufacture vaccine candidates based on HIV subtypes present in Africa and Asia to perform pre-clinical testing in laboratory animals; and test selected vaccine candidates in non-human, primate models to test safety and effectiveness of vaccine candidates to down-select best candidates for further testing in humans.			
<b>Accomplishments/Planned Programs Subtotals</b>		9.117	8.986
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT 874: Cbt Casualty Care Tech			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
874: Cbt Casualty Care Tech	-	16.837	19.821	18.271	-	18.271	16.829	17.693	18.788	20.119	Continuing	Continuing

<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

<sup>##</sup> The FY 2014 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 USAISR, the U.S. Army Dental Trauma Research Detachment (USADTRD), Fort Sam Houston, TX; 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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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 874: <i>Cbt Casualty Care Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
<b>Title:</b> Damage Control Resuscitation  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Initiated studies of blood vessels, platelets (cell fragments that play a role in blood clotting), and coagulation (blood clotting) factor contributions to the body's ability to properly clot blood following trauma, as well as determine whether blood products cause inflammation.  <b>FY 2013 Plans:</b> Continue coagulation (blood clotting) factor and inflammation studies; validate 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.  <b>FY 2014 Plans:</b> Will continue validation studies of portable, rapid, point-of-care devices that provide care givers information on clotting ability to guide resuscitation and will perform studies of blood product storage technologies suitable for use under battlefield conditions.		5.094	5.003
<b>Title:</b> Combat Trauma Therapies  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Developed local antibiotic delivery that can be used with negative pressure wound therapy; conducted studies of pre- vs. post-deployment dental classification; conducted research in skin, muscle, and bone repair; and moved work related to neuroprotection research to the TBI program and moved regenerative efforts in craniomaxillofacial trauma (soft tissue and skeletal injuries to the face, head and neck) to the Clinical and Rehabilitative Medicine Research Program.  <b>FY 2013 Plans:</b> Study 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.  <b>FY 2014 Plans:</b>		1.615	0.611

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 874: <i>Cbt Casualty Care Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Will formulate an anti-biofilm wound gel to combat wound infections, prevent chronic infections, and hasten wound healing.			<b>FY 2014</b>
<b>Title:</b> Combat Critical Care Engineering  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Developed advanced monitoring technology to rapidly and accurately detect early-onset of blood loss, continuously estimate blood loss volume, and predict patient's risk for cardiovascular collapse.  <b>FY 2013 Plans:</b> Further refine algorithms to track blood loss under conditions of heat, cold, dehydration, varying rates of blood loss, etc., to determine possible causal relationships.  <b>FY 2014 Plans:</b> Will continue work to optimize algorithms to improve fluid resuscitation and prevent hemorrhagic shock and will work to develop decision support algorithms to guide provision of critical care to casualties at the point of injury, during transport, and in field hospital.		0.753	1.525
<b>Title:</b> Clinical and Rehabilitative Medicine  <b>Description:</b> 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.  <b>FY 2012 Accomplishments:</b> Continued evaluation of novel drug delivery, diagnostic, and/or tissue repair strategies for eye injury; evaluated candidate strategies for maxillofacial (head, neck, face and jaw) reconstruction, including wound-healing control and tissue engineering/regeneration techniques to restore facial features; continued development and standardization of animal models for an artificial means for guiding nerve regeneration; continued studies of chronic bone defect and burn repair; continued studies of soft tissue repair strategies; and continued development and testing of experimental stem cell therapies and scaffolds (tissue-engineered grafts) in animal models.  <b>FY 2013 Plans:</b> Refine novel drug delivery, diagnostic, and tissue repair strategies including stem cell therapies utilizing knowledge deliverables from FY2012; further refine animal models to assess soft and hard tissue regeneration technologies; continue studies of burn,		7.613	10.626

