Department of Defense
Fiscal Year (FY) 2013 President's Budget Submission

February 2012

Army

Justification Book

Research, Development, Test & Evaluation, Army

RDT&E - Volume I, Budget Activity 2

Department of the Army

FY 2013 RDT&E Program

President's Budget 2013

Summary

Exhibit R-1

06-Jan-2012

Summary Recap of Budget Activities	Thousands of Dollars				
	FY2011	FY2012	FY2013	FY2013 OCO	FY2013 Total
Basic research	388,660	456,200	444,071	0	444,071
Applied Research	825,021	946,836	874,730	0	874,730
Advanced technology development	804,783	1,132,838	890,722	0	890,722
Advanced Component Development and Prototypes	930,583	544,328	610,121	19,860	629,981
System Development and Demonstration	3,968,785	3,238,656	3,286,629	0	3,286,629
Management support	1,400,358	1,097,294	1,153,980	0	1,153,980
Operational system development	1,437,782	1,339,540	1,664,534	0	1,664,534
Total RDT&E, Army	9,755,972	8,755,692	8,924,787	19,860	8,944,647

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Line No	Program Element Number	Act	Item	Thousands of Dollars FY2011	FY2012	FY2013	FY2013 OCO	FY2013 Total
			Basic research					
1	0601101A	01	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	21,095	21,031	20,860		20,860
2	0601102A	01	DEFENSE RESEARCH SCIENCES	190,019	213,604	219,180		219,180
3	0601103A	01	UNIVERSITY RESEARCH INITIATIVES	84,445	80,850	80,986		80,986
4	0601104A	01	UNIVERSITY AND INDUSTRY RESEARCH CENTERS	93,101	140,715	123,045		123,045
			Total: Basic research	388,660	456,200	444,071	0	444,071
			Applied Research					
5	0602105A	02	MATERIALS TECHNOLOGY	28,730	50,679	29,041		29,041
6	0602120A	02	SENSORS AND ELECTRONIC SURVIVABILITY	46,491	43,453	45,260		45,260
7	0602122A	02	TRACTOR HIP	14,126	14,207	22,439		22,439
8	0602211A	02	AVIATION TECHNOLOGY	40,869	44,539	51,607		51,607
9	0602270A	02	ELECTRONIC WARFARE TECHNOLOGY	16,939	15,765	15,068		15,068
10	0602303A	02	MISSILE TECHNOLOGY	48,092	67,079	49,383		49,383
11	0602307A	02	ADVANCED WEAPONS TECHNOLOGY	17,542	20,002	25,999		25,999
12	0602308A	02	ADVANCED CONCEPTS AND SIMULATION	19,907	20,900	23,507		23,507
13	0602601A	02	COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	61,893	64,205	69,062		69,062
14	0602618A	02	BALLISTICS TECHNOLOGY	60,595	59,121	60,823		60,823
15	0602622A	02	CHEMICAL, SMOKE AND EQUIPMENT DEFEATING TECHNOLOGY	10,555	4,869	4,465		4,465
16	0602623A	02	JOINT SERVICE SMALL ARMS PROGRAM	7,630	8,231	7,169		7,169
17	0602624A	02	WEAPONS AND MUNITIONS TECHNOLOGY	41,368	54,727	35,218		35,218
18	0602705A	02	ELECTRONICS AND ELECTRONIC DEVICES	63,186	62,862	60,300		60,300
19	0602709A	02	NIGHT VISION TECHNOLOGY	39,131	55,116	53,244		53,244
20	0602712A	02	COUNTERMINE SYSTEMS	18,507	32,728	18,850		18,850
21	0602716A	02	HUMAN FACTORS ENGINEERING TECHNOLOGY	20,583	21,767	19,872		19,872
22	0602720A	02	ENVIRONMENTAL QUALITY TECHNOLOGY	21,704	20,804	20,095		20,095
23	0602782A	02	COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	24,914	26,075	28,852		28,852
24	0602783A	02	COMPUTER AND SOFTWARE TECHNOLOGY	6,599	8,577	9,830		9,830
25	0602784A	02	MILITARY ENGINEERING TECHNOLOGY	73,346	80,190	70,693		70,693

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26	0602785A	02	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	18,982	18,917	17,781		17,781
27	0602786A	02	WARFIGHTER TECHNOLOGY	26,972	46,261	28,281		28,281
28	0602787A	02	MEDICAL TECHNOLOGY	96,360	105,762	107,891		107,891
	Total:		Applied Research	825,021	946,836	874,730	0	874,730
			Advanced technology development					
29	0603001A	03	WARFIGHTER ADVANCED TECHNOLOGY	36,122	52,896	39,359		39,359
30	0603002A	03	MEDICAL ADVANCED TECHNOLOGY	114,036	102,810	69,580		69,580
31	0603003A	03	AVIATION ADVANCED TECHNOLOGY	55,492	62,095	64,215		64,215
32	0603004A	03	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	65,495	76,955	67,613		67,613
33	0603005A	03	COMBAT VEHICLE AND AUTOMOTIVE ADVANCED TECHNOLOGY	125,677	145,914	104,359		104,359
34	0603006A	03	COMMAND, CONTROL, COMMUNICATIONS ADVANCED TECHNOLOGY	7,823	5,304	4,157		4,157
35	0603007A	03	MANPOWER, PERSONNEL AND TRAINING ADVANCED TECHNOLOGY	7,694	10,282	9,856		9,856
36	0603008A	03	ELECTRONIC WARFARE ADVANCED TECHNOLOGY	48,698	69,852	50,661		50,661
37	0603009A	03	TRACTOR HIKE	7,761	8,142	9,126		9,126
38	0603015A	03	NEXT GENERATION TRAINING & SIMULATION SYSTEMS	14,788	17,907	17,257		17,257
39	0603020A	03	TRACTOR ROSE	11,872	12,577	9,925		9,925
40	0603105A	03	MILITARY HIV RESEARCH	25,738	22,760	6,984		6,984
41	0603125A	03	COMBATING TERRORISM - TECHNOLOGY DEVELOPMENT	9,424	22,172	9,716		9,716
42	0603130A	03	TRACTOR NAIL		4,271	3,487		3,487
43	0603131A	03	TRACTOR EGGS		2,257	2,323		2,323
44	0603270A	03	ELECTRONIC WARFARE TECHNOLOGY	18,973	23,640	21,683		21,683
45	0603313A	03	MISSILE AND ROCKET ADVANCED TECHNOLOGY	76,272	90,458	71,111		71,111
46	0603322A	03	TRACTOR CAGE	9,661	10,299	10,902		10,902
47	0603461A	03	HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM		227,790	180,582		180,582
48	0603606A	03	LANDMINE WARFARE AND BARRIER ADVANCED TECHNOLOGY	26,089	31,491	27,204		27,204
49	0603607A	03	JOINT SERVICE SMALL ARMS PROGRAM	8,236	7,674	6,095		6,095
50	0603710A	03	NIGHT VISION ADVANCED TECHNOLOGY	71,723	42,348	37,217		37,217
51	0603728A	03	ENVIRONMENTAL QUALITY TECHNOLOGY DEMONSTRATIONS	15,417	15,934	13,626		13,626
52	0603734A	03	MILITARY ENGINEERING ADVANCED TECHNOLOGY	23,617	36,458	28,458		28,458

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53	0603772A	03	ADVANCED TACTICAL COMPUTER SCIENCE AND SENSOR TECHNOLOGY	24,175	30,552	25,226		25,226
	Total:		Advanced technology development	804,783	1,132,838	890,722	0	890,722
			Advanced Component Development and Prototypes					
54	0603305A	04	ARMY MISSLE DEFENSE SYSTEMS INTEGRATION	11,156	24,386	14,505		14,505
55	0603308A	04	ARMY SPACE SYSTEMS INTEGRATION	29,845	9,763	9,876		9,876
56	0603619A	04	LANDMINE WARFARE AND BARRIER - ADV DEV	14,686	19,596	5,054		5,054
57	0603627A	04	SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ADV DEV	2,337	4,572	2,725		2,725
58	0603639A	04	TANK AND MEDIUM CALIBER AMMUNITION	35,849	40,314	30,560		30,560
59	0603653A	04	ADVANCED TANK ARMAMENT SYSTEM (ATAS)	200,312	65,417	14,347		14,347
60	0603747A	04	SOLDIER SUPPORT AND SURVIVABILITY	26,847	13,903	10,073	19,860	29,933
61	0603766A	04	TACTICAL ELECTRONIC SURVEILLANCE SYSTEM - ADV DEV	19,610	5,856	8,660		8,660
62	0603774A	04	NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	4,975		10,715		10,715
63	0603779A	04	ENVIRONMENTAL QUALITY TECHNOLOGY - DEM/VAL	3,622	5,023	4,631		4,631
64	0603782A	04	WARFIGHTER INFORMATION NETWORK-TACTICAL - DEM/VAL	200,732	185,819	278,018		278,018
65	0603790A	04	NATO RESEARCH AND DEVELOPMENT	4,879	4,839	4,961		4,961
66	0603801A	04	AVIATION - ADV DEV	8,058	7,218	8,602		8,602
67	0603804A	04	LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	62,999	12,706	14,605		14,605
68	0603805A	04	COMBAT SERVICE SUPPORT CONTROL SYSTEM EVALUATION AND ANALYSIS	20,801	5,250	5,054		5,054
69	0603807A	04	MEDICAL SYSTEMS - ADV DEV	27,247	35,543	24,384		24,384
70	0603827A	04	SOLDIER SYSTEMS - ADVANCED DEVELOPMENT	51,415	18,030	32,050		32,050
71	0603850A	04	INTEGRATED BROADCAST SERVICE	939	1,494	96		96
72	0604115A	04	TECHNOLOGY MATURATION INITIATIVES	3,000	10,165	24,868		24,868
73	0604131A	04	TRACTOR JUTE		15,584	59		59
74	0604284A	04	JOINT COOPERATIVE TARGET IDENTIFICATION - GROUND (JCTI-G) / TECHNOLOG		15,287			
75	0604319A	04	INDIRECT FIRE PROTECTION CAPABILITY INCREMENT 2-INTERCEPT (IFPC2)			76,039		76,039
76	0604775A	04	DEFENSE RAPID INNOVATION PROGRAM	101,265				
77	0604785A	04	INTEGRATED BASE DEFENSE (BUDGET ACTIVITY 4)			4,043		4,043
78	0305205A	04	ENDURANCE UAVS	100,009	43,563	26,196		26,196

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	Total:		Advanced Component Development and Prototypes	930,583	544,328	610,121	19,860	629,981
			System Development and Demonstration					
79	0604201A	05	AIRCRAFT AVIONICS	70,926	119,573	78,538		78,538
80	0604220A	05	ARMED, DEPLOYABLE HELOS	69,922	82,363	70,277		70,277
81	0604270A	05	ELECTRONIC WARFARE DEVELOPMENT	196,428	34,233	181,347		181,347
82	0604280A	05	JOINT TACTICAL RADIO	755				
83	0604290A	05	MID-TIER NETWORKING VEHICULAR RADION (MNVR)			12,636		12,636
84	0604321A	05	ALL SOURCE ANALYSIS SYSTEM	24,322	7,405	5,694		5,694
85	0604328A	05	TRACTOR CAGE	17,914	26,552	32,095		32,095
86	0604601A	05	INFANTRY SUPPORT WEAPONS	73,008	83,395	96,478		96,478
87	0604604A	05	MEDIUM TACTICAL VEHICLES	3,578	3,957	3,006		3,006
88	0604609A	05	SMOKE, OBSCURANT AND TARGET DEFEATING SYS - ENG DEV	5,146				
89	0604611A	05	JAVELIN		9,930	5,040		5,040
90	0604622A	05	FAMILY OF HEAVY TACTICAL VEHICLES	2,829	55,426	3,077		3,077
91	0604633A	05	AIR TRAFFIC CONTROL	9,559	22,900	9,769		9,769
92	0604641A	05	TACTICAL UNMANNED GROUND VEHICLE (TUGV)			13,141		13,141
93	0604642A	05	LIGHT TACTICAL WHEELED VEHICLES	1,918	19,981	20,217		20,217
94	0604661A	05	FCS SYSTEMS OF SYSTEMS ENGR & PROGRAM MGMT	471,559	298,589			
95	0604662A	05	FCS RECONNAISSANCE (UAV) PLATFORMS	18,792				
96	0604663A	05	FCS UNMANNED GROUND VEHICLES	200,000	35,966			
97	0604664A	05	FCS UNATTENDED GROUND SENSORS	1,451				
98	0604665A	05	FCS SUSTAINMENT & TRAINING R&D	598,673				
99	0604710A	05	NIGHT VISION SYSTEMS - ENG DEV	44,513	59,195	32,621		32,621
100	0604713A	05	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	2,043	2,073	2,132		2,132
101	0604715A	05	NON-SYSTEM TRAINING DEVICES - ENG DEV	26,848	29,981	44,787		44,787
102	0604716A	05	TERRAIN INFORMATION - ENG DEV		1,594	1,008		1,008
103	0604741A	05	AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE - ENG DEV	139,662	82,932	73,333		73,333
104	0604742A	05	CONSTRUCTIVE SIMULATION SYSTEMS DEVELOPMENT	29,287	28,274	28,937		28,937
105	0604746A	05	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	13,553	14,361	10,815		10,815

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106	0604760A	05	DISTRIBUTIVE INTERACTIVE SIMULATIONS (DIS) - ENG DEV	15,031	15,787	13,926		13,926
107	0604780A	05	COMBINED ARMS TACTICAL TRAINER (CATT) CORE	26,699	22,205	17,797		17,797
108	0604798A	05	BRIGADE ANALYSIS, INTEGRATION AND EVALUATION			214,270		214,270
109	0604802A	05	WEAPONS AND MUNITIONS - ENG DEV	25,099	13,815	14,581		14,581
110	0604804A	05	LOGISTICS AND ENGINEER EQUIPMENT - ENG DEV	39,588	173,146	43,706		43,706
111	0604805A	05	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ENG DEV	73,042	81,733	20,776		20,776
112	0604807A	05	MEDICAL MATERIEL/MEDICAL BIOLOGICAL DEFENSE EQUIPMENT - ENG DEV	33,262	27,132	43,395		43,395
113	0604808A	05	LANDMINE WARFARE/BARRIER - ENG DEV	37,707	76,248	104,983		104,983
114	0604814A	05	ARTILLERY MUNITIONS - EMD	25,467	37,592	4,346		4,346
115	0604817A	05	COMBAT IDENTIFICATION	2,893				
116	0604818A	05	ARMY TACTICAL COMMAND & CONTROL HARDWARE & SOFTWARE	57,264	93,846	77,223		77,223
117	0604820A	05	RADAR DEVELOPMENT		2,885	3,486		3,486
118	0604822A	05	GENERAL FUND ENTERPRISE BUSINESS SYSTEM (GFEBS)	13,094	793	9,963		9,963
119	0604823A	05	FIREFINDER	22,455	10,348	20,517		20,517
120	0604827A	05	SOLDIER SYSTEMS - WARRIOR DEM/VAL	20,122	61,350	51,851		51,851
121	0604854A	05	ARTILLERY SYSTEMS - EMD	99,937	120,032	167,797		167,797
122	0604869A	05	PATRIOT/MEADS COMBINED AGGREGATE PROGRAM (CAP)	450,584	389,630	400,861		400,861
123	0604870A	05	NUCLEAR ARMS CONTROL MONITORING SENSOR NETWORK	7,017	7,391	7,922		7,922
124	0605013A	05	INFORMATION TECHNOLOGY DEVELOPMENT	50,054	32,065	51,463		51,463
125	0605018A	05	INTEGRATED PERSONNEL AND PAY SYSTEM-ARMY (IPPS-A)	58,348	68,628	158,646		158,646
126	0605450A	05	JOINT AIR-TO-GROUND MISSILE (JAGM)	71,760	126,895	10,000		10,000
127	0605455A	05	SLAMRAAM	18,358	1,529			
128	0605456A	05	PAC-3/MSE MISSILE	121,475	88,909	69,029		69,029
129	0605457A	05	ARMY INTEGRATED AIR AND MISSILE DEFENSE (AIAMD)	246,691	270,180	277,374		277,374
130	0605625A	05	MANNED GROUND VEHICLE	312,269	448,679	639,874		639,874
131	0605626A	05	AERIAL COMMON SENSOR	101,171	31,435	47,426		47,426
132	0605812A	05	JOINT LIGHT TACTICAL VEHICLE (JLTV) ENGINEERING AND MANUFACTURING D			72,295		72,295
133	0303032A	05	TROJAN - RH12	3,578	3,916	4,232		4,232
134	0304270A	05	ELECTRONIC WARFARE DEVELOPMENT	13,134	13,807	13,942		13,942

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	Total:		System Development and Demonstration	3,968,785	3,238,656	3,286,629	0	3,286,629
	Management support							
135	0604256A	06	THREAT SIMULATOR DEVELOPMENT	25,367	26,117	18,090		18,090
136	0604258A	06	TARGET SYSTEMS DEVELOPMENT	8,362	11,229	14,034		14,034
137	0604759A	06	MAJOR T&E INVESTMENT	40,671	49,359	37,394		37,394
138	0605103A	06	RAND ARROYO CENTER	19,763	20,352	21,026		21,026
139	0605301A	06	ARMY KWAJALEIN ATOLL	190,005	145,377	176,816		176,816
140	0605326A	06	CONCEPTS EXPERIMENTATION PROGRAM	17,101	28,755	27,902		27,902
141	0605502A	06	SMALL BUSINESS INNOVATIVE RESEARCH	232,092				
142	0605601A	06	ARMY TEST RANGES AND FACILITIES	399,931	311,650	369,900		369,900
143	0605602A	06	ARMY TECHNICAL TEST INSTRUMENTATION AND TARGETS	68,118	70,116	69,183		69,183
144	0605604A	06	SURVIVABILITY/LETHALITY ANALYSIS	42,320	43,414	44,753		44,753
145	0605605A	06	DOD HIGH ENERGY LASER TEST FACILITY	4,568	18			
146	0605606A	06	AIRCRAFT CERTIFICATION	4,938	5,621	5,762		5,762
147	0605702A	06	METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6,983	7,171	7,402		7,402
148	0605706A	06	MATERIEL SYSTEMS ANALYSIS	18,863	19,638	19,954		19,954
149	0605709A	06	EXPLOITATION OF FOREIGN ITEMS	5,285	5,436	5,535		5,535
150	0605712A	06	SUPPORT OF OPERATIONAL TESTING	68,481	68,678	67,789		67,789
151	0605716A	06	ARMY EVALUATION CENTER	60,694	63,202	62,765		62,765
152	0605718A	06	ARMY MODELING & SIM X-CMD COLLABORATION & INTEG	3,787	3,415	1,545		1,545
153	0605801A	06	PROGRAMWIDE ACTIVITIES	71,984	82,923	83,422		83,422
154	0605803A	06	TECHNICAL INFORMATION ACTIVITIES	49,579	55,286	50,820		50,820
155	0605805A	06	MUNITIONS STANDARDIZATION, EFFECTIVENESS AND SAFETY	42,474	57,054	46,763		46,763
156	0605857A	06	ENVIRONMENTAL QUALITY TECHNOLOGY MGMT SUPPORT	3,084	4,953	4,601		4,601
157	0605898A	06	MANAGEMENT HQ - R&D	15,845	17,530	18,524		18,524
158	0909999A	06	FINANCING FOR CANCELLED ACCOUNT ADJUSTMENTS	63				
	Total:		Management support	1,400,358	1,097,294	1,153,980	0	1,153,980