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 874: <i>Cbt Casualty Care Tech</i>	
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
scar-less wound, soft tissue, and bone repair strategies; expand refinement and testing of stem cell therapies and scaffolds (tissue-engineered grafts) in animal models; and build on promising approaches from FY2012 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.			
<b>FY 2014 Plans:</b> Will down-select novel drug delivery, diagnostic, tissue repair, and treatment strategies including pharmacologic (drugs) and stem cell therapies for eye trauma injury; will incrementally build on past successes to refine and develop novel drug delivery, diagnostic, reconstructive, and regenerative strategies; will 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 will build on promising 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.			
<b>Title:</b> Traumatic Brain Injury			
<b>Description:</b> This effort supports refinement of drugs and therapeutic strategies to manage brain injury resulting from battlefield trauma, to include 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.			
<b>FY 2012 Accomplishments:</b> Realigned neuroprotection research from the Combat Trauma Therapies task area to the TBI task area and continued studies of a single and combination drug therapies of silent seizures, animal studies of stem cell therapy for repair of brain tissue, and optimizing cooling temperature and duration of cooling to improve functional recovery.			
<b>FY 2013 Plans:</b> Further investigate selective brain cooling and non-embryonic stem cells derived from human amniotic fluid as non-traditional therapies for TBI.			
<b>FY 2014 Plans:</b> Will continue development of selective brain cooling and neural (nervous system) stem cell transplantation as non-traditional therapies for traumatic brain injury and will develop a combat-relevant animal model of repeated mild TBI/concussion.			
<b>Accomplishments/Planned Programs Subtotals</b>		1.762	2.546
			2.014
		16.837	19.821
			18.271
<b>C. Other Program Funding Summary (\$ in Millions)</b>			
N/A			

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> 874: <i>Cbt Casualty Care Tech</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b>		
<b>Remarks</b>		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT FH2: Force Health Protection - Applied Research			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
FH2: Force Health Protection - Applied Research	-	8.888	6.279	6.316	-	6.316	7.436	6.523	7.568	7.686	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
<p>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.</p>												
<p>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.</p>												
<p>Research conducted in this project focuses on the following three areas:</p> <p>(1) Millennium Cohort Research</p> <p>(2) Biomarkers of Exposure and Environmental Biomonitoring</p> <p>(3) Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injuries</p>												
<p>Promising efforts identified in this project are further matured under PE 0603002A, project FH4.</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>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 USARIEM, Natick, MA.</p>												
<p>Efforts in this project support the Soldier Portfolio and the principal area of Combat Casualty Care.</p>												

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY	PROJECT FH2: Force Health Protection - Applied Research		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<b>Title:</b> Millennium Cohort Research  <b>Description:</b> 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 design 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.  <b>FY 2012 Accomplishments:</b> Developed policy recommendations and potential intervention strategies for reduction of PTSD, depression, and anxiety symptoms and factors with a goal to reduce overall mental health symptoms.  <b>FY 2013 Plans:</b> Plan and conduct analyses to further identify gender risk differences for PTSD and depression associated with deployment; examine return-to-duty parameters related to multiple health and injury illnesses; and disseminate 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.  <b>FY 2014 Plans:</b> Will 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 will 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.		4.280	4.068	4.520
<b>Title:</b> Biomarkers of Exposure and Environmental Biomonitoring  <b>Description:</b> This effort supports refinement and evaluation of methods to detect environmental contamination and toxic exposure during military operations.  <b>FY 2012 Accomplishments:</b> Provided rapid toxicity identification for industrial and agricultural chemicals in Army field drinking water supplies and completed and submitted prototype toxicity sensors for evaluation based on the EPA's Technology Testing and Evaluation Program.  <b>FY 2013 Plans:</b>		2.925	0.757	0.719



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> FH2: <i>Force Health Protection - Applied Research</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
Conduct assessment of high-priority Army research needs in nanomaterial characterization, exposure assessment, toxicity studies, or risk assessment. This research provides Soldiers with exposure risk health assessment to the potential health hazards associated with nanomaterials in the environment.			
<b>FY 2014 Plans:</b> Will apply a risk ranking system to provide a screening-level assessment for hazardous exposures to the identified Army nanomaterials. These studies will identify Army materiel nanomaterials associated with having the highest initial risk rankings of potential exposures to Warriors			
<b>Title:</b> Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injury <b>Description:</b> 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.		1.683	1.454
<b>FY 2012 Accomplishments:</b> Developed software that evaluated the combined physiological effects of toxic gas exposure; assessed software that estimates lung, heart, and rib injury from blunt trauma caused by debris impact (secondary blast injury); and assessed increased functionality and support of end-users for health hazard assessment, survivability assessment, and personal protection evaluation and improvement.			
<b>FY 2013 Plans:</b> Refine 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.			
<b>FY 2014 Plans:</b> Will 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.			
<b>Accomplishments/Planned Programs Subtotals</b>		8.888	6.279
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	PROJECT FH2: <i>Force Health Protection - Applied Research</i>