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			Operational system development					
159	0603778A	07	MLRS PRODUCT IMPROVEMENT PROGRAM	19,016	66,641	143,005		143,005
160	0607665A	07	BIOMETRICS ENTERPRISE	65,781	45,511			
161	0607865A	07	PATRIOT PRODUCT IMPROVEMENT			109,978		109,978
162	0102419A	07	AEROSTAT JOINT PROJECT OFFICE	399,477	327,338	190,422		190,422
163	0203347A	07	INTELLIGENCE SUPPORT TO CYBER (ISC) MIP	2,283				
164	0203726A	07	ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	23,812	29,500	32,556		32,556
165	0203735A	07	COMBAT VEHICLE IMPROVEMENT PROGRAMS	187,207	36,150	253,959		253,959
166	0203740A	07	MANEUVER CONTROL SYSTEM	24,648	42,347	68,325		68,325
167	0203744A	07	AIRCRAFT MODIFICATIONS/PRODUCT IMPROVEMENT PROGRAMS	121,084	149,469	280,247		280,247
168	0203752A	07	AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRAM	688	822	898		898
169	0203758A	07	DIGITIZATION	6,103	8,016	35,180		35,180
170	0203759A	07	FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2)	3,748				
171	0203801A	07	MISSILE/AIR DEFENSE PRODUCT IMPROVEMENT PROGRAM	23,415	53,015	20,738		20,738
172	0203808A	07	TRACTOR CARD	14,340	42,487	63,243		63,243
173	0208053A	07	JOINT TACTICAL GROUND SYSTEM	12,005	27,586	31,738		31,738
174	0208058A	07	JOINT HIGH SPEED VESSEL (JHSV)	3,041		35		35
175	0301359A	07	SPECIAL ARMY PROGRAM					
176	0303028A	07	SECURITY AND INTELLIGENCE ACTIVITIES		2,850	7,591		7,591
177	0303140A	07	INFORMATION SYSTEMS SECURITY PROGRAM	12,232	15,684	15,961		15,961
178	0303141A	07	GLOBAL COMBAT SUPPORT SYSTEM	123,136	160,491	120,927		120,927
179	0303142A	07	SATCOM GROUND ENVIRONMENT (SPACE)	32,525	12,085	15,756		15,756
180	0303150A	07	WWMCCS/GLOBAL COMMAND AND CONTROL SYSTEM	12,606	23,899	14,443		14,443
181	0305204A	07	TACTICAL UNMANNED AERIAL VEHICLES	38,049	26,508	31,303		31,303
182	0305208A	07	DISTRIBUTED COMMON GROUND/SURFACE SYSTEMS	125,404	31,649	40,871		40,871
183	0305219A	07	MQ-1 SKY WARRIOR A UAV	119,195	121,846	74,618		74,618
184	0305232A	07	RQ-11 UAV	1,547	1,935	4,039		4,039
185	0305233A	07	RQ-7 UAV	7,555	31,896	31,158		31,158
186	0305235A	07	MQ-18 UAV		7,500	2,387		2,387
187	0307665A	07	BIOMETRICS ENABLED INTELLIGENCE	2,069	15,018	15,248		15,248

Line No	Program Element Number	Act	Item	Thousands of Dollars FY2011	FY2012	FY2013	FY2013 OCO	FY2013 Total
188	0708045A	07	END ITEM INDUSTRIAL PREPAREDNESS ACTIVITIES	56,816	59,297	59,908		59,908
		Total:	Operational system development	1,437,782	1,339,540	1,664,534	0	1,664,534
Total:	RDT&E, Army			9,755,972	8,755,692	8,924,787	19,860	8,944,647

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Budget Activity 02: Applied Research
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Budget Activity 02: Applied Research
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Program Element Table of Contents (Alphabetically by Program Element Title)

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	28.730	50.679	29.041	-	29.041	26.592	28.890	29.009	29.237	Continuing	Continuing
H7B: *Advanced Materials Initiatives (CA)*	-	20.468	-	-	-	-	-	-	-	Continuing	Continuing
H7G: *NANOMATERIALS APPLIED RESEARCH*	4.714	5.291	4.912	-	4.912	4.989	5.622	5.696	5.789	Continuing	Continuing
H84: *MATERIALS*	24.016	24.920	24.129	-	24.129	21.603	23.268	23.313	23.448	Continuing	Continuing

Note

FY12 funding increase for congressional add.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	29.882	30.258	27.999	-	27.999
Current President's Budget	28.730	50.679	29.041	-	29.041
Total Adjustments	-1.152	20.421	1.042	-	1.042
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	20.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.400	-			
• Adjustments to Budget Years	-	-	1.042	-	1.042
• Other Adjustments 1	-0.752	-0.079	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7B: *Advanced Materials Initiatives (CA)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H7B: *Advanced Materials Initiatives (CA)*	-	20.468	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Advanced Materials Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Nanotechnology Research ***Description:*** This is a Congressional Interest Item. ***FY 2012 Plans:*** Congressional add funding for Nanotechnology Research	-	7.998	-
Title: Silicon Carbide Research ***Description:*** This is a Congressional Interest Item. ***FY 2012 Plans:*** Congressional add funding for Silicon Carbide Research.	-	12.470	-
Accomplishments/Planned Programs Subtotals	-	20.468	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H7G: *NANOMATERIALS APPLIED RESEARCH*	4.714	5.291	4.912	-	4.912	4.989	5.622	5.696	5.789	Continuing	Continuing

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 fibers and materials, (2) battle suit medicine, (3) blast and ballistic protection, (4) chemical and biological sensing, and (5) nanosystem integration. 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 2011	FY 2012	FY 2013
Title: Nanomaterials Applied Research	4.714	5.291	4.912
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.			
FY 2011 Accomplishments: Researched novel materials and hybridization of materials for personnel protection in ballistic environments.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Investigate the incorporation of nanoparticles, nanotubes and nanofibers into materials systems to produce novel sensing capabilities for enhanced situational awareness. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	4.714	5.291	4.912

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H84: *MATERIALS*	24.016	24.920	24.129	-	24.129	21.603	23.268	23.313	23.448	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Structural Armor	5.613	6.960	4.363
Description: Conduct applied research to design and evaluate lightweight armor materials and structures, investigate novel processing methodologies for cost effective manufacturing, and utilize existing and emerging modeling and simulation tools to enable formulation of lightweight, frontal, and structural armor materials for current and future platform applications.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Determined candidate materials and configurations for ceramic only transparent armor solutions; and characterized materials properties and microstructures to determine optimal configurations for ballistic protection. ***FY 2012 Plans:*** Develop and validate model capability for composite materials that includes high rate effects, thermal effects and fatigue; characterize the high rate properties of structural adhesives and synthesize novel adhesive compositions for inclusion in emerging armor solutions. ***FY 2013 Plans:*** Will 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.			
Title: Soldier-Borne Armor Materials ***Description:*** Utilizing understanding of defeat mechanisms from PE62618/Project H80, conduct applied research of emerging lightweight armor materials and structures to enable affordable design of multifunctional ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new lethal mechanisms/protection schemes for the individual Warfighter. ***FY 2011 Accomplishments:*** Developed new, mass-efficient, protection materials and technologies to mitigate energy from both ballistic and blast events. ***FY 2012 Plans:*** Provide the capability to non-destructively characterize the relationship between ceramic tile quality and ballistic performance; and validate the synthesis of rate dependent soft material tissue surrogates for the development and characterization of personnel armor concepts. ***FY 2013 Plans:*** Will 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	3.122	2.759	3.252

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Composites ***Description:*** This effort designs, models, validates, and optimizes advanced materials (such as ceramic, composite, polymers, lightweight and high-strength metals) including processing techniques for protection against smaller but more lethal penetrators/ warheads using affordable, lightweight, high performance armaments for revolutionary weapons effectiveness in urban and irregular operations. ***FY 2011 Accomplishments:*** Established a complete set of parameters that will lead to adiabatic (no heat given off or absorbed) shear behavior of fully dense pure metals; and developed a scaled processing approach for fully dense pure metals and produced samples of sufficient size to permit sub-scale ballistic evaluation. ***FY 2012 Plans:*** Develop cold spray techniques to successfully deposit novel material compositions in confined spaces; validate methods for the composite cladding of advanced gun barrel designs; and validate improvements in gun barrel erosion. ***FY 2013 Plans:*** Will 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.	4.333	3.916	3.000
Title: Electronic Materials ***Description:*** 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. ***FY 2011 Accomplishments:*** Advanced optimization methodologies to enable low defect synthesis of ferroelectric oxide thin film materials; and performed optimization of low temperature synthesis of ferroelectric oxide thin film materials for Complementary Metal Oxide Semiconductor (CMOS) compatibility and integration. ***FY 2012 Plans:***	0.500	0.514	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Develop the material designs, fabrication methods, and process science protocols required for CERDEC to achieve high quality, affordable, performance consistent, tunable beam steering antenna elements.			
Title: Nanomaterials ***Description:*** Mature and scale-up nanomaterials processes, fabrication, characterization and performance measures to enable revolutionary concepts for future force lethality and survivability beyond those addressed for individual Soldier protection in project H7G. ***FY 2011 Accomplishments:*** Developed new reactive structural material compositions and optimized microstructures based on models and experiments; and characterized nanoscale structures using analytical microscopy tools. ***FY 2012 Plans:*** Validate nanograined metallic structures fabrication process using thermodynamic techniques, and provide an initial validation of the improvement in the ballistic capability of transparent materials reinforced with natural cellulose nanofibers. ***FY 2013 Plans:*** Will 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-architectured cellulose based composite materials; and investigate nano-tungsten materials to evaluate engineering properties for ballistic launch survivability.	1.486	1.544	1.736
Title: Multifunctional Armor Materials ***Description:*** 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. ***FY 2011 Accomplishments:*** Performed failure mode characterization of passive and active armor materials; determined propagation fracture toughness in ceramics; measured and modeled residual stress in metal matrix composite armor materials; developed scale up processes for multi-modal materials microstructures; and examined novel metallic structures to reduce weight and manage ballistic impact loads. ***FY 2012 Plans:***	8.962	9.227	11.778

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Provide new multifunctional composite materials with structural and power storage capability; develop synthesis routes for soft polymer nano-composites with controllable electrical properties; and provide composite materials with improved damage tolerance for use in ultra-lightweight structures and armors. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	24.016	24.920	24.129

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602120A: *Sensors and Electronic Survivability*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	46.491	43.453	45.260	-	45.260	50.877	52.127	58.435	54.819	Continuing	Continuing
H15: *GROUND COMBAT ID TECH*	7.112	2.066	2.181	-	2.181	4.841	4.705	4.384	4.456	Continuing	Continuing
H16: *S3I TECHNOLOGY*	17.521	19.883	20.726	-	20.726	21.258	21.198	21.382	21.370	Continuing	Continuing
SA2: *BIOTECHNOLOGY APPLIED RESEARCH*	5.296	5.476	4.852	-	4.852	5.131	5.859	5.316	6.072	Continuing	Continuing
TS1: *TACTICAL SPACE RESEARCH*	1.526	3.719	4.303	-	4.303	4.956	6.428	7.100	6.202	Continuing	Continuing
TS2: *ROBOTICS TECHNOLOGY*	15.036	12.309	13.198	-	13.198	14.691	13.937	20.253	16.719	Continuing	Continuing

Note

FY13 - 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),

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army	DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602120A: *Sensors and Electronic Survivability*

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. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	48.929	43.521	47.014	-	47.014
Current President's Budget	46.491	43.453	45.260	-	45.260
Total Adjustments	-2.438	-0.068	-1.754	-	-1.754
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.910	-			
• Adjustments to Budget Years	-	-	-1.754	-	-1.754
• Other Adjustments 1	-1.528	-0.068	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H15: *GROUND COMBAT ID TECH*	7.112	2.066	2.181	-	2.181	4.841	4.705	4.384	4.456	Continuing	Continuing

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 and Communications, 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, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Combat Identification (CID) Technologies	3.905	2.066	2.181
Description: This effort evaluates and enhances CID modeling and simulation tools, concepts, and algorithms to improve anti-fratricide and combatant/non-combatant identification capabilities. Soldier-to-Soldier CID algorithms that interoperate with non-traditional CID sensors (air and ground) are developed to increase situational awareness (SA), feed the common operating picture, and increase the combat effectiveness of Soldier and Brigade Combat Teams (BCTs). Work being accomplished under PE 0603270A/project K16 complements this effort.			
FY 2011 Accomplishments: Modeled fusion algorithms for improved battlespace awareness to include geolocation and target identification algorithms utilizing blue force emitter information to resolve current radar, laser, and ultra-violet/infrared (UV/IR) warning receiver sensor ambiguities; linked to Distributed Common Ground System-Army (DCGS-A) Enterprise for initial assessment/user jury to obtain user community feedback and recommendations for algorithm improvements; performed communication and network modeling and simulation.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Improve 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; Investigate 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. ***FY 2013 Plans:*** Will 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.			
Title: Multi-Intelligence Data Fusion and Targeting ***Description:*** This effort investigates and develops software technologies for intelligence/battle command (Intel/BC) enterprise collaboration to provide faster and higher quality decision making support for the Commander and his key staff. Specific efforts focus on integrating the intelligence, surveillance and reconnaissance planning and multi-echelon execution (task force/battalion through individual Soldier) as well as efforts that enable the enterprise to identify, fuse, and trace/track specific human targets in an asymmetric environment. Work being accomplished under PE 0602270A/project 906 compliments this effort. ***FY 2011 Accomplishments:*** Associated Intel requirements, geolocation data needs and collection opportunities with operational mission tasks for Intel and BC communities; matured common architecture and framework to provide a portable software environment, storage and access for Intel and Operations communities. Complementary work is also being accomplished under PE 0602270A/project 906.	3.207	-	-
Accomplishments/Planned Programs Subtotals	7.112	2.066	2.181

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H16: *S3I TECHNOLOGY*	17.521	19.883	20.726	-	20.726	21.258	21.198	21.382	21.370	Continuing	Continuing

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Title: Non-Imaging Intelligence, Surveillance, and Reconnaissance (ISR) Sensing (previously titled Unattended Ground Sensors (UGS)) ***Description:*** This effort evaluates and designs technologies for multi-modal low-cost networked sensors to enhance persistent sensing capabilities with increased probability of target detection and reduced false alarms. A key focus is on acoustic, seismic, magnetic, E-field, and passive RF with unique capabilities for Army & DoD applications such as technologies that enable detection of underground facilities. ***FY 2011 Accomplishments:*** Implemented the concept of unattended ground sensors (UGS) for persistent surveillance with increased interoperability with multiple UGS vendors; enhanced acoustic localization accuracy through meteorological correction of solution vectors; exploited acoustic, seismic, magnetic, and electric fields for locating, reliable target characterization, and classification; and investigated airborne multimodal sensing of targets. ***FY 2012 Plans:*** Investigate new fusion techniques for enhanced discrimination between vehicles, humans and animals and develop algorithms for acquiring 360 degree situational awareness from multisensory wide-area persistent surveillance platforms; apply acoustic, seismic, magnetic, and E-field to subsurface anomaly detection and characterization; apply advanced transient event classification algorithms to fielded acoustic systems; and enhance detection range and localization accuracy of airborne acoustic systems to include an unmanned aerial vehicle (UAV) with both acoustic and E-field sensors. ***FY 2013 Plans:*** Will 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; 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.	5.242	5.860	4.014
Title: Networked Sensing and Data Fusion (previously titled Sensor and Data Fusion) ***Description:*** This effort will develop and assess a concept to link physical sensors and information sources to Soldiers and small units. Specifically the research focuses on (1) 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	4.272	5.127	5.650

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
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. ***FY 2011 Accomplishments:*** Implemented novel fusion methodologies, and decentralized and distributed data fusion using heterogeneous sensor systems, platforms, and networks for enhanced detection, tracking, and classification of threats; exploited multi-modal sensing and fusion concepts to characterize underground facilities, materiel and tunnels; developed new policy-based sensor information algorithms for robust communication up to coalition level; and implemented new computationally efficient anomaly detection algorithms for imaging target recognition. ***FY 2012 Plans:*** Apply advanced fusion algorithms to multimodal sensors and systems; exploit magnetic and E-field fusion for equipment characterization, power line monitoring, and target localization; employ acoustic and seismic techniques to augment E-field subsurface imaging; enhance sensing from airborne platforms with multi-modal sensors, cueing and fusion algorithms; and implement fusion algorithms to discriminate humans versus other targets with high accuracy. ***FY 2013 Plans:*** Will 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; implement quality of information (QoI) based data discovery, collection and fusion techniques to extract desired information from large data sets.			
Title: Tagging Tracking and Locating (TTL) ***Description:*** Conduct applied research to support advances in state-of-the-art clandestine TTL for non-traditional hostile forces and non-cooperative targets. Specific technical details related to this effort are classified. ***FY 2011 Accomplishments:*** Designed, fabricated, and evaluated TTL experimental devices including unattended ground sensors (UGS) integration, RF Tags, and IR Tags for transition to CERDEC. ***FY 2012 Plans:*** Optimize and transition TTL technologies to CERDEC and implement improvements to RF and IR Tags. ***FY 2013 Plans:***	1.006	1.553	2.072

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will investigate alternate technologies including UV, IR, 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.			
Title: Ultra Wideband Radar ***Description:*** 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. ***FY 2011 Accomplishments:*** Investigated advanced Improvised Explosive Device (IED)-discrimination algorithms and technologies that exploit physics-based features to reduce false alarms in low-artifact radar imagery. ***FY 2012 Plans:*** Collect 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 investigate 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. ***FY 2013 Plans:*** Will 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; investigate utilizing radar data to build interior structure maps as well as stationary target detection techniques using 3-D computer-generated radar images.	3.724	3.385	2.114
Title: Networked Compact Radar, Wide Bandgap Optoelectronics, and Laser Protection Technologies (previously titled Multi-Function Radio Frequency System (MFRFS) and Wide Bandgap Optoelectronics) ***Description:*** 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. ***FY 2011 Accomplishments:***	1.021	1.291	4.115

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Applied RF biometric algorithms to an unattended compact radar for perimeter watching as part of a larger unmanned ground sensor network and established baseline designs of a sub-millimeter wave (sub-mmW) imager for human-borne IED detection; extended UV source and detector research to 250-nm. ***FY 2012 Plans:*** Develop new methods of moving target classification based on micro-doppler analysis; explore the phenomenology and image processing associated with sub-mmW imaging of human-borne IEDs and validate new sub-mmW / terahertz device technology; extend research on 230-275-nm optical sources including LEDs, lasers, and detectors. ***FY 2013 Plans:*** Will 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 230-275-nm 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.			
Title: Information Fusion ***Description:*** This effort develops network infrastructure concepts and validates algorithms, filters and software agent technologies to enable improved situational awareness in complex/urban terrain and reduced cognitive load for Soldiers and small units. ***FY 2011 Accomplishments:*** Investigated the transition of Network Science and the Micro Autonomous Systems and Technology Collaborative Technology Alliance technologies and assessed their potential impact on persistent surveillance for situational awareness. ***FY 2012 Plans:*** Develop algorithms and enhance applications directed to persistent surveillance, sensor management, and asset-to-asset taskings to minimize the cognitive workload of a lower echelon commander. ***FY 2013 Plans:*** Will 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.	2.256	2.667	2.761
Accomplishments/Planned Programs Subtotals	17.521	19.883	20.726

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
SA2: *BIOTECHNOLOGY APPLIED RESEARCH*	5.296	5.476	4.852	-	4.852	5.131	5.859	5.316	6.072	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Institute for Collaborative Biotechnologies (ICB)	5.296	5.476	4.852
Description: This effort exploits breakthroughs in biotechnology basic research invented at the ICB to enable capabilities in sensors, electronics, photonics, and network science.			
FY 2011 Accomplishments: Fabricated and evaluated arrays of bio-inspired material-based thermal imagers; implemented bio-inspired algorithms for optimized collection of data from sensor networks; implemented gecko-mimicking reversible adhesives in robotic applications; experimentally validated surface-enhanced Raman spectroscopic detection of explosives in open-channel micro-fluidic devices; and implemented bio-inspired flocking and search algorithms for unmanned vehicles in GeoTrack system.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Design/build hardware/software required to image single cells in 3D and collect initial 3D images; apply the lessons learned in microbial fuel cells to implement enhanced fermentation, environmental monitoring, and investigate waste water treatment; complete characterization and investigation of bacterial nanowires fabricated artificially from the naturally occurring proteins; and complete and validate algorithms for control of data displayed on crew stations based on neural processing, and begin two new start projects selected in FY11. ***FY 2013 Plans:*** Will complete 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.			
Accomplishments/Planned Programs Subtotals	5.296	5.476	4.852

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
TS1: *TACTICAL SPACE RESEARCH*	1.526	3.719	4.303	-	4.303	4.956	6.428	7.100	6.202	Continuing	Continuing

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, and Communications (C3) 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)	FY 2011	FY 2012	FY 2013
Title: Tactical Space Research	1.526	2.719	3.303
Description: This effort designs, develops, and evaluates space-based, high altitude and cyberspace technologies, components, and tools that lead to smaller, lighter, more responsive payloads and applications to assess cyber risks. These technologies allow for the rapid integration and development of tactical payloads in support of responsive space and high altitude environments. In addition, this effort evaluates cyber risks from supply chain components to integrated weapon systems.			
FY 2011 Accomplishments: Investigated component technologies for high altitude payloads and small satellites, such as sensor subsystems, data links/ cross links, propulsion, power, energy, guidance, navigation, and flight control; Investigated protection technologies for uplinks, downlinks, and cross-links of space and high altitude assets; investigated and designed a Space Analysis Laboratory for			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
component development, testing, and system integration for ground testing and evaluation in support of space and high altitude applications. ***FY 2012 Plans:*** Continue development of advanced power technologies for use in space and high altitude payload efforts; investigate and identify previously developed space sensor and power component technologies to implement in high altitude payloads; begin tool development to support evaluations of cyber attack risks and remediation approaches for acquisition efforts, to include space and high altitude payloads and systems. ***FY 2013 Plans:*** Will 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.			
Title: Space and Analysis Lab ***Description:*** This effort provides an in-house capability to design and conduct analytic evaluations of space, high altitude, and cyberspace technologies. ***FY 2012 Plans:*** Implement 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. ***FY 2013 Plans:*** Will design payload ground systems to monitor health and status of small satellite systems during flight operations.	-	1.000	1.000
Accomplishments/Planned Programs Subtotals	1.526	3.719	4.303

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
TS2: *ROBOTICS TECHNOLOGY*	15.036	12.309	13.198	-	13.198	14.691	13.937	20.253	16.719	Continuing	Continuing

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 basis for 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 Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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 2011	FY 2012	FY 2013
Title: Robotics CTA	6.565	7.250	5.925
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			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
in populated environments and minimize the cognitive workload on Soldier operators, enable more dexterous manipulation of objects, and explore unique modes of mobility. ***FY 2011 Accomplishments:*** Extended research to examine robot understanding of cues and activity permitting more 'human-like' control of unmanned systems; researched methods for improving perception in increasingly cluttered environments from both a static and dynamic perspective, and increased application of learning techniques to improve flexibility in unknown environments. ***FY 2012 Plans:*** Enable lower cost sensory capability for smaller unmanned systems; examine issues of trust in automation and develop a common mental picture between soldier and unmanned system; and will examine mid- and long- range scene recognition to facilitate tactical behavior in unmanned systems. ***FY 2013 Plans:*** Will 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.			
Title: Perception and Intelligent Control ***Description:*** Advance perception and intelligent control technologies required to achieve autonomous tactical behaviors and other objective capabilities for future unmanned vehicles of multiple size scales and to transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle and Automotive Advanced Technology) project 515 (Robotic Ground Systems) for integration into test bed systems. ***FY 2011 Accomplishments:*** Investigated tactical behavior appropriate to military missions in 'urban-like' environments. ***FY 2012 Plans:*** Conduct applied research for improved shared understanding of tactical environment between soldier and unmanned systems. ***FY 2013 Plans:*** Will 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.	4.728	3.815	7.273
Title: Autonomous Robotics - Component Maturation	3.743	1.244	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: 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. ***FY 2011 Accomplishments:*** Evaluated the ability of unmanned systems to maneuver intelligently and autonomously in urban-like environments. ***FY 2012 Plans:*** Conduct initial assessments to establish baseline capability for unmanned systems to understand terrain and behaviors.			
Accomplishments/Planned Programs Subtotals	15.036	12.309	13.198

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602122A: *TRACTOR HIP*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	14.126	14.207	22.439	-	22.439	30.357	21.575	10.935	11.038	Continuing	Continuing
622: *D622*	1.885	1.649	2.657	-	2.657	3.440	3.457	3.507	3.484	Continuing	Continuing
B72: *AB72*	2.902	3.285	12.693	-	12.693	22.467	13.090	2.316	2.355	Continuing	Continuing
B73: *AB73*	9.339	9.273	7.089	-	7.089	4.450	5.028	5.112	5.199	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	14.624	14.230	13.407	-	13.407
Current President's Budget	14.126	14.207	22.439	-	22.439
Total Adjustments	-0.498	-0.023	9.032	-	9.032
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	9.032	-	9.032
• Other Adjustments 1	-0.498	-0.023	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
622: *D622*	1.885	1.649	2.657	-	2.657	3.440	3.457	3.507	3.484	Continuing	Continuing

Note

Not Applicable

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. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Not Applicable	1.885	1.649	2.657
Description: Not Applicable ***FY 2011 Accomplishments:*** Not Applicable ***FY 2012 Plans:*** Not Applicable ***FY 2013 Plans:*** Not Applicable			
Accomplishments/Planned Programs Subtotals	1.885	1.649	2.657

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
B72: *AB72*	2.902	3.285	12.693	-	12.693	22.467	13.090	2.316	2.355	Continuing	Continuing

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. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Not applicable ***Description:*** . ***FY 2011 Accomplishments:*** . ***FY 2012 Plans:*** . ***FY 2013 Plans:*** .	2.902	3.285	12.693
Accomplishments/Planned Programs Subtotals	2.902	3.285	12.693

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
B73: *AB73*	9.339	9.273	7.089	-	7.089	4.450	5.028	5.112	5.199	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: The details of this program are reported in accordance with Title 10, United States Code 119(a)(l). ***Description:*** N/A ***FY 2011 Accomplishments:*** . ***FY 2012 Plans:*** . ***FY 2013 Plans:*** .	9.339	9.273	7.089
Accomplishments/Planned Programs Subtotals	9.339	9.273	7.089

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602211A: *AVIATION TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	40.869	44.539	51.607	-	51.607	53.663	50.111	41.338	47.859	Continuing	Continuing
47A: *AERON & ACFT WPNS TECH*	35.564	38.972	45.898	-	45.898	47.460	43.597	34.539	40.947	Continuing	Continuing
47B: *VEH PROP & STRUCT TECH*	5.305	5.567	5.709	-	5.709	6.203	6.514	6.799	6.912	Continuing	Continuing

Note

FY13 funding increase for enhancements to Aviation Survivability research

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) and PE 0602303A (Missile 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; Fort Eustis, VA; Moffett Field, CA; and Hampton, VA, and at the Army Research Laboratory (ARL), located at Adelphi, MD; Hampton, VA; and Cleveland, OH.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602211A: *AVIATION TECHNOLOGY*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	43.476	44.610	45.123	-	45.123
Current President's Budget	40.869	44.539	51.607	-	51.607
Total Adjustments	-2.607	-0.071	6.484	-	6.484
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.479	-			
• Adjustments to Budget Years	-	-	6.484	-	6.484
• Other Adjustments 1	-2.128	-0.071	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
47A: *AERON & ACFT WPNS TECH*	35.564	38.972	45.898	-	45.898	47.460	43.597	34.539	40.947	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

Work in this project is fully coordinated with PE 0603003A (Aviation Advanced Technology) and work in this project related to aircraft weapons integration is also fully coordinated with PE 0602624A (Weapons and Munitions Technology) and PE 0602303A (Missile 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 Aero-Flight Dynamics Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), (located at the NASA Ames Research Center, Moffett Field, CA; and the NASA Langley Research Center, Hampton, VA); and the Aviation Applied Technology Directorate, Fort Eustis, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: National Rotorcraft Technology Center (NRTC)	6.385	8.167	3.912
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 2011 Accomplishments: Evaluated metal matrix composite structural elements as replacements for titanium elements; incorporated new dynamic stall model, based on a hybrid computational approach, into a comprehensive code and validated the new model by comparison with test data; and validated physics-based analysis methodology predictions for hub drag reductions with available test data.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Conduct an icing evaluation of a spinning rotor in the NASA Icing Research Tunnel (IRT) to validate prediction tools; conduct hover stand evaluation of rotor with Miniature Trailing-edge Effector (MiTE) actuation system; perform validation testing of an in-flight acoustic detection footprint prediction system and in-cockpit display; and validate analytic predictions with UH-60 wind tunnel and flight test data. ***FY 2013 Plans:*** Will 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 a 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.			
Title: Rotor Technology ***Description:*** Evaluate performance enhancements gained from advanced rotor technologies, including on-blade controls. This effort continues in FY13 under the Rotors & Vehicle Management Technologies effort. ***FY 2011 Accomplishments:*** Acquired high quality interactional aerodynamics measurements for a high speed active flow control rotor configuration; executed active on-blade control evaluation; and utilized high quality UH-60 rotor measurements to assess rotorcraft modeling and simulation tools for rotor structural loads, deflections and flowfield measurements. ***FY 2012 Plans:*** Apply advanced, high performance computing tools, simulating UH-60 rotor measurements, to assess accuracy of computed rotor structural loads, deflections and flowfield measurements; perform pre-test computations and participate in international evaluation of an active twist rotor; and apply aeromechanics analysis tools to rotorcraft configurations for improved performance in support of PE 0603003A, Project 313.	3.104	3.385	-
Title: Flight Controls ***Description:*** 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. ***FY 2011 Accomplishments:***	2.537	4.119	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Defined control system architectures for emerging rotorcraft configurations based on initial dynamic simulation models and in-flight simulation experiments. ***FY 2012 Plans:*** Investigate integrated control of large rotorcraft using feedback of rotor state, external loads, and structural measurements.			
Title: Rotors & Vehicle Management Technologies ***Description:*** Design and investigate advanced airfoil and rotor blade technologies, including active control elements, to support goals of increased hover and cruise efficiency. Design and evaluate advanced flight control and vehicle management component technologies to support goals of increased maneuverability, reliability, and reduced weight and cost. This effort consolidates and continues efforts initiated prior to FY13 under the Rotor Technology effort and the Flight Controls effort. ***FY 2013 Plans:*** Will assess advanced computational methods for prediction of helicopter main rotor and pylon aerodynamic interaction with fixed tail surfaces; perform post-test computations for 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 interaction; and initiate flight mechanics modeling and handling qualities criteria development for advanced aircraft configurations, including compounds.	-	-	8.429
Title: Aircraft and Occupant Survivability Technologies (previously titled Survivability Technologies) ***Description:*** Investigate advanced technologies to reduce susceptibility and vulnerability of aircraft to damage from threats or accidents, as well as technologies to defeat small arms, rocket and missile threats. ***FY 2011 Accomplishments:*** Fabricated crashworthy systems/subsystems, evaluated, and correlated test results with models previously developed; and integrated optic laser fiber and optical parametric oscillator (OPO) component technologies into a complete multi-function IR and visual laser countermeasure system, and transitioned to PE 0603003A, Project 313 effort for flight evaluation on a threat range. ***FY 2012 Plans:*** Begin design of advanced infra-red(IR)/electro-optical (EO) signature control materials; and develop 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. ***FY 2013 Plans:*** Will 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	8.766	7.083	7.147

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
against conventional and nonconventional weapons, to include directed energy, blast/overpressure, and high velocity low mass fragments; and design and validate active crash energy management subsystems; and evaluate and validate fuel containment technologies that provide self-sealing capability independent of fuel type.			
Title: Engine Technologies (previously titled Advanced Engines) ***Description:*** Design and evaluate advanced turboshaft engine component technologies to support goals of reduced fuel consumption, engine size, weight, cost, as well as improved reliability and maintainability. ***FY 2011 Accomplishments:*** For a cargo sized aircraft, completed advanced combustor design for improved engine performance and structural life; completed fabrication of advanced compressor for improved engine performance and reduced weight; and completed evaluation of gas generator turbine to validate improved engine performance and durability. ***FY 2012 Plans:*** For a cargo sized aircraft, complete advanced mechanical systems fabrication for improved engine performance and structural life; complete evaluation of advanced compressor for improved engine performance and reduced weight; and transition technologies to engine advanced development efforts under PE 0603003A, Project 447. ***FY 2013 Plans:*** Will 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.	2.486	3.590	3.049
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 2011 Accomplishments:*** Enhanced/extended the fidelity of the integrated analysis and design environment to increase prediction accuracy as well as investigated techniques for rigorous optimization of the rotorcraft design in full flight envelope simulation. ***FY 2012 Plans:*** Complete small scale wind tunnel test to validate performance predictions and document requirements for multi-role configuration technology.	2.256	2.055	-
Title: Platform Design & Structures Technologies	-	-	3.735

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Description: 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). ***FY 2013 Plans:*** Will 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.			
Title: Network Operations and System Integration ***Description:*** 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. ***FY 2011 Accomplishments:*** Investigated use of Umnanned Aerial Systems (UAS) supervisory techniques in Manned-Unmanned Teaming flight evaluations; developed/evaluated interface technologies for rapid immersion of UAS operators into remote environments; integrated a lightweight, distributed sensor array into a UAS test-bed platform to evaluate autonomous pilotage and collision avoidance techniques; developed/evaluated virtual interface technologies for rapid virtual immersion of UAS operators into UAS operating environment; extended supervisory control techniques to airborne control station applications; continued assessment of low space, weight and power wide field of view sensor systems for local situational awareness; and completed ground based evaluation of autonomous sniper system with fire control upgrades. ***FY 2012 Plans:*** Investigate UAS supervisory control techniques applied in relevant tactical operations through flight evaluation; investigate integration of advanced lethality concepts for application to manned and unmanned aviation assets, addressing energy storage, system pointing accuracy, stabilization, and incapacitation effects.	5.307	6.128	-
Title: Unmanned and Optionally Manned Technologies	-	-	3.278

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Description: Design and develop collaboration and cooperation algorithms to support goal of intelligent teaming for manned-unmanned operations. Design and develop advanced unmanned aerial system (UAS) components to support goal of improved small UAS performance. Prior to FY13, human/machine interface work was exhibited in the Network Operations and System Integration effort. ***FY 2013 Plans:*** Will 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.			
Title: Aircraft Weapon & Sensor Technologies ***Description:*** Design and develop innovative approaches for integrating advanced weapons and sensors on aircraft platforms, including smart dispensers, data transfer, and post-launch weapon communication. Prior to FY13, the advanced rotary wing weapons integration concept work was exhibited in of the Network Operations and System Integration effort. ***FY 2013 Plans:*** Will 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.	-	-	1.521
Title: Maintainability & Sustainability Technologies (previously titled Durability and Sustainment Technologies) ***Description:*** Develop prognostic and system health assessment technologies to enable transition to a Condition Based Maintenance supportability structure. ***FY 2011 Accomplishments:*** Developed prognostic capabilities for more chaotic, nonlinear dynamic failure modes of mechanical systems; developed improved probabilistic methods for prediction of failure initiation and progression; evaluated nano-sensing technology for real-time integrity monitoring; and implemented improved design and analysis criteria. ***FY 2012 Plans:*** Develop prognostic algorithms for predicting remaining life of engine controls, sensors and lubrication systems; perform evaluation of data fusion of structural integrity algorithms for extending component time on wing and damage tolerance; and develop algorithms to assess rotor component health and vehicle control systems. ***FY 2013 Plans:***	4.723	4.445	4.827

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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 a combined crack and corrosion detection sensor for improved accuracy and validate on airframe structural components.			
Title: Survivability For Degraded Visual Environment Operations ***Description:*** Will research advanced sensor and cockpit display technologies to provide ability to maintain terrain situational awareness during degraded visual environments caused by dust and snow particulates (brown-out & white-out). ***FY 2013 Plans:*** Characterizatize 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 densoties. Investigate multi-band sensor fusion techniques to enhance performance. Investigate cockpit display technology (heads-up and heads-down) to provide terrain representation to aircrew.	-	-	10.000
Accomplishments/Planned Programs Subtotals	35.564	38.972	45.898

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
47B: *VEH PROP & STRUCT TECH*	5.305	5.567	5.709	-	5.709	6.203	6.514	6.799	6.912	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Rotor and Structure Technology	0.983	1.981	2.043
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 2011 Accomplishments: Performed a series of analytical and validation studies, including in-flight evaluations conducted jointly with the Federal Aviation Administration and other Research, Development and Engineering Center field elements, to enhance analytical tools and methodologies for structural damage detection and condition-based maintenance of key structural components. Completed fabrication of six 1/4-scale high-performance active-twist rotor blades based on Apache baseline performance characteristics. Conducted parametric wind-tunnel evaluations of two sets of advanced active-twist rotor configurations, one of which was optimized for rotor performance improvements. Completed analytical comparison study with data validation to document benefits of high-performance active designs.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Complete wind-tunnel evaluation of high performance ATR blades and validate prognostics and diagnostics technologies and framework for computation of remaining useful life of vehicle structures. ***FY 2013 Plans:*** Will use enhanced 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 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.			
Title: Engine and Drive Train Technology (previously titled Propulsion and Drive Train Technology) ***Description:*** Investigate high temperature materials, advanced models for flow physics and improved methods for predicting propulsion system mechanical behavior to increase fuel efficiency and reduce propulsion system weight. ***FY 2011 Accomplishments:*** Analyzed joining technologies to enable the fabrication and integration of ceramic fuel injectors for improved combustion process design, and investigated a coupled engine and drive train dynamic model that will enhance the accuracy of mechanical behavior predictions. ***FY 2012 Plans:*** Investigate the feasibility of fabricating hybrid ceramic/metal turbine engine components for future air platforms.. ***FY 2013 Plans:*** 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; and characterize the dynamics of a pericyclic variable transmission (PVT) for use in rotorcraft applications to reduce transmission weight.	4.322	3.586	3.666
Accomplishments/Planned Programs Subtotals	5.305	5.567	5.709

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602270A: *Electronic Warfare Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	16.939	15.765	15.068	-	15.068	15.221	15.783	15.825	15.839	Continuing	Continuing
906: *Tactical Electronic Warfare Applied Research*	16.939	15.765	15.068	-	15.068	15.221	15.783	15.825	15.839	Continuing	Continuing

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, 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602270A: *Electronic Warfare Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	17.330	15.790	15.058	-	15.058
Current President's Budget	16.939	15.765	15.068	-	15.068
Total Adjustments	-0.391	-0.025	0.010	-	0.010
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.100	-			
• Adjustments to Budget Years	-	-	0.010	-	0.010
• Other Adjustments 1	-0.291	-0.025	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
906: *Tactical Electronic Warfare Applied Research*	16.939	15.765	15.068	-	15.068	15.221	15.783	15.825	15.839	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

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

Work in this project 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, 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 2011	FY 2012	FY 2013
Title: Multi-Intelligence Data Fusion and Targeting	6.220	4.090	3.300
Description: This effort investigates, designs and codes advanced automated exploitation and fusion analysis tools, applications, and software services for the creation of improved intelligence products, common information management and information dissemination systems to facilitate collaboration between intelligence and mission command functions. This will provide relevant			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
and timely information in support of command decisions, such as high value identification and targeting in an asymmetric environment. Work being accomplished under PE 0602120A/project H15 and PE 0603772A/project 243 compliments this effort. ***FY 2011 Accomplishments:*** Integrated additional fusion algorithms, data, sensor and message types, temporal enhancements, as well as integrated extraction, visualization, and conceptualization tools into a fusion & exploitation framework for improved target tracking and identification; conducted metrics study in support of non-cooperative biometrics for single and multi-modality matching and fusion algorithms. ***FY 2012 Plans:*** Investigate biometric data matching and fusion algorithms for use in non-cooperative intelligence collection environment; investigate 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; code enhanced algorithms to conduct near-real-time matching and fusion of cooperative and non-cooperative biometric intelligence into enhanced biometric intelligence products; finalize data collection process, generate candidate templates, and conduct non-cooperative sensor data collection to assess the process and templates. ***FY 2013 Plans:*** Will 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.			
Title: Offensive Information Operations Technologies ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed capability for identification and capture of protocols of interest; implemented algorithms to allow for surgical and coordinated exploitation amongst nodes; developed traffic analysis techniques to discriminate amongst individual data sessions; developed communication and coordination capabilities between CNO and EW systems. ***FY 2012 Plans:***	4.223	4.646	4.454