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT VB4: System Biology And Network Science Technology			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
VB4: System Biology And Network Science Technology	-	4.596	4.802	4.839	-	4.839	4.792	4.869	4.957	5.048	Continuing	Continuing
<sup>#</sup> FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
<sup>##</sup> The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
This project conducts research in systems biology to provide a highly effective mechanism to understand, compare, and combine iterative biological tests, computer simulations, and animal studies that have the potential to significantly reduce the time and effort invested in medical product refinement.												
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 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 2012	FY 2013	FY 2014
Title: Systems Biology										4.596	4.802	4.839
Description: This project conducts multidisciplinary applied research in systems biology designed to understand, compare, and combine animal studies, computational simulations, and biologics (products derived from living organisms).												
FY 2012 Accomplishments: Refined experimental systems for assessment and enhancement of computational models for identifying pharmacological interventions for heat stroke-caused multi-organ failure. Developed multidisciplinary approaches to predict health effects from occupational and environmental stressors and the host responses to environmental hazards. Also assessed the pulmonary (lung) effects of inhalational environmental exposures in Southwest Asia.												
FY 2013 Plans: Perform 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]); refine and begin validating a computational platform and												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>	<b>PROJECT</b> VB4: <i>System Biology And Network Science Technology</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>
mathematical models for biological responses to toxicity, disease, and injury; and identify candidate biomarkers for adverse host responses.			
<b>FY 2014 Plans:</b> Will evaluate high-content data sets from environmental exposures using computational platform to identify activated-toxicity pathways (understanding the physiology of toxicity) and will screen and down-select candidate PTSD and coagulopathy (abnormal blood clotting) biomarkers for further analysis and validation.			
<b>Accomplishments/Planned Programs Subtotals</b>		4.596	4.802
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A			
<b>Remarks</b>			
<b>D. Acquisition Strategy</b> N/A			
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.			

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Exhibit R-2A, RDT&E Project Justification: PB 2014 Army									DATE: April 2013			
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602787A: MEDICAL TECHNOLOGY				PROJECT VJ4: Suicide Prevention/Mitigation			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 <sup>#</sup>	FY 2014 Base	FY 2014 OCO <sup>##</sup>	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
VJ4: Suicide Prevention/Mitigation	-	10.000	10.109	10.114	-	10.114	0.000	0.000	0.000	0.000	Continuing	Continuing
# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
## The FY 2014 OCO Request will be submitted at a later date												
A. Mission Description and Budget Item Justification												
This project funds research over a planned 5-year period to examine the mental and behavioral health of Soldiers to counter suicidal behavior. This work will focus on advancing understanding of the multiple determinants of suicidal behavior, psychopathology (study of the causes and nature of abnormal behavior), psychological resilience, and role functioning. A significant thrust area will focus on the refinement of better methods for preventing and mitigating suicidal behavior as well as to improve the overall mental health and behavioral function of Army personnel during and after their military service.												
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) through extramural cooperative research grants in collaboration with the Department of the Army.												
Efforts in this project support the Soldier Portfolio and the principal area of Military Operational Medicine.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: Suicide Prevention/Mitigation									10.000	10.109	10.114	
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 2012 Accomplishments: Continued epidemiological (population-based) studies to further identify determinants of suicidal behavior as well as potential modifiable risk factors; collected data for suicide-death case control study; and conducted research efforts to assist in improved identification of individuals at greatest risk for suicide as well as to validate screening measures and enhance prevention/intervention methods.												
FY 2013 Plans:												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2014 Army		<b>DATE:</b> April 2013		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A: <i>MEDICAL TECHNOLOGY</i>		<b>PROJECT</b> VJ4: <i>Suicide Prevention/Mitigation</i>
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2012</b>	<b>FY 2013</b>	<b>FY 2014</b>
Continue epidemiological (population-based) studies to further identify determinants of suicidal behavior and potential modifiable risk factors; collect data for suicide-death case control study; and conduct research efforts to assist in improved identification of individuals at greatest risk for suicide, validate screening measures, and enhance prevention/intervention methods.				
<b>FY 2014 Plans:</b> Will develop data-driven methods for mitigating or preventing suicide behaviors in service members (Active Duty and Reserve Component Soldiers) from a longitudinal study; will determine modifiable risk and protective factors associated with suicide, mental health and psychological resilience; will refine at risk factors for identification of individuals who are at a greater risk for suicide; will refine improved suicide prevention interventions.				
<b>Accomplishments/Planned Programs Subtotals</b>		10.000	10.109	10.114
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				