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Refine techniques to perform computer network manipulation to include, traffic redirection, data-in-transit, and network situational awareness; develop comprehensive visualization interface that takes into account CNO and EW missions; assess feasibility of integrating next-generation EW systems with tactical CNO capabilities to maximize effects on targets and minimize the training requirements on operator to executing a CNO mission; develop anti-tamper and adapted offensive components, networking resource mutation for network manipulation, and virtualization/virtual-machine monitors for isolation. ***FY 2013 Plans:*** Will 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.			
Title: Multispectral Threat Warning ***Description:*** This effort investigates and evaluates software and sensor/countermeasure components to increase probability of detection of small arms and probability of detection and defeat of man-portable air defense system (MANPADS) type threats for aviation platforms. ***FY 2011 Accomplishments:*** Finalized infrared (IR) and ultraviolet (UV) sensor integration algorithms; experimented with integration concept of these multispectral sensors and their affect on detection and false alarm in a laboratory environment; determined effectiveness of acoustic sensor in enhancing hostile fire indication (HFI) algorithms. ***FY 2012 Plans:*** Investigate countermeasure techniques against next-generation MANPADS employing digital imaging seekers; use modeling and simulation and limited hardware-in-the-loop methods to investigate potential effectiveness of current platform-resident IR focal plane arrays, likely tracking algorithms, digital IR countermeasure lasers and available imaging sources against these advanced seekers. ***FY 2013 Plans:*** Will 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.	2.999	3.500	3.569
Title: Passive and Active Targeting Techniques	3.497	3.529	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: 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. ***FY 2011 Accomplishments:*** Enhanced geolocation techniques based on results of representative hardware analysis; performed additional simulation and laboratory validation of these enhancements utilizing synthesized and outdoor wireless RF data collected in relevant field environments; transitioned executable software package, software model and associated engineering analysis quantifying technique performance and effectiveness to applicable follow-on technology demonstration, program of record or quick reaction capability. ***FY 2012 Plans:*** Investigate techniques to improve the resolution of conventional non-cooperative time-difference-of-arrival (TDoA) based geolocation techniques; investigate 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.			
Title: Multi-Function Intelligence, Surveillance and Reconnaissance (ISR) Technologies ***Description:*** This effort investigates and codes software algorithms and techniques to intelligently integrate tactical ISR sensors, improve their individual performance and increase the effectiveness of battlespace awareness/intelligence data in an area of operations. Efforts focus on networking of sensors in support of area/base camp protection and investigating an open, scalable architecture adaptable for multiple base sizes and environments and other ISR sensors. This effort transitions from Passive and Active Targeting Techniques which ends in FY12. Work being accomplished under PE 63772/243 complements this effort ***FY 2013 Plans:*** Will 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.	-	-	3.745
Accomplishments/Planned Programs Subtotals	16.939	15.765	15.068

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	48.092	67.079	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing
214: *MISSILE TECHNOLOGY*	48.092	50.605	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing

Note

FY12 funding increase is due to congressional add.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	49.525	50.685	50.822	-	50.822
Current President's Budget	48.092	67.079	49.383	-	49.383
Total Adjustments	-1.433	16.394	-1.439	-	-1.439
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.865	-			
• Adjustments to Budget Years	-	-	-1.439	-	-1.439
• Other Adjustments 1	-0.568	-0.106	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
214: *MISSILE TECHNOLOGY*	48.092	50.605	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

This project supports the ground portfolio.

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

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Smaller, Lighter, Cheaper Tactical Missile Technologies	8.301	12.744	12.187
Description: This effort designs and evaluates innovative smaller, lighter, and cheaper component technologies as well as system concepts to reduce precision missile cost per kill and/or logistics burden to meet urban and emerging threats. These technologies transition to PE 0603313A for maturation.			
FY 2011 Accomplishments: Designed, fabricated, and evaluated sample composite mounting brackets with integrated electrical conductivity to increase strength and reduce weight; tailored common electronic safe and arm device (ESAD) design for upgrades to Tube-launched, Optically-tracked, Wire-guided (TOW) and Javelin missiles; completed small ESAD design, fabrication and component evaluation for small lightweight precision munitions; designed and evaluated candidate small height of burst sensor (HOBS) and single chip inertial sensor designs for small precision munitions.			
FY 2012 Plans: Perform trade studies and begin initial critical component design for a small, light, low power navigation-grade sensor package that can detect and maintain track of the direction north; conduct initial packaging of single chip inertial sensor module; conduct			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
trade studies for small, low cost components for precision munitions; design component technologies for the next generation of precision weapon systems including: 1) reduced cost, advanced light weight materials; 2) reduced cost, advanced 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. ***FY 2013 Plans:*** Will 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.			
Title: Target Classification Sensors, Advanced Fuzing Technology and Warhead Integration ***Description:*** This effort designs and demonstrates a low cost inertial sensor capable of identifying the target material class (heavy armor, light armor, concrete, sand, aluminum, and brick) on impact, and advanced fuzing technology to use target classification sensor data for optimizing the warhead effectiveness based on target class. The determination of the different target classifications will be derived from the collaborative Multi-Mode, Multi-Effect warhead effort designed in PE 0602624A Weapons and Munitions Technology. ***FY 2011 Accomplishments:*** Determined the ability of the third generation target classification sensor to identify the six target classes defined in collaboration with the Armaments Research, Development, and Engineering Center (ARDEC). Integrated the improved third generation target classification sensor with miniaturized electronics to reduce the sensor footprint in a hardened package that can operate in real-time. Integrated sensor with advanced fuzing technology and demonstrated in the lab with explosively driven reverse ballistic hardware and/or an air gun to impact the sensor with target materials.	3.705	-	-
Title: Missile Seeker Technology ***Description:*** 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. ***FY 2011 Accomplishments:***	9.663	9.140	10.525

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Designed and evaluated affordable phased array and next-generation imaging seeker components to enable affordable all-weather missile fire control sensors, tactical seekers, and data links; matured technologies to monitor missile system health to extend missile shelf-life; and validated low cost synthetic aperture radar (SAR) seeker evaluation results. ***FY 2012 Plans:*** Begin to address thermal issues for affordable phased array seeker technologies; continue optimization of phased array seeker operating power levels; begin integration of affordable phased array technologies to demonstrate a seeker array with appropriate power levels and in a form factor for missile applications; continue 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; evaluate missile system health monitor performance in a relevant environment; design reconfigurable SAR evaluation test-bed for demonstration of tactical missile applications. ***FY 2013 Plans:*** Will 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, and handover from air platform capabilities for missile seekers; and evaluate nanotechnology for power storage, sensors, and guidance in small guided munitions.			
Title: Missile Guidance, Navigation and Controls Technologies ***Description:*** This effort designs, fabricates and evaluates guidance, navigation, and control systems and software, as well as information and signal processing systems for rocket and missile applications. Goals of this effort include more affordable missile guidance; miniaturization of guidance electronics; maintaining performance in global positioning system denied environments; improved image processing; improved missile power systems; improved communication with ground and other systems; technologies to track and respond to swarms of incoming and outgoing munitions; and electrical connections embedded in missile structures. Beginning in FY13, the Structural Electronics effort below will be included in this effort. ***FY 2011 Accomplishments:*** Designed image gyro system using camera imagery and terrain databases to provide a navigation solution when data is not available from the global positioning system; developed miniaturized guidance electronics; simulated imagery and image feature data combination for infrared and millimeter wave multi-mode seeker algorithm development; and completed evaluation of inertial navigation systems developed under the Enhanced Deeply Integrated Guidance and Navigation Unit effort previously completed in this Project. ***FY 2012 Plans:***	6.760	7.416	7.052

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Integrate image gyro system hardware and software for captive flight demonstration; complete laboratory and limited environmental evaluation of a one-piece, integrated optical data pipe module; design enhanced miniaturized image stabilization hardware module for transition to the Small Organic Precision Munition effort in PE 0603313 Project 263; investigate technologies for increased accuracy and precision of acceleration measurements for navigation in a Global Positioning System denied environment; and complete data combination for infrared and millimeter wave multi-mode seeker algorithm development. ***FY 2013 Plans:*** Will 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.			
Title: Missile Sustainment, Simulations, Launchers, and Fire Control Systems ***Description:*** This effort designs and evaluates advanced health monitoring technologies to increase missile useful life; advanced simulations to increase performance and reduce size, weight, and cost in missile systems; launchers to deliver effects from the air and ground platforms; and fire control systems for area protection and air defense. 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. ***FY 2011 Accomplishments:*** Continued improving methods for subsonic airfoil design and characterization as well as completed updates to aerodynamic prediction codes; collected wind tunnel data on multiple airframe designs to validate and improve aerodynamic prediction models and techniques; designed advanced simulation technologies to enable missile component trade studies; and designed technologies to enable more reliable micro-electromechanical missile components. ***FY 2012 Plans:*** Design aerodynamic prediction codes for hypersonic flight, dynamic damping derivatives prediction methods, airfoil section enhancements, and inlet aerodynamics; design integrated baseline system engineering tool for system-level simulations linking missile component models to system capability; design and evaluate health monitoring technologies for current and future missile systems. ***FY 2013 Plans:*** Will 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	2.848	3.054	5.480

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Missile Propulsion, Structures, Lethality, and Aerodynamic Technology ***Description:*** This effort designs, fabricates, evaluates, and demonstrates missile enabling technologies including: advanced missile propulsion with reduced launch signatures; increased lethality and range of lethality options; improved structural integrity of light weight missile cases; and beginning in FY13, increased understanding of missile aerodynamic interactions previously captured under the High Fidelity Simulation effort above. ***FY 2011 Accomplishments:*** Performed a flight demonstration of a variable yield warhead against a representative concrete target and transitioned to Guided Multiple Launch Rocket System; investigated feasibility of using existing and new propellant ingredients in missile and rocket propulsion to regain performance while maintaining insensitive munitions compliance. ***FY 2012 Plans:*** Demonstrate high performance propellants; perform signature evaluations of current Army ignition materials as a baseline for the signature metrics; and develop, screen for sensitivity, and characterize candidate ignition materials. ***FY 2013 Plans:*** Will 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.	4.821	4.194	6.239
Title: Multi-Role Missile Technology ***Description:*** This effort evaluates critical technology and designs component for future affordable rockets and missiles to provide overwhelming defeat of conventional and asymmetrical threats in all environments. Beginning in FY13, the Swarming Missiles Technologies effort below will be captured here. Successful technologies are matured and demonstrated in PE 603313A Project 263. ***FY 2011 Accomplishments:***	9.257	9.838	7.900

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Refined, fabricated, and evaluated components and subsystems including: 1) miniaturization/packaging of sensors, guidance, and electronics; 2) more efficient, advanced propulsion; 3) warhead integration and lethal effects including non-lethal payload options; performed trade studies to determine the component technologies to support improved precision fire engagements. ***FY 2012 Plans:*** 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. ***FY 2013 Plans:*** Will 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; and design and evaluate guidance and tracking algorithms as well as sensor technology to support attack of a large array of targets.			
Title: Swarming Missile Technology ***Description:*** 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. ***FY 2011 Accomplishments:*** Defined swarming missile mission concepts to derive and define key performance parameters for these missions; identified key component technologies for design and demonstration. ***FY 2012 Plans:*** Finalize key component technology identification based on trade studies performed; begin key component technology design; begin guidance and control algorithm design to support attack of large arrays of targets; evaluate options for low cost advanced sensor design for tracking of large arrays of targets.	1.661	2.913	-
Title: Structural Electronics ***Description:*** 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.	1.076	1.306	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Investigated mechanical and electrical properties of emerging approaches to embed electrical connections in curved forms regarding their applicability to missile structure and component design. ***FY 2012 Plans:*** Fabricate and evaluate sample missile electronics subsystems based on prior year results; evaluate suitability for missile system application; and document design guidelines based on results.			
Accomplishments/Planned Programs Subtotals	48.092	50.605	49.383

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Missile Technologies Initiatives applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Missile Lethality and Precision Research	-	16.474	-
Description: This is a Congressional Interest Item.			
FY 2012 Plans: Congressional add funding for Missile Lethality and Precision Research.			
Accomplishments/Planned Programs Subtotals	-	16.474	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	17.542	20.002	25.999	-	25.999	22.862	21.076	19.976	20.314	Continuing	Continuing
042: *HIGH ENERGY LASER TECHNOLOGY*	17.542	20.002	25.999	-	25.999	22.862	21.076	19.976	20.314	Continuing	Continuing

Note

FY13 funding increase to accomodate transfer from 0603004A L96 to mature laser technologies prior to demonstration.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*			R-1 ITEM NOMENCLATURE PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*		
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	18.190	20.034	21.377	-	21.377
Current President's Budget	17.542	20.002	25.999	-	25.999
Total Adjustments	-0.648	-0.032	4.622	-	4.622
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.542	-			
• Adjustments to Budget Years	-	-	4.622	-	4.622
• Other Adjustments 1	-0.106	-0.032	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
042: *HIGH ENERGY LASER TECHNOLOGY*	17.542	20.002	25.999	-	25.999	22.862	21.076	19.976	20.314	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Solid State Laser (SSL) Effects	2.886	5.948	7.934
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 Experiment (SSLTE), which is a 100kW class laser testbed located at the HELSTF for conducting SSL effects experiments in an open air environment. Beginning in FY13, multiple SSLTE related project tasks were reorganized and are now captured in this planned program.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Determined SSL effectiveness against targets of interest in both static and dynamic test scenarios to assess a broad spectrum of mission applications and validate M&S tools that support analysis of alternatives, HEL power levels, and associated ranges across multiple mission sets. ***FY 2012 Plans:*** Continue static and dynamic evaluations at various power levels up to 100kW using the SSL at the High Energy Laser Systems Test Facility (HELSTF) against Rockets, Artillery, and Mortars (RAM) and Unmanned Aerial Systems (UAS) targets in conjunction with the other Services. ***FY 2013 Plans:*** Will continue to conduct static and dynamic experiments using the SSLTE 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.			
Title: SSL Development, Phase 3 - 100 kW ***Description:*** The goal of this Joint High Power Solid State Laser (JHPSSL) Phase 3 effort is to develop and demonstrate 100 kW-class, near-diffraction-limited diode-pumped solid-state lasers that have architectures favorable for tactical weapon applications. This effort was completed in FY11 after two laboratory experiments successfully achieved >100kW power in the laboratory. ***FY 2011 Accomplishments:*** Demonstrated potential mission applications, including Counter-RAM (CRAM), and explored performance of the HEL TD BCS; successfully completed the second JHPSSL 100kW laser demonstration.	1.945	-	-
Title: Advanced Beam Control Component Development ***Description:*** This effort investigates technologies to enable lighter, more agile beam control systems that are robust enough to be used in Army ground platforms. This work is done in collaboration with the HEL JTO and other Services. Beginning in FY13, support activities were redistributed across all planned programs rather than solely captured in this activity. ***FY 2011 Accomplishments:*** Fabricated and assembled advanced beam control components for integration into the light weight beam director to reduce size and weight and increase the effective range of the beam control system. ***FY 2012 Plans:*** Coat optics, begin assembly, and conduct laboratory demonstrations of a lightweight beam director with the performance characteristics required for a tactical HEL weapon system. ***FY 2013 Plans:***	2.592	0.751	1.184

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: High Efficiency Laser Development ***Description:*** This effort develops component technologies that lead to increased SSL wall-plug efficiencies, which will lead to reductions in size and weight for multiple subsystems that greatly improve the ability to integrate SSL systems onto mobile Army weapon platforms. This work is done in collaboration with the HEL JTO and other Services. ***FY 2011 Accomplishments:*** Began risk reduction for assembly and integration of two 25 kW high efficiency breadboards using alternative technical approaches; began the conceptual design of a 100 kW class high efficiency device; and continued to develop thermal management techniques specific to high efficiency lasers that minimize thermal distortions, alignment errors, and beam quality degradation. ***FY 2012 Plans:*** Complete 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; complete the interim design of the 25 kW laboratory devices; complete the conceptual design of the 100 kW class device, to include thermal management techniques; and leverage small business innovation research efforts to complete eye-safe laser component demonstrations. ***FY 2013 Plans:*** In concert with the HEL JTO and the other services, will 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 HEL TD 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.	9.115	12.489	15.947
Title: HEL Research and Development Laboratory ***Description:*** This effort focuses on developing in-house expertise through SSL assessments. This work is done in cooperation with the Aviation and Missile Research Development and Engineering Center (AMRDEC). ***FY 2011 Accomplishments:***	1.004	0.814	0.934

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Investigated new deformable mirror designs to identify those with lower cost and sufficient performance; and investigated causes of poor beam quality in SSLs to determine where investments can advance the technology for Army applications. ***FY 2012 Plans:*** Conduct modeling and simulation studies to characterize and optimize HEL system and component performance; and enhance state-of-the-art reflectance measurement capability and continue collecting reflectance data of threat targets. ***FY 2013 Plans:*** Will conduct experiments using AO components to develop and validate algorithms for correction of atmospheric distortions to improve effective range.			
Accomplishments/Planned Programs Subtotals	17.542	20.002	25.999

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	19.907	20.900	23.507	-	23.507	24.063	24.237	25.191	25.662	Continuing	Continuing
C90: *Advanced Distributed Simulation*	14.045	14.713	17.125	-	17.125	17.566	17.632	18.474	18.831	Continuing	Continuing
D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*	5.862	6.187	6.382	-	6.382	6.497	6.605	6.717	6.831	Continuing	Continuing

Note

FY13 funding increased for training and simulation technology.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	20.582	20.933	21.291	-	21.291
Current President's Budget	19.907	20.900	23.507	-	23.507
Total Adjustments	-0.675	-0.033	2.216	-	2.216
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.506	-			
• Adjustments to Budget Years	-	-	2.216	-	2.216
• Other Adjustments 1	-0.169	-0.033	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
C90: *Advanced Distributed Simulation*	14.045	14.713	17.125	-	17.125	17.566	17.632	18.474	18.831	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Live, Virtual, Constructive (LVC) Simulations	3.607	3.949	4.533
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.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continued investigations in predictive technologies for behaviors and reasoning of computer generated forces; and completed development of real-time physics-based rendering of asymmetric forces in urban environments to support asymmetric warfare simulations in embedded training for LVC training. ***FY 2012 Plans:*** Investigate technologies to create visual and aural battlefield effects; will produce a more holistic sensory experience for a live training audience; and complete laboratory experiments of dynamic terrain/environment shared architecture, physics based algorithms in virtual and constructive simulations, as well as apply high performance computing in preparation for future advance technology demonstrations. ***FY 2013 Plans:*** Will 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.			
Title: Modeling and Simulation Training Technologies	3.820	3.969	3.165
Description: 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. ***FY 2011 Accomplishments:*** Investigated methods and technologies to emulate live tissue replacement, and conducted experiments to assess training effectiveness; initiated structured research and conduct testing with medical holograms and virtual patients; developed low-cost, rugged person-worn immersive systems for dismounted Soldier training as well as tracking systems and hand-held devices to support dismounted training exercises. ***FY 2012 Plans:*** Conduct 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 investigate game engine and virtual world in terms of improving the human interfaces as well as developing new innovative training environments in accordance with the United States Army Learning Concept for 2015 document. ***FY 2013 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: Collaborative and Immersive Environment Technologies ***Description:*** This effort investigates adaptive tutoring and immersive learning environments with social simulations to conduct kinetic and non-kinetic training for individuals and teams. ***FY 2011 Accomplishments:*** Continued the development of infantry immersive simulation and learning environments to include intelligent tutoring feedback; developed the enhanced realism of simulation environment to support the battle command training and decision making; validateed algorithms and methodologies through user assessments; as well as investigated and developed virtual world and gaming technologies to accomplish multi-player, large scale, distributed training and learning; with evaluation of the technologies and the impact on human performance. ***FY 2012 Plans:*** Continue 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 can be readily created by others. ***FY 2013 Plans:*** Will 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.	6.618	6.795	9.427
Accomplishments/Planned Programs Subtotals	14.045	14.713	17.125

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*	5.862	6.187	6.382	-	6.382	6.497	6.605	6.717	6.831	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

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).

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 2011	FY 2012	FY 2013
Title: Immersive Technology Environments	2.862	3.024	3.185
Description: Performs applied research that enable responsive and reconfigurable environments that immerse human senses such as sight, sound, and touch in mixed reality environments which also includes physical elements providing touch and feel to simulate objects such as obstacles and walls. The goal is to identify technologies which enhance realism for training and leader development. Developed technologies and techniques are transitioned for maturation and demonstration to PE 0603015A/Project S28.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Investigated technologies to make mixed reality training,which combines real and imagined images as well as environments, more portable and affordable. ***FY 2012 Plans:*** Develop tools that allow others to easily create immersive environments; develop and integrate improved natural language capabilities into the multi-party conversational agent simulation to investigate improved contextual knowledge and understanding of events within the simulation. ***FY 2013 Plans:*** Will 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 supporting the therapy of veterans and active duty Soldiers for (i.e. PTSD) and examine effectiveness of immersive training on hand-held devices and tablets.			
Title: Immersive Technology Techniques ***Description:*** This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments and therefore creating enhanced realism. ***FY 2011 Accomplishments:*** Investigated and developed technologies and techniques to implement high-quality video and interactive experiences on mobile hand-held devices; evaluated and developed research technologies and components for supporting interactive learning. ***FY 2012 Plans:*** Investigate tools for semi-automatically creating training materials based on rapid assimilation of actual experiences; and conduct analysis of pilot data from a complex negotiation/bargaining task to develop implementation of emotional behaviors in virtual humans. ***FY 2013 Plans:*** Will create training toolkits based on assimilation of actual experiences available for Army use; will develop improved data structures and methods (algorithms and software) for integration of scanned facial data into the Virtual Human Architecture for more human like representations and design tools for annotating transcripts with semantic information and speech acts to assist future social cultural training technologies.	3.000	3.163	3.197
Accomplishments/Planned Programs Subtotals	5.862	6.187	6.382

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	61.893	64.205	69.062	-	69.062	67.789	71.809	70.503	64.873	Continuing	Continuing
C05: *ARMOR APPLIED RESEARCH*	24.776	25.798	28.440	-	28.440	27.037	28.407	28.547	25.414	Continuing	Continuing
H77: *National Automotive Center*	16.016	15.120	16.250	-	16.250	15.939	16.606	16.813	17.010	Continuing	Continuing
H91: *Ground Vehicle Technology*	21.101	23.287	24.372	-	24.372	24.813	26.796	25.143	22.449	Continuing	Continuing

Note

FY13 funding increased for vehicle blast research and alternative fuels research.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	64.740	64.306	62.264	-	62.264
Current President's Budget	61.893	64.205	69.062	-	69.062
Total Adjustments	-2.847	-0.101	6.798	-	6.798
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.006	-			
• Adjustments to Budget Years	-	-	6.798	-	6.798
• Other Adjustments 1	-1.841	-0.101	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
C05: *ARMOR APPLIED RESEARCH*	24.776	25.798	28.440	-	28.440	27.037	28.407	28.547	25.414	Continuing	Continuing

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 M&S, hit avoidance, kill avoidance, safety, sensors, 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)	FY 2011	FY 2012	FY 2013
Title: Vehicle Armor Protection for Lightweight Combat Systems:	10.505	9.966	-
Description: This effort designs, fabricates, and investigates add-on lightweight armor packages to protect combat systems against projectiles, warheads, penetrators and blast fragments.			
FY 2011 Accomplishments: Performed armor recipe optimization to establish armor efficiency; completed ballistic testing of selected armor systems to validate the armor design; downselected materials/armor systems for entire vehicle protection and procured long lead items for future demonstration builds; and matured and validated performance of multifunctional armor.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Complete armor design and fabrication; perform shaker and ballistic assessment to validate and improve armor design, armor attachment durability, and ballistic performance for combat vehicles. This work is done in conjunction with program elements 0602105A, 0602618A, and 0603005A.			
Title: Advanced Armor Development: ***Description:*** The objective of this effort is to design, integrate and validate performance of advanced armor systems to defeat single and multiple chemical and kinetic energy (CE and KE) emerging threats for combat and tactical vehicles. These systems include base armor (small arms / medium caliber opaque B-kits and transparent), applique armor (passive / reactive / active multi-threat C-kits) and multifunctional armor (embedded antennas & health monitoring devices). ***FY 2011 Accomplishments:*** Validated advanced armor designs at the panel level while reducing armor weight by 10,000 pounds; improved armor recipe to meet threshold areal density while defeating threshold threat for the Ground Combat Vehicle platform. ***FY 2012 Plans:*** Develop advanced armor designs at the panel level that will reduce areal density from the threshold level while still defeating threshold threat. Investigate integration of communication antennas and health monitoring equipment into armor recipe and design. This work is done in conjunction with program elements 0602105A, 0602618A and 0603005A. ***FY 2013 Plans:*** Will 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.	8.470	7.160	10.950
Title: Blast Mitigation: ***Description:*** This effort designs, fabricates and evaluates advanced survivability and protection capabilities, tools and technologies to improve protection against vehicle mines, improvised explosive devices (IEDs) and other underbody threats, and crash events. This effort also designs and evaluates technologies purposed for protecting the occupant such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious research and development of blast-mitigating technologies. Blast and crash mitigation technologies are further investigated and matured in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, sensors for active technologies and performance evaluation, M&S, experimentation and instrumentation. ***FY 2011 Accomplishments:***	5.801	8.672	12.490

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Developed techniques for complete vehicle structure design and crew protection methods for landmine/explosive events; investigated performance and integration of extinguishing mechanisms; enhanced fire M&S tools to incorporate new extinguishing agents, delivery systems, and predictive capabilities for ballistic events; increased cook-off resistance of small arms ammunition via improved stowage without compromising accessibility. ***FY 2012 Plans:*** Increase fidelity in end-to-end M&S tools for occupant protection and vehicle underbody and Soldier blast protection. Validate live fire test and evaluation events with M&S to reduce program risk and expense, and use high fidelity models to identify quick reaction solutions to the Warfighter. Mature techniques to reduce flammability of vehicle tires, track, and composite materials and protect lithium-ion batteries against fire events. ***FY 2013 Plans:*** Will 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.			
Title: Synergistic Vehicle Protection Technologies ***Description:*** This effort investigates and integrates advanced synergistic survivability technologies and simulation tools to provide enhanced protection for ground vehicles while minimizing overall system burdens. Synergistic survivability technologies such as, armor and active protection, offer the potential of non-linear survivability improvements. The modular approach facilities trade-offs between protection, payload, performance, cost drivers and performance of vulnerability assessments throughout the life cycle of a system. Provides quantifiable metrics for development of requirements and evaluation of concept feasibility in the development of survivable combat systems. ***FY 2013 Plans:*** Will 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.	-	-	5.000
Accomplishments/Planned Programs Subtotals	24.776	25.798	28.440

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H77: *National Automotive Center*	16.016	15.120	16.250	-	16.250	15.939	16.606	16.813	17.010	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Alternative Energy:	8.573	9.062	-
Description: This effort leverages opportunities from industry to develop alternative energy technologies for Army applications.			
FY 2011 Accomplishments: Continued development of waste to energy technologies to reduce fuel consumption in power generation; continued to conduct experiments with synthetic and renewable fuel blends for alternative fuels qualification program for ground vehicle systems; expanded development and commercialization of dual-use Modeling and Simulation (M&S) tools by conducting high-density hybrid engine modeling and vehicle thermal management modeling.			
FY 2012 Plans: Conclude development of dual-use M&S tools for advanced high-density hybrid engine powered non-tactical vehicle business case analysis; begin planning for large scale investigation of vehicle-to-grid and grid-to-vehicle capabilities integrated into a power			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
grid with a high proportion of renewable generation; continue to pursue qualification of alternative fuels for use in ground vehicle systems; conduct system level assessments of synthetic and renewable fuel blends supporting their implementation into military fleets. This work is being done in conjunction with program element 0602705A.			
Title: Conditioned Based Maintenance (CBM) and Intelligent Systems: ***Description:*** 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. ***FY 2011 Accomplishments:*** Expanded development and investigation of dual-use CBM tools by developing battery prognostics and diagnostics M&S tools, as well as investigating on-board vehicle health awareness tools. ***FY 2012 Plans:*** Pursue fleet level evaluation of dual-use CBM tools for battery prognostics and diagnostics and begin development and investigation of dual-use CBM tools for additional vehicle subsystem prognostics and diagnostics.	2.152	2.272	-
Title: Power, Energy and Mobility: ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed dual-use automotive subsystems and components that can be modified for application to military platforms and alternative chassis structures; pursued power and energy component development; designed high-yield renewable energy generation technology architecture and prepared distributed generation transition criteria for PM Mobile Electric Power; and expanded development of methodologies to validate and explore true potential of proposed advanced engine technologies. ***FY 2012 Plans:*** Continue the pursuit of dual-use power and energy component development and integrate initial products into non-tactical vehicles for assessment on military installations. Continue to support transition of distributed generation hardware to PM Mobile Electric Power or other materiel developers. ***FY 2013 Plans:***	3.103	3.786	5.933

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: Joint Recovery and Distribution System (JRaDS): ***Description:*** Provides a Family of Systems (FoS) which enables execution of multiple mission profiles via a small number of trailer variants vs. the current large inventory of distinct service type trailer systems. Will offer high reliability and parts commonality, reducing service logistics and maintenance requirements associated costs of ownership, and requirements for supplementary Materiel Handling Equipment and supporting personnel. ***FY 2011 Accomplishments:*** Reduced risk for DoD Joint Recovery and Distribution System (JRaDS) JCTD by enabling the purchase of additional prototype trailer systems and supported the broader scoped Operational Military Utility Assessment. Fielded JRaDs trailers in Afghanistan for a successful operational assessment.	2.188	-	-
Title: Dual Use Technologies ***Description:*** This effort investigates, researches and evaluates ground vehicle technologies with both military and commercial applications such as renewable energy technologies, electrical power management between vehicles and the grid, alternative fuels, and advanced vehicle networking and communication (telematics). This effort maximizes commercial technology investment for military applications in line with the National Automotive Center's Charter. Collaborations with industry, universities and other government agencies on standards writing for joint applications will facilitate this activity. This work is done in conjunction with program element 0603005A. ***FY 2013 Plans:*** Will actively 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.	-	-	10.317
Accomplishments/Planned Programs Subtotals	16.016	15.120	16.250

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H91: *Ground Vehicle Technology*	21.101	23.287	24.372	-	24.372	24.813	26.796	25.143	22.449	Continuing	Continuing

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)	FY 2011	FY 2012	FY 2013
Title: Pulse Power:	5.997	3.784	1.002
Description: This effort focuses on growing compact, high frequency/high energy/high power density components and devices for several advanced electric-based survivability and lethality weapon systems. Technologies include direct current (DC) to DC chargers, high energy batteries, pulse chargers, high density capacitors, and solid state switches. This effort is coordinated with PEs 0603005A (Combat Vehicle and Automotive Advanced Technology) and 0602705A (Electronics and Electronic Devices).			
FY 2011 Accomplishments: Investigated solid state Silicon (Si) and Silicon Carbide (SiC) based Super Gate Turn Off (SGTO) applications such as high power microwaves, electrified armors, and directed energy weapons applications.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Investigate silicon carbide (SiC) based super gate turn off (SGTO) switches for electro-mechanical armor applications; investigate SiC components in high power electrical conversion components, and pulse chargers; investigate improvements in fast high energy density capacitors with improved clearing agents using newly developed films for directed energy weapons (DEW). ***FY 2013 Plans:*** Will investigate 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.			
Title: JP-8 Reformation for Military Fuel Cells: ***Description:*** This effort investigates JP-8 reformer and desulfurization technologies so that JP-8 may be utilized as a fuel source for fuel cells in future military vehicle power applications. ***FY 2011 Accomplishments:*** Further matured major JP-8 reforming fuel cell system components performance and interoperability; designed and developed balance of components for the JP-8 reforming fuel cell system and ensured program specifications met user capability requirements. This effort was done in coordination with efforts in PE 0603005A, project 441. This effort continues in FY1`2 under the Advanced Non-Primary Power Systems effort.	2.061	-	-
Title: Propulsion and Thermal Systems: ***Description:*** This effort researches, designs and evaluates high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), increased electrical power generation needs (onboard communications, surveillance and exportable power), improved fuel economy (fuel cost & range), enhanced mobility (survivability), and reduced cooling system burden (size, heat rejection). 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). ***FY 2011 Accomplishments:*** Completed common rail fuel pump development and conducted durability experiments with JP-8; completed the design and fabrication of closed-loop fuel injection system; conducted initial fuel injection system performance tests; began advanced drivetrain efficiency design and development; and advanced powertrain noise abatement technology development. ***FY 2012 Plans:***	1.797	5.201	4.334

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Investigate the durability and reliability of advanced fuel systems operating on JP-8 fuel at high temperatures; examine engine performance when using military grade fuels; complete powertrain analysis for efficiency and thermal heat rejection; examine designs to improve the mechanical efficiency of advanced transmissions while increasing ratio spread and electronic controls; investigate and develop components to reduce engine cooling burden. ***FY 2013 Plans:*** Will 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 waste heat recovery feasibility from the engine compartment and innovative thermoelectric generator designs to achieve greater conversion to onboard electricity.			
Title: Power & Thermal Management: ***Description:*** This effort investigates power and thermal management components, including traction motors, inverters, DC-DC converters, new motor and generator concepts and control strategies to meet objective power requirements. ***FY 2011 Accomplishments:*** Developed advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads; initiated development of reliable, cost effective, high temperature power electronic components to reduce system cooling burden. This effort was done in coordination with efforts in 0603005A. For FY12, this effort is continued under titles Power Management Technologies and Power Electronics, Hybrid Electric and On-Board Vehicle Power Components.	5.863	-	-
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. ***FY 2012 Plans:*** Enhanced advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads. ***FY 2013 Plans:*** This effort will continue to mature a common vehicle power management control architecture as well as write and evaluate power control software. Additionally, this effort will design high voltage power electronics with high operating temperatures to be further	-	1.016	3.916

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
matured in 0603005A, project 497. These technologies will optimize power distribution and minimize thermal burdens on the vehicle as demands for greater electrical power continue to increase.			
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 turn off critical mission 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. ***FY 2012 Plans:*** Investigate 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. ***FY 2013 Plans:*** Will 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.	-	6.446	1.968
Title: Advanced Non-Primary Power Systems ***Description:*** 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	-	2.119	2.998

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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. ***FY 2012 Plans:*** Investigate JP-8 reformer/fuel cell system models and component level evaluation data; finalize JP-8 reformer/fuel cell system design; investigate small engine technologies for use on small unmanned ground vehicles. ***FY 2013 Plans:*** In order to reduce fuel consumption and meet the increasing power demands of military vehicles, this effort will investigate modular/scalable small engine technologies, mature fuel injection strategies and validate their application for use as auxiliary power units for military ground vehicles and unmanned ground systems.			
Title: Elastomer Improvement Program ***Description:*** 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. ***FY 2013 Plans:*** This effort will integrate advanced nano-composites into elastomer designs and formulations to increase durability and reduce flammability of materials. In addition, novel running gear elastomers designs will be fabricated and tested in order to reduce maintenance and increase system durability. Finally, this effort will perform laboratory testing of new compounds to validate the new materials/properties are exceeding the properties of existing materials.	-	-	1.000
Title: Intelligent Systems Technology Research: ***Description:*** This effort investigates improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems such as maneuver and tactical behavior algorithms, driver assist techniques, autonomy kits, advanced navigation and planning, vehicle self-protection, local situational awareness, advanced perception, vehicle and pedestrian safety, and robotic command and control. ***FY 2011 Accomplishments:*** Analyzed the integration of robotic sensor data into a network communication model to validate accurate vehicle operations; developed algorithms from the fused sensor data that allow more accurate and precise vehicle manipulation within various virtual environments and predicted vehicle payload effects; developed and evaluated approaches to enhance the capabilities	4.030	4.721	7.909

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
for unmanned systems to work in a dynamic environment; and developed interoperability profiles and architectures to facilitate command and control of the unmanned systems from a common Warfighter machine interface. ***FY 2012 Plans:*** Conduct initial trade studies in the areas of intelligence, perception, communications, robotic control and payload integration for a weaponized robotic system; advance 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 develop intelligent architectures for systems level weaponized robotic control. ***FY 2013 Plans:*** Will 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.			
Title: Diagnostics/Prognostics for Condition Based Maintenance: ***Description:*** This effort focuses on reduction of maintenance time and cost by developing the tools to gather data from ground vehicles to allow more accurate diagnoses of problems, leading to prediction of failures before they occur. ***FY 2011 Accomplishments:*** Leveraged past algorithm development to create diagnostics and prognostics on power and energy components (batteries, power converters, alternators). This included failure mode effects and analysis development, model development, root cause analysis, and algorithm updates.	1.353	-	-
Title: Petroleum, Oil, and Lubricant (POL) Products: ***Description:*** This project focuses on creating and evaluating innovative petroleum, oil and lubricant (POL) products that reduce logistic burdens, maintenance requirements, and fuel consumption. Products will be developed in areas such as alternative fuels, fuel additives, lubricants, power train fluids, coolants, and petroleum, oil, and lubricant products to support new military technology requirements (i.e. anti-lock brakes, semi-active suspension, etc.). ***FY 2013 Plans:*** Will 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	-	-	1.245

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
evaluation of nanofluid technology that suspends nanoparticles in coolants and lubricants to improve thermal, friction, and wear properties.			
Accomplishments/Planned Programs Subtotals	21.101	23.287	24.372

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	60.595	59.121	60.823	-	60.823	60.568	62.011	69.703	69.416	Continuing	Continuing
H80: *Survivability and Lethality Technology*	60.595	59.121	60.823	-	60.823	60.568	62.011	69.703	69.416	Continuing	Continuing

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 future technologies. 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.

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	60.342	59.214	58.340	-	58.340
Current President's Budget	60.595	59.121	60.823	-	60.823
Total Adjustments	0.253	-0.093	2.483	-	2.483
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.836	-			
• Adjustments to Budget Years	-	-	2.483	-	2.483
• Other Adjustments 1	1.089	-0.093	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H80: *Survivability and Lethality Technology*	60.595	59.121	60.823	-	60.823	60.568	62.011	69.703	69.416	Continuing	Continuing

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 future technologies for improved ballistic 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 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 2011	FY 2012	FY 2013
Title: Structural Armor	12.390	9.840	7.560
Description: This effort conducts applied research to design advanced lightweight structural armor technologies, such as ceramic, metallic, transparent, and electromagnetic, for transition to current and future tactical as well as combat vehicle			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
designers. The goal is to provide designs that reduce weight while improving ballistic protection and affording multifunctional capabilities. ***FY 2011 Accomplishments:*** Validated the performance of third generation armor concepts under realistic environmental conditions, through testing coupled with modeling and simulation with emphasis on ceramic-composite and encapsulated ceramic technologies. ***FY 2012 Plans:*** Investigate third generation structural armor performance incorporating most promising ceramic-composite and encapsulated ceramic materials technologies; evaluate 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); use modeling and simulation coupled with experimentation to validate emerging ballistic defeat mechanisms that couple structural materials with energy absorbing mechanisms against future threats. ***FY 2013 Plans:*** Will 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.			
Title: Mine Blast Protection ***Description:*** This effort investigates and designs tools, techniques, and technologies for protection against mine/IED blast threats, ballistic shock mitigation, and fuel/ammunition fires to enable survivability of current and future platforms and the dismounted Soldier. ***FY 2011 Accomplishments:*** Assessed and computationally validated advanced mine protection concepts (to include active seating) at goal weights for threshold threat defeat, and proved performance under relevant environmental conditions. ***FY 2012 Plans:*** Incorporate 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 validate the simulated results for mine blast events using data from live-fire test events. ***FY 2013 Plans:***	3.694	5.407	3.869

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: Enabling Precision Munitions ***Description:*** 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). ***FY 2011 Accomplishments:*** Showed feasibility of non-GPS guidance technologies. Provided technology assessment of precision hit technology across munition size and domain. ***FY 2012 Plans:*** Combine 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. ***FY 2013 Plans:*** Will 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.	4.228	4.833	4.588
Title: Energetic Materials ***Description:*** This effort investigates, evaluates, selects, and models propulsion and energetic materials and technologies to validate novel energetic materials concepts (such as nano-structural and insensitive) that exploit managed energy release required for improving the effectiveness and reducing the vulnerability of future gun/missile systems and warheads. ***FY 2011 Accomplishments:*** Studied green energetic material formulation and investigate feasibility of replacing Hexahydro-Trinitro-Triazine (RDX) in novel energetics. ***FY 2012 Plans:***	5.025	5.496	5.158

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Validate ability to characterize energetic materials through multiscale modeling; and simulation; provide understanding of energetic material properties to synthesizers and formulators; support 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 investigate solid rocket throttleable propulsion for extending missile range. ***FY 2013 Plans:*** Will 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.			
Title: Advanced Munitions and Lethality Technologies ***Description:*** This effort identifies and models preferred options to reduce energy/mass required to defeat emerging armor threats and to provide multi-purpose capabilities for revolutionary future lethality. In addition, this effort investigates technology options for scaling warhead lethality to enhance urban Warfighting capabilities including control of collateral damage. ***FY 2011 Accomplishments:*** Conducted assessments and documented advances in scalable effects on targets. ***FY 2012 Plans:*** Identify 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 conduct applied research and prove novel lethal mechanisms for defeat of expanding target set, which includes vehicles, buildings and Soldiers. ***FY 2013 Plans:*** Will 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.	3.700	3.094	3.449
Title: Survivability/Lethality Analyses ***Description:*** This effort devises state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats against future weapon systems. ***FY 2011 Accomplishments:***	5.150	4.319	9.373

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Completed integration of ballistics effects into a system-of-systems context with other threat classes including electronic and information warfare; performed improvements to tools, techniques, and methodologies for ballistic survivability/lethality analysis to ensure analysis tools are relevant and credible for developmental army systems using new lethality and survivability technologies. ***FY 2012 Plans:*** Develop new methodologies for assessing soldier/platform occupant injury probabilities in support of efforts to develop a new military specific anthropomorphic test device (WIAMan); conduct advanced experimentation and simulation to improve biofidelic characterization and injury correlation of helmet back face deformation; incorporate an enhanced shot-line viewer, virtual components, active protection systems and multiple threat functionalities to Modular UNIX-based Vulnerability Estimation Suite (MUVES) 3. ***FY 2013 Plans:*** Will 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.			
Title: Multi-Threat Armor Formulations and Designs ***Description:*** This effort devised and matured 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. ***FY 2011 Accomplishments:*** Determined and refined candidate dual threat defeat armor solution candidates for maturation in PE 0602601A/project C05; validated the assessment and computational tools that will be used to design and develop active and hybrid armors concepts and proved the feasibility of using a hybrid armor in a multi-threat scenario with component level proof of principle validation in relevant environments. ***FY 2012 Plans:*** Downselect the most promising multi-threat armor concepts and transition technology to TARDEC (PE 0602601A/project C05) for maturation; investigate advanced reactive and electromagnetic physics for defeat of multiple threat types to include development of algorithms that capture the symbiotic relationships between the mechanisms; develop multi-disciplinary physics-based modeling tools that connect impacts on personal protection technologies to Soldier biologic insult and damage; and develop experimentally validated constitutive material mechanics models that capture high-rate human tissue mechanics. ***FY 2013 Plans:*** Will 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	21.403	21.863	19.962

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Penetrator Lethality Applied Research ***Description:*** This effort evaluates effects of velocity and novel penetrator designs for future lethality applications across the spectrum of targets to include vehicles, buildings, and personnel. ***FY 2011 Accomplishments:*** Validated effects on lethality of velocity - ranging from ordnance velocity to hypervelocity - and also the effect of novel penetrator designs; completed validation and assessment of benefits of novel penetrator effects at ordnance velocity; conducted initial validation of most promising novel penetrator designs at hypervelocity, and improved penetration and lethality models based on novel penetrator data; and investigated advanced propulsion system concepts to achieve velocities above current ordnance velocities. ***FY 2012 Plans:*** Prove 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 validate concepts that overcome current propulsion technology limitation of muzzle pressure that enables use of next generation propellants. ***FY 2013 Plans:*** Will 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.	5.005	4.269	6.864
Accomplishments/Planned Programs Subtotals	60.595	59.121	60.823

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	10.555	4.869	4.465	-	4.465	4.490	3.968	3.889	3.945	Continuing	Continuing
552: *SMOKE/NOVEL EFFECT MUN*	5.154	4.869	4.465	-	4.465	4.490	3.968	3.889	3.945	Continuing	Continuing
BA1: *Protection Technologies (CA)*	5.401	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

FY11 funding increased for Congressional Add.

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 (Countermine & 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
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*		
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	5.324	4.877	4.431	-	4.431
Current President's Budget	10.555	4.869	4.465	-	4.465
Total Adjustments	5.231	-0.008	0.034	-	0.034
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	5.520	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.289	-			
• Adjustments to Budget Years	-	-	0.034	-	0.034
• Other Adjustments 1	-	-0.008	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
552: *SMOKE/NOVEL EFFECT MUN*	5.154	4.869	4.465	-	4.465	4.490	3.968	3.889	3.945	Continuing	Continuing

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 (Countermine & 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 2011	FY 2012	FY 2013
Title: Advanced Obscurants	1.355	1.398	1.411
Description: This effort investigates new materials and compounds to enable safe, effective screening of personnel and equipment.			
FY 2011 Accomplishments: Developed, refined and optimized bi-spectral packaging and dissemination concepts through testing and modifications to make them suitable for weaponization.			
FY 2012 Plans: Evaluate optimized bispectral materials and initiate analysis of spectrally selective obscurant concepts.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will begin small scale synthesis of spectrally selective materials and conduct characterization.			
Title: Obscurant Enabling Technology ***Description:*** This effort investigates distribution technologies for various obscurants. ***FY 2011 Accomplishments:*** Conducted studies of dissemination techniques for low hazard visual obscurants to increase their obscuration performance and to make them suitable for weaponization. ***FY 2012 Plans:*** Refine and optimize new visual low hazard obscurants. ***FY 2013 Plans:*** Will conduct dissemination studies of new low hazard visual obscurants.	0.875	0.968	1.056
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). ***FY 2011 Accomplishments:*** Established and validated forensic sampling protocols for sensing explosives on surfaces; identified the differences in instrumentation used in theater and within continental United States-based laboratories; continued fate and transport studies of trace energetics and chemical components focusing on surface residues; evaluate and determine decomposition patterns and pathways to provide additional signature markers; identified chemical signatures for sensing, leveraging data from DARPA Portable Open Source Security Elements (POSSE) program; investigated the ability to combine chemical and explosive hazard detection; and utilized findings to help guide detector/detection specifications. ***FY 2012 Plans:*** Investigate improved signature information and novel algorithms and experimentally evaluate performance for explosives and precursor materials in existing chemical point and stand-off detection sensor systems.	2.924	2.503	-
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. ***FY 2013 Plans:***	-	-	1.998

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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); and demonstrate integrated biometric and chemical sensing for attribution using Raman chemical imaging.			
Accomplishments/Planned Programs Subtotals	5.154	4.869	4.465

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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 BA1: *Protection Technologies (CA)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
BA1: *Protection Technologies (CA)*	5.401	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Protection Technologies applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Emerging Chemical Agent Threat	5.401	-	-
Description: This is a Congressional Interest Item			
FY 2011 Accomplishments: This is a Congressional Interest Item			
Accomplishments/Planned Programs Subtotals	5.401	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602623A: *JOINT SERVICE SMALL ARMS PROGRAM*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	7.630	8.231	7.169	-	7.169	7.818	8.969	9.114	9.267	Continuing	Continuing
H21: *JT SVC SA PROG (JSSAP)*	7.630	8.231	7.169	-	7.169	7.818	8.969	9.114	9.267	Continuing	Continuing

Note

FY13 funding decrease to support higher priority efforts.

A. Mission Description and Budget Item Justification

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

Work in this PE is related to, and fully coordinated with, efforts in PE 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.

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	7.893	8.244	8.604	-	8.604
Current President's Budget	7.630	8.231	7.169	-	7.169
Total Adjustments	-0.263	-0.013	-1.435	-	-1.435
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.202	-			
• Adjustments to Budget Years	-	-	-1.435	-	-1.435
• Other Adjustments 1	-0.061	-0.013	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H21: *JT SVC SA PROG (JSSAP)*	7.630	8.231	7.169	-	7.169	7.818	8.969	9.114	9.267	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Advanced Lethal Armament Technology for Small Arms ***Description:*** This effort addresses terminal effects and launch aspects of small arms weapon systems. ***FY 2011 Accomplishments:*** Asses optimum small caliber payloads, fire control and advanced fuzing through component demonstrations confirming critical characteristics, (such as flight dynamics) in a wind tunnel and confirm results with modeling and simulation; develop target-orientation sensors for small caliber payloads designs.	3.134	-	-
Title: Advanced Fire Control Technology for Small Arms ***Description:*** This effort addresses advanced fire control technologies to reduce miss distance of small arms weapon systems. ***FY 2011 Accomplishments:*** Evaluated capability of critical components to engage defilade and covered targets; designed weapon-aiming components improving timeline and target centroid location to increase effectiveness; performed critical lab advanced-aiming assessments; conducted evaluation of tradeoffs resulting from the incorporation of enhancements to small arms critical components.	4.496	-	-
Title: Advanced Small Unit (Squad) Small Arms Technology Concepts	-	3.655	3.801

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
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 Plans:*** Investigate, design and develop the next generation (2016 and beyond) small arms weapons platforms; investigate critical technologies and concepts that can be integrated into weapons system platforms to provide the Warfighter the next generation new small arms capabilities; conduct experiments to mature small arms component technologies in target engagement, target effectiveness, and power and energy requirements. ***FY 2013 Plans:*** Will 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.			
Title: Small Arms Material and Process Technology ***Description:*** This effort addresses state of the art material substrates and surface coatings to improve reliability, reduce maintenance and improve weapon diagnostics through embedded technology. ***FY 2012 Plans:*** Perform a detailed investigation of these new materials and techniques as applied to current and new weapon systems; mature past investments in lubricous weapon coatings, shot counters and other indicators to increase weapon life, improve durability and reduce weight. ***FY 2013 Plans:*** Will 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.	-	4.576	3.368
Accomplishments/Planned Programs Subtotals	7.630	8.231	7.169

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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)*

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602624A: *Weapons and Munitions Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	41.368	54.727	35.218	-	35.218	33.613	34.124	34.884	34.198	Continuing	Continuing
H18: *Weapons & Munitions Technologies*	18.728	11.945	16.596	-	16.596	12.700	13.011	12.671	12.795	Continuing	Continuing
H19: *ASYMMETRIC & COUNTER MEASURE TECHNOLOGIES*	11.386	16.207	7.762	-	7.762	9.049	8.989	8.819	8.886	Continuing	Continuing
H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	-	14.976	-	-	-	-	-	-	-	Continuing	Continuing
H28: *WARHEADS/ ENERGETICS TECHNOLOGIES*	11.254	11.599	10.860	-	10.860	11.864	12.124	13.394	12.517	Continuing	Continuing

Note

FY12 funding increase is a congressional add.

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 evaluatesH28 evaluates munition components such as fuzes, power, warheads with tailorable effects, and insensitive munition compliant energetic materials.

Work in this PE is related to, and fully coordinated with, PE 0602303A (Aviation Advanced Technology), 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and, PE 0603008A (Electronic Warfare Advanced Technology). The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602624A: *Weapons and Munitions Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	42.645	39.813	37.740	-	37.740
Current President's Budget	41.368	54.727	35.218	-	35.218
Total Adjustments	-1.277	14.914	-2.522	-	-2.522
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.825	-			
• Adjustments to Budget Years	-	-	-2.522	-	-2.522
• Other Adjustments 1	-0.452	-0.086	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H18: *Weapons & Munitions Technologies*	18.728	11.945	16.596	-	16.596	12.700	13.011	12.671	12.795	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: High Power Microwave (HPM) - Anti-Materiel Munitions	3.150	-	-
Description: This effort designs, fabricates and evaluates HPM technologies such as antenna, power sources, and radio frequency sources for use in non-lethal (NL) munitions.			
FY 2011 Accomplishments: Developed, tested and integrated frequency adjusting technology components for graduated effects on multiple targets. In addition, bound target set frequency vulnerabilities through use of susceptibility analysis and modeling to enable optimization of weapon antenna, radio frequency source, power conditioning, and prime power; explored ability to create graduated target effects			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
through geometry variations, dielectric and magnetic material choices, and antenna gain design; and integrated components to determine performance improvements and insure repeatable results.			
Title: Novel Propulsion Technology for the Future ***Description:*** This effort explores propellant technologies such as powder coextrusion and grain coatings, while retaining insensitive properties, for employment in gunin gun launch environments as well as directional thrusters including those that deliver a broad spectrum of effects. ***FY 2011 Accomplishments:*** Fabricated more propellant for objective demonstrations and completed integration with objective munition designs; characterized performance in live fire tests; continued to develop, verify, and refine M&S to predict performance in an integrated munition. Efforts described here are coordinated and complimentary to related Scaleable Effect efforts in PE 0602624A/Project H28 and PE 0603004A/Project 232. ***FY 2012 Plans:*** Model propulsion systems and conduct 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; formulate promising propellants and evaluate them for performance and insensitivity. ***FY 2013 Plans:*** Will investigate new propulsion ingredients for scale up of formulations to provide extended range; design and fabricate and evaluate new charge systems using coextrusion of multiple materials as well as coatings for burn rate modification.	1.608	3.029	4.035
Title: Advanced Munition Components ***Description:*** This effort designs and investigates individual components in the firing chain for gun launched munitions. ***FY 2011 Accomplishments:*** Completed design of scalable adaptable munition and began fabrication of the laboratory demonstrators; tested and evaluated the performance of laboratory demonstrator munitions in selected system configurations against a spectrum of targets to determine performance and effectiveness.	3.461	-	-
Title: Advanced Munition Payloads ***Description:*** This effort investigates novel payloads and related components for integration into gun-fired munitions and missiles to enable DoD cluster munition replacement policy. ***FY 2011 Accomplishments:***	5.056	3.502	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Developed and validated M&S tools for deflagrating munitions; performed trade studies to evaluate submunition component technologies; and conducted initial tests to verify deflagration models. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/Project 232. ***FY 2012 Plans:*** Investigate environments that will provide useful data for the development of components- setback, expulsion and impact; mature components and validate effectiveness and reliability through component and bench level testing. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/Project 232.			
Title: Advanced Weapons Technology ***Description:*** This effort investigates innovative weapon technologies such as recoil energy mitigation, affordable precision, extended range/guided technologies, and advanced propelling for future medium caliber direct fire systems that could provide similar or greater lethality than current systems. ***FY 2011 Accomplishments:*** Selected the most promising weapon technologies to develop breadboard components and began target effectiveness tests to determine optimum size, weight, and power required to defeat various targets; and optimized selected technologies based on their ability to defeat the widest variety of targets. ***FY 2012 Plans:*** Continue to mature most promising weapon technologies and evaluate for transition to advanced development; conduct additional small scale research into multiple novel weapon system candidate technologies. ***FY 2013 Plans:*** Will 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.	3.500	2.214	3.178
Title: Affordable Precision Technology ***Description:*** This effort investigates and incorporates technologies like actuators and magnetic navigation to provide affordable precision to the full spectrum of gun calibers. ***FY 2011 Accomplishments:***	1.953	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Sorted most promising technologies by applicable caliber size and prioritize by greatest capability increase and cost to implement; and chose and initiated development of the most promising/most affordable efforts to enhance weapon precision. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/Project H19.			
Title: Fire Control Target Recognition ***Description:*** This effort designs and develops networked fire control hardware and software that can be integrated with existing command and control architectures. ***FY 2012 Plans:*** Model fire control hardware and fire control and target recognition algorithms and conduct 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. ***FY 2013 Plans:*** Will 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
Title: Line-of-Sight (LOS) Course Correction Munition Technology ***Description:*** This effort investigates and evaluates technologies such as small thrusters fired to the side of the round to correct trajectory and to improve precision and lower collateral damage in munitions. ***FY 2012 Plans:*** Design and develop components for line-of-sight (LOS) course correction munitions, i.e. warhead, sensor, communication link and guidance/Control; investigate performance enhancements of a LOS Course correction munitions. ***FY 2013 Plans:*** Will 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
Title: Precision Munition Technologies ***Description:*** This effort designs and investigates scalable and modular enabling technologies such as novel decelerators, advanced explosive detonators, and advanced control actuators for gun-launched munitions. ***FY 2013 Plans:***	-	-	4.283

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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.			
Accomplishments/Planned Programs Subtotals	18.728	11.945	16.596

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H19: *ASYMMETRIC & COUNTER MEASURE TECHNOLOGIES*	11.386	16.207	7.762	-	7.762	9.049	8.989	8.819	8.886	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Pulsed Laser Component Technologies	3.492	-	-
Description: This effort investigates and miniaturizes key Directed Energy technology components to enable a Laser Induced Plasma Channel (LIPC) capability. The LIPC effect uses a short pulse laser to generate a conductive path in the air in which high powered microwaves (HPM) and/or high voltage bursts are channeled to defeat different targets at stand-off.			
FY 2011 Accomplishments: Developed LIPC system design based upon results of parametric studies and modeling efforts; and continued to mature and integrate subsystem components towards fieldable requirements, i.e. volume, weight, ruggedness.			
Title: Novel Battlefield Effectors	2.003	1.970	0.800
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 2011 Accomplishments: Completed full target effectiveness testing with the bread board system and designed a brassboard to demonstrate novel battlefield effects for direct and indirect fire platforms.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Continue to develop most promising effector technologies and evaluate for transition to advanced development; conduct additional research into multiple novel battlefield effector candidate technologies. ***FY 2013 Plans:*** Will continue to investigate most promising effector technologies and evaluate for transition to advanced development; conduct additional research into multiple novel battlefield effector candidate technologies.			
Title: Active Denial Technologies ***Description:*** This effort develops non-lethal, counter-personnel directed energy (DE) technology that can repel personnel up to 100 meters. . ***FY 2011 Accomplishments:*** This effort investigated compact non-lethal, counter-personnel DE technologies such as thermal management, beam optimization to achieve an operational effective level of personnel incapacitation. ***FY 2012 Plans:*** Complete design and build of a palletized system to validate that solid state active denial technology can achieve desired range (100 meters); conduct experiments to determine personnel incapacitation or repel effects are achievable. ***FY 2013 Plans:*** Will complete integration and conduct experiments of the solid state active denial technology system to achieve the desired range of 100 meters.	2.415	3.360	1.761
Title: Counter Countermeasure (CCM) Technologies for weapons and munitions ***Description:*** This effort investigates guidance signal reduction, inertial measurement unit, and antenna design technologies to enable continued effectiveness of US weapon systems against enemy countermeasures including Active Protection Systems (APS), Global Positioning System (GPS) jamming, and active seeker jamming. ***FY 2011 Accomplishments:*** Prioritized and down selected CCM technologies and began design and fabrication of breadboard components to demonstrate superior counter-countermeasure technologies with respect to current systems. ***FY 2012 Plans:***	3.476	4.522	2.241

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Continue to develop most promising CCM technologies and evaluate for transition to advanced development; conduct additional small scale research into multiple counter countermeasure candidate technologies. ***FY 2013 Plans:*** Will 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.			
Title: Novel Penetrator Designs ***Description:*** This effort provides novel direct fire capabilities against advanced heavy armor threats by investigating several projectile configurations and non depleted uranium materials to achieve flight stability and effectiveness against new armored targets ***FY 2012 Plans:*** Design and develop novel penetrator designs concepts and conduct penetration experiments against range targets. ***FY 2013 Plans:*** Will 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
Title: Directed Energy (DE) Standoff Enabler ***Description:*** This effort investigates the capability for stand-off neutralization technology of improvised explosive devices (IED) utilizing high power, DE sources. ***FY 2012 Plans:*** Design and develop DE standoff improvised explosive device (IED) neutralization technology; conduct research on high voltage and RF coupling to laser induced plasma filaments; mature components required to achieve multi-mode anti-materiel DE effects	-	3.340	-
Accomplishments/Planned Programs Subtotals	11.386	16.207	7.762

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602624A: *Weapons and Munitions Technology*	PROJECT H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	-	14.976	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Program Increase	-	14.976	-
Description: This is a Congressional Interest Item.			
FY 2012 Plans: Congressional add funding.			
Accomplishments/Planned Programs Subtotals	-	14.976	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H28: *WARHEADS/ ENERGETICS TECHNOLOGIES*	11.254	11.599	10.860	-	10.860	11.864	12.124	13.394	12.517	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Scalable Warhead Technology	7.800	4.451	4.210
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 2011 Accomplishments: Fabricated and investigated scalable and adaptive munitions; and tested and evaluated warheads and munitions to determine characteristics and performance.			
FY 2012 Plans: Mature scalable and adaptive technology components for small to medium caliber munitions; determine levels of reduced collateral damage using scalable and adaptive technologies.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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.			
Title: Energetic Materials and Warheads ***Description:*** This effort designs energetic materials with controlled energy release for precision munition and counter-munition applications. ***FY 2011 Accomplishments:*** Verified/validated model predications of the pyrotechnic formulations with the selected ingredient materials; conducted fabrication studies for integrating promising formulations into high efficiency energetic materials; fabricated energetic formulations for laboratory scale testing and model validation; and modelled use of energetic promising formulations in enhanced warheads. ***FY 2012 Plans:*** Conduct scaled-up experiments with new pyrotechnic formulations, high efficiency energetics formulations and warheads with novel energetic material; validate the performance enhancements of new pyrotechnics, energetics and warheads. Also, model structural materials which exhibit potential for explosive characteristics and conduct 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. ***FY 2013 Plans:*** Will 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.	2.804	1.784	1.950
Title: Insensitive Munitions Multi-Scale Reactive Modeling (IM-MSRM) ***Description:*** The IM-MSRM effort designs and investigates new M&S tools for the design and development of insensitive munitions. ***FY 2011 Accomplishments:*** Designed models of detonation products based on predictions obtained at the insensitive energetic material atomic and micro levels. ***FY 2012 Plans:*** Investigate and mature continuum models of thermal kinetics ignition based on meso and molecular/atomic level predictions. ***FY 2013 Plans:***	0.650	0.700	0.700

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will continue to investigate and develop atom level computer code modifications to create material models; will 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.			
Title: Explosives Research ***Description:*** This effort develops high energy/high performance, multi-purpose insensitive munitions (IM) explosives. ***FY 2012 Plans:*** Design and develop new insensitive formulations using IM MSRM modeling and simulation tools; begin to validate the models with experiments of new insensitive energetics ingredients; and investigate different caliber munitions for the application of the new energetics. ***FY 2013 Plans:*** Will 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.	-	4.664	4.000
Accomplishments/Planned Programs Subtotals	11.254	11.599	10.860

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	63.186	62.862	60.300	-	60.300	55.721	54.211	54.672	54.124	Continuing	Continuing
EM8: *High Power and Energy Component Technology*	13.196	15.378	15.116	-	15.116	14.927	14.233	14.257	14.398	Continuing	Continuing
H11: *Tactical and Component Power Technology*	15.646	11.377	10.022	-	10.022	9.891	10.736	11.559	10.648	Continuing	Continuing
H17: *FLEXIBLE DISPLAY CENTER*	6.728	7.496	6.629	-	6.629	2.704	0.854	0.854	0.866	Continuing	Continuing
H94: *ELEC & ELECTRONIC DEV*	27.616	28.611	28.533	-	28.533	28.199	28.388	28.002	28.212	Continuing	Continuing

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, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*			R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*		
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	60.859	62.962	63.203	-	63.203
Current President's Budget	63.186	62.862	60.300	-	60.300
Total Adjustments	2.327	-0.100	-2.903	-	-2.903
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.899	-			
• Adjustments to Budget Years	-	-	-2.903	-	-2.903
• Other Adjustments 1	3.226	-0.100	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
EM8: *High Power and Energy Component Technology*	13.196	15.378	15.116	-	15.116	14.927	14.233	14.257	14.398	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

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

The work in this project is coordinated with the 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).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: High Power and Energy Technologies	2.288	1.177	1.200
Description: Research and evaluate electronic materials, structures, and components that will enable the realization of higher energy density and efficiency required by future Army systems such as electromagnetic armor, directed energy weapons, power grid protection, and other pulsed-power systems. Special emphasis is on components operating at high voltages - greater than (>) 10 kilovolts (kV).			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Implemented system with new sources and antennas for counter electronics applications; developed SiC based high-power density modules for switching levels > 25 MW; and investigated and evaluated pulse power technologies for electromagnetic armor and microwave applications. ***FY 2012 Plans:*** Investigate advanced wide band gap materials for use in high voltage pulse applications (>10kV). ***FY 2013 Plans:*** Will 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.			
Title: High Energy Laser Technology ***Description:*** 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. ***FY 2011 Accomplishments:*** Investigated power and efficiency scaling potential of resonantly-pumped Ytterbium (Yb)-free Erbium (Er) doped fiber laser architectures for high power eye-safe Directed Energy Weapons applications. ***FY 2012 Plans:*** Investigate 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. ***FY 2013 Plans:*** Will 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.	2.348	2.499	2.541
Title: Directed Energy/Electromagnetic Environments (EME) Technologies ***Description:*** Investigate and evaluate emerging technologies related to DE technology, electronic warfare (EW) survivability/ lethality, operations in the EME, and supporting high power components with the goal of enhancing the survivability/lethality of Army platforms.	1.599	2.165	2.270

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Supported ARDEC in demonstrating military utility of payload concept. Supported Air Defense Artillery Center and AMRDEC in investigating the feasibility and effectiveness of RF DEWs against electronically guided rockets, artillery and mortars (RAM) for their Enhanced Area Air Defense program. Transitioned target effects data and basic design package for RF DE to the Air Defense System to Center via AMRDEC. Investigated susceptibility profile for unmanned aerial vehicle system. ***FY 2012 Plans:*** Continue the development of counter electronic systems and electronic warfare (EW) technology for CERDEC; continue susceptibility investigations of a variety of targets; as well as transition effects data to applicable Research Development and Engineering Centers (RDECs). ***FY 2013 Plans:*** Will 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.			
Title: Electronic Components and Materials Research ***Description:*** Investigate, and evaluate compact, high-efficiency, high-temperature, high-power component technologies (such as semiconductor, magnetic, and dielectric devices) for hybrid-electric propulsion, electric power generation and conversion, and smart/micro-grid power distribution. Research addresses current and future Army-unique performance and operational requirements. ***FY 2011 Accomplishments:*** Investigated power components for higher temperature operations (110 °C coolant) and smaller circuits for platform upgrade programs. ***FY 2012 Plans:*** Evaluate 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. ***FY 2013 Plans:***	3.712	4.684	4.435

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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.			
Title: Power System Components Integration and Control Research ***Description:*** Research and evaluate the configuration of electronic components and control strategies required to achieve high-power density and high efficiency power utilization in current and future platform sub-systems, vehicle, and micro-grid (installation) applications to include the operation of military-specific power distribution topologies at the system and circuit levels. ***FY 2011 Accomplishments:*** Conducted experiments with high-temperature, high power density 100 kW battery-to-bus converter. ***FY 2012 Plans:*** Research control techniques and the use of advance passive devices to provide <60kW high-temperature (110 C) converters; and investigate advanced power conversion techniques for directed energy applications. ***FY 2013 Plans:*** Will 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.	1.600	3.628	3.650
Title: Pulsed-Power Components and Systems Research ***Description:*** Investigate, and evaluate emerging technologies such as energy storage capacitors, high voltage converters, and high rate-of-current-rise semiconductor switches, explosive based pulse generators, that improve the reliability and efficiency of pulsed-power components for applications such as electromagnetic armor, electronic fuze initiators, and electronic protection systems. ***FY 2011 Accomplishments:*** Investigated component technology that can be implemented into a compact high-efficiency DC-DC pulse converter and SiC pulse switch die at 4.5 kA with fast rate-of-current-rise for powering a distributed EM Armor system. ***FY 2012 Plans:*** Investigate silicon carbide (SiC) pulse switch die at 6 kA with fast rate-of-current-rise; and experimentally validate 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. ***FY 2013 Plans:***	1.649	1.225	1.020

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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.			
Accomplishments/Planned Programs Subtotals	13.196	15.378	15.116

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H11: *Tactical and Component Power Technology*	15.646	11.377	10.022	-	10.022	9.891	10.736	11.559	10.648	Continuing	Continuing

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 and Communications, 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, 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 2011	FY 2012	FY 2013
Title: Soldier Hybrid Power and Smart Chargers	7.515	7.247	5.124
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.			
FY 2011 Accomplishments: Developed processes and materials required for an integrated safe lithium air (Li/Air) battery; evaluated a disposable Soldier battery (Li/Air) at 800 watt hours per kilogram (Wh/kg) in a relevant environment; experimented with a 150-300W portable squad power source/charger weighing 25 lbs, and a 50-100W hybrid power source weighing 3.5 lbs at 1000 Wh/kg.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Develop a lower cost membrane for protected lithium anode portion of lithium air battery; optimize solid electrolyte membrane to prevent lithium metal corrosion; investigate and develop lower cost processes capable of high volume manufacturing of Li/ Air battery; experiment with packaged battery having >800 Wh/kg energy density; validate safety characteristics of disposable Soldier battery (Li/Air); experiment with disposable Soldier battery (Li/Air) in an operational environment; assess 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; experiment with hybrid power source in a relevant environment. ***FY 2013 Plans:*** Will 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.			
Title: Silent Mobile Power ***Description:*** This effort investigates power generation materials, components and systems to increase energy output, reduced weight and noise, while increasing fuel and cost efficiency in mobile power generation sources. Products are silent mobile power components and materials, waste-heat recovery components and systems, transitional power sources in the 500W-2kW range, and towable generator sets up to 100 kW. ***FY 2011 Accomplishments:*** Experimented with a high mobility multipurpose wheeled vehicle towable 100 kilowatt power unit in a relevant environment; experimented with a waste-heat recovery system in a relevant environment. ***FY 2012 Plans:*** Conduct studies to identify emerging nanomaterials for applications to power electronics and fuel processing subsystems for 250W to 2 kW applications; advance and incorporate a new generation of materials (like catalysts for processing 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. ***FY 2013 Plans:*** Will 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	4.131	4.130	4.898

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Power and Energy for the Soldier Venture Capital Initiative ***Description:*** This effort focuses on innovative power and energy technologies for Soldier power needs to include fuel cells, batteries, alternate power sources and power management. Technologies may include, but are not limited to, devices, systems and software that generate, store, control and manage the power and energy required by the individual soldier for communications, computing, sensing, weapons functioning, mobility and comfort. Focus of interest includes low weight and volume, safety, reliability, cost-effectiveness, longevity, reduced system power requirements, minimal logistics impact, and devices, systems and software that dramatically increase the performance of, or reduce the costs of, other power and energy devices, systems or software. ***FY 2011 Accomplishments:*** Investigated high output solar panels for tactical and installation power, smart grid management and control technologies, improved rechargeable Soldier batteries and a fuel cell solution to replace the BA 5390 battery pack in a low power short wavelength infrared micro-sensor system.	4.000	-	-
Accomplishments/Planned Programs Subtotals	15.646	11.377	10.022

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H17: *FLEXIBLE DISPLAY CENTER*	6.728	7.496	6.629	-	6.629	2.704	0.854	0.854	0.866	Continuing	Continuing

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 and Communications 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)	FY 2011	FY 2012	FY 2013
Title: Flexible Display Center (FDC)	4.854	5.583	6.629
Description: The Flexible Display Center (FDC) is developing high resolution flexible reflective (electrophoretic) and emissive (organic light emitting diodes) displays. ***FY 2011 Accomplishments:*** The FDC optimized color reflective displays for size and resolution, and transitioned reflective displays up to 6-8 inch diagonal to PEO Soldier. ***FY 2012 Plans:*** The FDC continues 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. ***FY 2013 Plans:*** Will design full color light emitting displays and the related flexible electronics for soldier applications.			
Title: FlexTech Alliance (FTA) (formerly known as U.S. Displays Consortium)	1.874	1.913	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: Flexible display partnerships funded through the FTA for development of tools, processes, and materials that directly support the FDC mission for the Army. ***FY 2011 Accomplishments:*** The FTA conducted flexible electronics development to enable emissive displays. The FTA continued to support the development for emerging needs in state-of-the-art tools, materials development and materials processes that directly support the goals of the FDC. ***FY 2012 Plans:*** The FTA supports 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.			
Accomplishments/Planned Programs Subtotals	6.728	7.496	6.629

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H94: *ELEC & ELECTRONIC DEV*	27.616	28.611	28.533	-	28.533	28.199	28.388	28.002	28.212	Continuing	Continuing

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)	FY 2011	FY 2012	FY 2013
Title: Antennas and Millimeter Wave Imaging (previously titled Antennas)	1.774	3.473	3.400
Description: This effort designs evaluates and validates high performance antenna components and software for multifunction radar and communication systems. Research areas include scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability.			
FY 2011 Accomplishments: Validated in-situ antenna performance.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Develop and fabricate new antenna material structures. ***FY 2013 Plans:*** Will 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.			
Title: Advanced Micro and Nano Devices (previously titled RF MEMS) ***Description:*** This effort designs and evaluates micro and nanotechnology components for multifunctional and integrated radio frequency (RF) applications; microrobotics, integrated energetics, control sensor interfaces and sensors for improved battlefield awareness. ***FY 2011 Accomplishments:*** Investigated system-in-package solutions for combining active components with piezoelectric micro electric mechanical systems (MEMS) (PiezoMEMS) wafer level antenna, PiezoMEMS switchable filters, and broadband PiezoMEMS switch matrices; investigated building blocks for mechanical microcontroller based on PiezoMEMS switch technology (i.e. registers, latches, and arithmetic logic units). ***FY 2012 Plans:*** Determine cycle reliability in packaged PiezoMEMS switches targeting lifetime in excess of 1 Billion Cycles; develop switch technologies with extremely low on state resistances (<0.5 Ohm); develop switchable filter technology spanning low MHz to low GHz; and investigate PiezoMEMS devices for operation near or above 100 GHz. ***FY 2013 Plans:*** Will 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.	2.694	4.205	3.553
Title: Millimeter Wave Components and Architectures for Advanced Electronic Systems ***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 2011 Accomplishments:***	6.499	3.701	3.841

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Developed reduced chip-set, thermally optimized RF modules, and perform material and device measurements to correlate and validated device models for new materials and processes for high speed and high power electronic devices. ***FY 2012 Plans:*** Design highly integrated silicon based technology for multi-channel, multi-function RF Integrated Circuits (ICs); develop emerging III-V devices for heterogeneous integration of millimeter wave to terahertz subsystems. ***FY 2013 Plans:*** Will design high density RF circuit with reduced 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.			
Title: Imaging Laser Radar (LADAR) and Vision Protection ***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 2011 Accomplishments:*** Extended opto-electronic sensor protection effort to address jamming threats; ruggedized and hardened autonomous navigation LADAR; and implemented solid-state scannerless LADAR for unmanned ground applications. ***FY 2012 Plans:*** Perform skin-based phenomenology measurements for development of long-range uncooperative biometric identification; integrate LADAR onto additional small-robotic platforms and perform relevant-environment experiments; experimentally validate multi-element electro-optic shutter array. ***FY 2013 Plans:*** Will 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.	3.109	2.591	2.296
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. ***FY 2011 Accomplishments:***	2.385	1.576	1.901

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Examined luminescence manipulation of hazardous materials using femto-second laser pulse-shaping excitation techniques; investigated Silicon photonic modulator devices for high bandwidth on-chip interconnects. ***FY 2012 Plans:*** Investigate active and passive optical fuzes; down-select laser pulse-shaping excitation scheme for further investigations of energetic materials detection; down-select and develop photoacoustics method with most potential for trace energetic detection using currently maturing infrared laser diodes sources; investigate construction of advanced peptide recognition elements using iterative process involving computational modeling coupled with experimental characterizations. ***FY 2013 Plans:*** Will 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.			
Title: Power and Thermal Management for Small Systems (previoulsy titled MEMS) ***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. ***FY 2011 Accomplishments:*** Matured a milliwatt scale battery to actuator power converter component for micro robotic system ***FY 2012 Plans:*** Mature a milliwatt scale battery to actuator power converter component for micro robotic system. ***FY 2013 Plans:*** Will 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.	1.570	3.190	3.917
Title: Prognostics and Diagnostics (P&D) ***Description:*** 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	3.013	2.979	1.973

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
and evaluates databases for integration into decision systems to extend sensor rationalization and minimize downtime via condition-based maintenance. ***FY 2011 Accomplishments:*** Designed scheme for implementation on electronic subsystems. ***FY 2012 Plans:*** Implement and conduct experiments of P&D on a vehicle electronic system. ***FY 2013 Plans:*** Will 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.			
Title: Infrared (IR) Imaging ***Description:*** This effort designs and evaluates materials, components and focal plane arrays (FPA) for the next generation of Army's night vision systems, missile seekers, and general surveillance devices. Technologies investigated include mercury cadmium telluride (HgCdTe) on Silicon (Si), strained layer superlattices (SLS) and corrugated quantum well infrared photodetector (C-QWIP) detector arrays for both the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral regions with goals to increase the operating temperature and decrease the cost of focal plane arrays. Work accomplished under PE 0602709A/ project H95 compliments this effort. ***FY 2011 Accomplishments:*** Implemented an Electro-Optic (EO) based sensor solution to detect threat launches prior to threat arrival; determined feasibility of integrating commercially available EO imagers into a threat warning and location sensor system; integrated narrow band filters into EO imager optical path to enhance threat signal count; evaluated large area dual color FPAs suitable for such applications as persistent surveillance and distributed aperture systems. ***FY 2012 Plans:*** Experimentally validate an improvement in SLS minority carrier lifetimes and show progress toward achieving 2K x 2K quantum well infrared focal plane arrays. ***FY 2013 Plans:***	2.234	2.639	2.480

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will 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.			
Title: Power and Energy ***Description:*** This effort designs and evaluates chemistries, materials and components for advanced batteries, fuel reformers, and fuel cells. Potential applications include hybrid power sources, smart munitions, hybrid electric vehicles, and Soldier power applications. Investigate applicability of photosynthesis to provide fuel and electricity for Soldier power applications. Investigate silicon carbide (SiC) power module components to enable compact high efficiency, high temperature, and high power density converters for motor drive and pulse power applications. ***FY 2011 Accomplishments:*** Developed high temperature (100-110 C) SiC power modules for high-efficiency high density power conversion; developed higher rate cathodes for Lithium (Li) ion chemistries; investigated and developed materials, components, and devices for thin film and conformal thermal batteries and advanced liquid reserve batteries. ***FY 2012 Plans:*** Investigate 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; investigate stable high voltage anode, cathode and electrolyte components for Li ion batteries; incorporate Si anode materials in Li ion cells; develop improved alkaline fuel cell membranes; as well as evaluate lifetime and rise time of thin film batteries. ***FY 2013 Plans:*** Will 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; will investigate and evaluate processes for synthetically generating energy through photosynthesis; evaluate device physics reliability issues (i.e. material defects, interface impedences) of WBG devices; investigate and characterize high frequency operation of WBG devices and for new device material implementation in vehicle motor drives and pulse power applications.	4.338	4.257	5.172
Accomplishments/Planned Programs Subtotals	27.616	28.611	28.533

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602709A: *NIGHT VISION TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	39.131	55.116	53.244	-	53.244	43.426	36.899	36.920	37.188	Continuing	Continuing
H95: *Night Vision and Electro-Optic Technology*	39.131	55.116	53.244	-	53.244	43.426	36.899	36.920	37.188	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

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

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

Work in this PE is performed by the 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602709A: *NIGHT VISION TECHNOLOGY*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	40.228	57.203	53.704	-	53.704
Current President's Budget	39.131	55.116	53.244	-	53.244
Total Adjustments	-1.097	-2.087	-0.460	-	-0.460
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.581	-			
• Adjustments to Budget Years	-	-	-0.460	-	-0.460
• Other Adjustments 1	-0.516	-2.000	-	-	-
• Other Adjustments 2	-	-0.087	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H95: *Night Vision and Electro-Optic Technology*	39.131	55.116	53.244	-	53.244	43.426	36.899	36.920	37.188	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

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

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

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence	1.253	1.323	1.533
Description: This effort researches a Defense-wide virtual/distributed capability to interactively process both real and generated 3-Dimension multispectral scenes from sensor simulations. Automatic target recognition (ATR) and aided target recognition (AiTR) algorithms are evaluated against realistic operational scenarios in aided or fully autonomous reconnaissance, surveillance, and target acquisition (RSTA) missions to include roadside threats/explosively formed projectiles.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Researched, investigated and developed algorithms for the autonomous detection and tracking of mounted and dismounted targets/threats for distributed aperture systems, targets of focus are those that emerge from hiding/defilade in an urban combat arena. ***FY 2012 Plans:*** Investigate the Aided Target Recognition (AiTR) algorithm evaluation process for multiple sensor modalities including threat explosive detection; evaluate 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; evaluate 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. ***FY 2013 Plans:*** Will 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.			
Title: Sensor Modeling and Simulation Technology ***Description:*** This effort investigates, verifies and validates engineering models, measurement techniques, and realistic simulations concurrently with the development and transition of core sensor technologies. The 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. ***FY 2011 Accomplishments:*** Developed and implemented new sensor measurement models to include visible and short wave infrared (IR) bands and systems with nonlinear image processing; conducted analysis to define the next generation of cooled IR technology; began the development of next generation simulations to support wargames and engineering tradeoff studies; developed and validated models to represent color or visible electro-optical (EO) IR sensors and distributed aperture systems. ***FY 2012 Plans:*** Refine and complete development and validation of complex search and persistent surveillance models and simulations incorporating the next generation cooled Infrared (IR) technology; incorporate the ability to effectively model and simulate moving targets and platforms in a full spherical (180 degrees by 180 degrees) sensor simulation; continue development of next generation sensor simulations to support wargames and engineering tradeoff studies. ***FY 2013 Plans:***	4.916	5.187	5.242

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: Advanced Multifunction Laser Technology ***Description:*** This effort investigates technology for a new class of multi-wavelength laser modules which will replace multiple laser systems and reduce the size, weight and cost of current devices such as laser designators, laser rangefinders (LRFs), pointers, markers, warning systems and illuminators. The goal is to achieve a single housing, electronics board, power supply and telescope for all applications to provide a drastic reduction in the SWaP of multi-function laser system, as well as reduction in the logistics inherent in deploying multiple systems. ***FY 2011 Accomplishments:*** Evaluated and optimized operation of individual laser segment; selected and optimized best technique for fabrication of structure, segmented laser diode stack and segmented output coupler mirror; evaluated candidate of laser optical bench configuration and components in the laboratory, and determined the key performance parameters of each design. ***FY 2012 Plans:*** Investigate laser output (pulse energies, wavelength, beam divergence) to support the laser capabilities for designation, range finding, daytime pointing and explosive detection; evaluate laser modules to perform size, weight and power trade-offs for assessment of platform transition opportunities; assemble breadboard laser modules capable of generating the required energy or power to produce three or more wavelengths in selectable modes. ***FY 2013 Plans:*** Will 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 brassboard laser with the goal of minimizing laser SWaP for applications such as designation/marking, LRF and illumination.	3.918	3.981	3.257
Title: High Performance Small Pixel Uncooled Focal Plane Array (FPA) ***Description:*** This effort increases the working performance of both uncooled Longwave Infrared (LWIR) and Shortwave Infrared (SWIR) technologies. Through design and improved fabrication techniques this work increases detector resolution to high definition formats (LWIR-1902x1200 pixels, SWIR- 1280x720), improves sensitivity and image quality to increase recognition and identification ranges while reducing SWaP	2.830	6.730	7.485

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Developed a 1920 x 1080 pixel read out integrated circuit (ROIC) design for large format LWIR; researched and demonstrated the large format LWIR Focal Plane Array (FPA) packaging using an in-house developed capability; delivered and tested the leveraged Defense Advanced Research Project Agency (DARPA) Shortwave Infrared (SWIR) array electronics; and investigated the development of recognition and identification ranges for both large format LWIR and large format SWIR FPAs. ***FY 2012 Plans:*** Continue the development of the pixel material processing of the Long-Wave Infrared (LWIR) Focal Plane Array (FPA) with associated Read Out Integrated Circuits (ROICs); develop 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; investigate and evaluate the identification range performance of the large format LWIR/Shortwave Infrared (SWIR) FPA electronic system; design and develop the brass-board optics for SWIR hyperspectral imaging; research new low noise ROIC that supports HD format clocking and timing; establish multiple design lots to prove out the performance of the HD detector and ROIC; investigate camera electronics that support 60Hz HD video (>276MB/sec data rate) in order to support the testing and video analysis of the HD FPA. ***FY 2013 Plans:*** Will 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.			
Title: Advanced Structures for Cooled Infrared (IR) Sensors	4.135	3.517	3.727
Description: This effort researches detector materials and substrates for infrared (IR) sensors. The emphasis is on reducing material defects and increasing the reliability by means of new ways to prepare and treat the substrates and new designs and methods of growing the structures. The goal is to develop cost effective components for high definition Army IR sensors.			
FY 2011 Accomplishments: Developed and tested Longwave Infrared (LWIR) Type II Strained Layer Superlattice (SLS) 256x256 pixel Focal Plane Arrays (FPAs) with improved material uniformity, better material and substrates structural view and lower noise levels.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Validate the proof of concept of 2-color 256x256 pixel Longwave Infrared (LWIR) and 640x480 pixel Midwave Infrared/Longwave Infrared (MWIR/LWIR) performance; investigate and validate 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. ***FY 2013 Plans:*** Will 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.			
Title: Soldier Sensor Component and Signal Processing ***Description:*** This effort investigates new digital image intensified (I2) components to improve maneuver and situational awareness for the dismounted and mounted Soldier, also benefiting pilotage, unmanned aerial systems(UAS) and Unmanned Ground Vehicle (UGV) applications. ***FY 2011 Accomplishments:*** Evaluated and tested (laboratory, controlled environment field testing and human factors studies) the brass-board low-light camera, hands free focus optics and monochrome display utilizing digital on-chip processing for high speed video transmission, high resolution, high dynamic range and no-focus digital filtering/closed loop control.	6.629	-	-
Title: Compact Hyperspectral Imaging (HSI) Component Technology ***Description:*** This effort investigates hyperspectral focal plane arrays (FPAs) and sensors for ground and air based platforms that possess the capability to detect targets and discriminate from clutter for overwatch scenarios, while ground-based hyperspectral sensors can detect targets from clutter in close-in urban situations. ***FY 2011 Accomplishments:*** Characterized Hyperspectral Imaging (HSI) imagers from each modality and waveband of interest to exploit sensor capability and identify targets of military significance in diverse environments; integrated sensor hardware and software; conducted tests on the HSI images to assess the sensor capability.	3.291	-	-
Title: Digital Readout Integrated Circuit (ROIC) ***Description:*** This effort investigates and designs new Digital Readout Integrated Circuit (ROIC) technology (digital-in-pixel) enabling the affordable very large format and multiband Infrared Focal Plane Arrays (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. 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.	2.600	7.000	6.500

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Conducted design of small digital Digital Readout Integrated Circuit (ROIC) unit cell to meet dynamic range requirements by doing analog to digital conversion within the pixel; improved digital ROIC sampling noise to meet signal/noise requirements through improved control of parasitic capacitances; researched and investigated innovative on-chip signal processing designs to reduce overall IR sensor size, weight and power. ***FY 2012 Plans:*** Fabricate 640x480 pixel digital ROIC implementing innovative on-chip signal processing designs with reduced pitch unit cell; measure dynamic range and signal/noise performance; conduct analysis allowing correlation of digital ROIC sampling noise and parasitic capacitances to signal/noise data; conduct design of ROIC for the 640x480 pixel focal plane array (FPA) with reduced pitch unit cell while maintaining performance. ***FY 2013 Plans:*** Will 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 FPAs.			
Title: Enhanced IR Detector ("nBn") Technology ***Description:*** This effort investigates and improves a new barrier detector structure that makes 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. ***FY 2011 Accomplishments:*** Developed structures to improve the ***FY 2012 Plans:*** Fabricate 1-2 Mega pixel (Mpix) focal plane array (FPA) implementing successes from design of experiments on dopant level, type and thickness of individual semi-conductors material layers; further investigate growth of semi-conductor material layers (nBn) on larger diameter (approximately 4-6 inches) GaSb and GaAs wafers to reduce defects of the FPA and determine cause of defects; design 5Mpix FPA incorporating feedback from the results of the 1-2Mpix FPA design process. ***FY 2013 Plans:***	4.335	10.300	9.300

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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.			
Title: Strained Layer Superlattices (SLS) Technology ***Description:*** This effort investigates and improves III-V material (materials formed by a combination of elements from group III and V of the periodic table) thin film crystal growth of IR FPAs using a very flexible Strained Layer Superlattice (SLS), structure which will allow high performance multiband IR FPAs to be produced at much lower costs than the existing II-VI FPAs with improved uniformity due to leveraging of III-V material and process investments used for commercial products to include cell phone chips. This effort contributes to the U.S. ability to ensure its historical night vision advantage. ***FY 2011 Accomplishments:*** Improved the performance of SLS detectors through increased sensitivity; reduced excess noise of SLS longwave infrared detectors levels through novel side-wall passivation materials and techniques and novel diode architectures; developed lithography suitable for high definition format, small pixel, multiband SLS FPAs; designed uniform large area SLS wafers by transitioning SLS growth from 3-inch to 4 -inch diameter Gallium Antimonide (GaSb) wafers. ***FY 2012 Plans:*** Fabricate 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; design 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; correlate material performance of growth on GaSb versus GaAs; convert detector fabrication processes from 3 inches to 5 inches diameter GaSb wafer capability. ***FY 2013 Plans:*** Will 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.	5.224	11.133	10.700
Title: Wide Field of View Displays and Processing for Head Mounted Display Systems ***Description:*** This effort investigates and designs optical filters, objective lenses and personal display viewing optics that will enable ultra-low profile, lightweight sensors and virtual displays for both individual head mounted and vehicle based, multi-user vision systems using the latest developments in holograms for small package optics that can be readily reconfigured (i.e. ultra-	-	3.328	5.500

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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 63710/K86. ***FY 2012 Plans:*** Investigate and evaluate techniques for the development of foveated (pitted) pixel architecture sensors and displays for ultra high resolution without trading field of view or low power. ***FY 2013 Plans:*** Will 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. Will validate operation of low latency/power color processing algorithms on dedicated processing hardware platform; will perform laboratory based proof-of-concept validation of key performance metrics with clear path for SWaP scalability.			
Title: Solid State Low Light Imaging ***Description:*** This effort develops true starlight and below low light sensing, solid state focal plane technology with very low power and low production cost for Soldier vision enhancement under reduced visibility and low light conditions. ***FY 2012 Plans:*** Research, investigate and assess the power, cost and low light sensitivity trade-offs for employing pixel enhanced quantum efficiency silicon material; evaluate pixel design architecture for in-pixel gain and ultra-low noise readout circuits.	-	2.617	-
Accomplishments/Planned Programs Subtotals	39.131	55.116	53.244

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602712A: *Countermine Systems*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	18.507	32.728	18.850	-	18.850	20.574	21.542	21.747	22.113	Continuing	Continuing
H24: *COUNTERMINE TECH*	15.724	17.321	15.834	-	15.834	17.508	18.431	18.585	18.898	Continuing	Continuing
H35: *CAMOUFLAGE & COUNTER-RECON TECH*	2.783	2.927	3.016	-	3.016	3.066	3.111	3.162	3.215	Continuing	Continuing
HB2: *COUNTERMINE COMPONENT TECHNOLOGY (CA)*	-	12.480	-	-	-	-	-	-	-	Continuing	Continuing

Note

FY12 funding increase due to congressional add.

A. Mission Description and Budget Item Justification

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

Work in this PE is related to and fully coordinated with PE 0602120A, (Sensors and Electronic Survivability), PE 0602622A, (Chemical, Smoke and Equipment Defeating Technology), PE 0602624A, (Weapons and Munitions Technology), PE 0602709A, (Night Vision Technology), PE 0602784A (Military Engineering Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603606A, (Landmine Warfare and Barrier Advanced Technology), PE 0603710A (Night Vision Advanced Technology).

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

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602712A: *Countermine Systems*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	19.118	20.280	20.878	-	20.878
Current President's Budget	18.507	32.728	18.850	-	18.850
Total Adjustments	-0.611	12.448	-2.028	-	-2.028
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	12.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.441	-			
• Adjustments to Budget Years	-	-	-2.028	-	-2.028
• Other Adjustments 1	-0.170	-0.052	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H24: *COUNTERMINE TECH*	15.724	17.321	15.834	-	15.834	17.508	18.431	18.585	18.898	Continuing	Continuing

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 and Communications, 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, 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 2011	FY 2012	FY 2013
Title: Department of Defense Unexploded Ordnance (UXO) Center of Excellence (UXOCOE)	0.480	0.493	0.487
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 2011 Accomplishments: Continued the coordination, with the Joint services, for the Unexploded Ordnance (UXO) detection and clearance research, demonstration, test and evaluation program.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Research and evaluate the UXO RDT&E detection and clearance information and coordinate across the DoD. ***FY 2013 Plans:*** Will investigate various UXO detection sensors, perform field data collections against UXO surrogates and real targets in realistic background environments and update signature database.			
Title: Standoff Mine/Defeat Neutralization Technology ***Description:*** 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. ***FY 2011 Accomplishments:*** Conducted laboratory tests with the brassboards for laser drilling and for munitions in an environment that simulates theater operations (e.g. threat, weather, and environmental conditions) to assess the relative performance against a spectrum of buried and obscured threats. ***FY 2012 Plans:*** Investigate and integrate diode based laser pump technology into a neutralization brassboard; evaluate the power and energy output with regards to requirements to defeat mine and threat explosives.	7.369	3.562	-
Title: Standoff Explosive Compound Detection Technology ***Description:*** 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. ***FY 2011 Accomplishments:*** Performed a comprehensive evaluation of the candidate brassboard (such as laser induced breakdown spectroscopy and ultra-violet spectroscopy) for standoff performance validation (standoff range) and continued to refine the performance of the ground based and airborne detection systems. Conducted field evaluations of selected technologies. ***FY 2012 Plans:*** Conduct data collection of domestic and foreign explosive compounds in order to populate and categorize signatures and utilize the data in conjunction with algorithm development; research potential to increase detection sensitivity with newly designed	3.201	3.735	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
algorithms versus the sensitivity of current technology; investigate explosive detection sensors that have potential to reduce false alarms in high clutter areas.			
Title: Advanced Electro-Magnetic (EM) and Electro Optic (EO) Sensors for Detection of Emerging Threat Devices ***Description:*** 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). ***FY 2011 Accomplishments:*** Began efforts to investigate advanced electromagnetic induction technologies and electro-optic (EO) sensors; incorporated the advances made in forward looking ground penetrating radar and electromagnetic induction and EO sensors for detection of metallic mines and explosive threats buried in-road and in urban areas. ***FY 2012 Plans:*** Design and develop a brassboard with data collection capabilities incorporating Electromagnetic (EM), Electromagnetic Interference (EMI) and Electro-Optic (EO) advancements; evaluate EO sensing and EM detection concepts for detection of emerging threats; integrate and combine 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. ***FY 2013 Plans:*** Will 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. Will 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.	4.674	4.701	7.695
Title: Detection of Home Made Explosive (HME) Production Facilities and Threats ***Description:*** This effort investigates emerging chemically-specific explosive hazards (to include homemade 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. ***FY 2012 Plans:***	-	4.830	4.907

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Investigate short wave infrared and long wave infrared hyperspectral imaging techniques for detecting homemade explosive threats; determine and analyze 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); research algorithm techniques for separation of HME signatures from background clutter leading to algorithms for automated HME detection. ***FY 2013 Plans:*** Will 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 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.			
Title: Short Range Man Portable Explosive Hazard Detector Technology ***Description:*** This effort investigates emerging technologies enabling the dismounted Soldier to detect explosive hazards in addition to landmine threats, explosive hazards include: IEDs, HMEs, explosively formed penetrators (EFPs) and antitank/ antipersonnel landmines(metal and non-metallic). Emphasis will be on rate-of-advance, high detection probability, and low false alarm rates. Size, weight, and power issues will be considered and studied to ensure solutions are viable for Soldier-portable applications. ***FY 2013 Plans:*** Will 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.	-	-	2.745
Accomplishments/Planned Programs Subtotals	15.724	17.321	15.834

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H35: *CAMOUFLAGE & COUNTER-RECON TECH*	2.783	2.927	3.016	-	3.016	3.066	3.111	3.162	3.215	Continuing	Continuing

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 and Communications, and Ground portfolios.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Camouflage and Counter-Reconnaissance Technology for Advanced Spectral Sensors:	2.783	2.927	3.016
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 2011 Accomplishments: Continued to develop the optical signature reduction effort; widen the key sensor waveband coverage and future staring sensors, such as day television and shortwave infrared; investigated camouflage paints or other systems for hyperspectral signature reduction; validated for effectiveness and potential for implementation in operational systems.			
FY 2012 Plans: Continue investigation of the susceptibility of foreign and friendly systems to hyperspectral detection methods; conduct experiments and evaluate multiple technologies to ensure signature reduction is achieved and incorporate results into sensor			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
models for advanced characterization; collaborate with industry to develop near-term improvements to camouflage paints, coatings, and systems in both the visible and other wavelength regions. ***FY 2013 Plans:*** Will 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. Camouflage efforts will 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.			
Accomplishments/Planned Programs Subtotals	2.783	2.927	3.016

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
HB2: *COUNTERMINE COMPONENT TECHNOLOGY (CA)*	-	12.480	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Countermine Systems applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Unexploded Ordinance and Landmine Detection Research	-	12.480	-
Description: This is a Congressional Interest Item.			
FY 2012 Plans: Congressional add funding for Unexploded Ordinance and Landmine Detection Research.			
Accomplishments/Planned Programs Subtotals	-	12.480	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	20.583	21.767	19.872	-	19.872	21.339	20.988	20.912	21.081	Continuing	Continuing
H70: *HUMAN FACT ENG SYS DEV*	20.583	21.767	19.872	-	19.872	21.339	20.988	20.912	21.081	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) is to conduct 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*			R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*		
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	21.042	21.801	21.484	-	21.484
Current President's Budget	20.583	21.767	19.872	-	19.872
Total Adjustments	-0.459	-0.034	-1.612	-	-1.612
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.090	-			
• Adjustments to Budget Years	-	-	-1.612	-	-1.612
• Other Adjustments 1	-0.369	-0.034	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H70: *HUMAN FACT ENG SYS DEV*	20.583	21.767	19.872	-	19.872	21.339	20.988	20.912	21.081	Continuing	Continuing

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 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 robotic 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).

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Adaptive Learning Methods and Strategies	2.353	2.588	3.308

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Description: Identify areas where innovative training methods can be used to reduce mismatches between Soldier performance and technological capabilities. Identify adaptive learning tools and assessment measures which have the potential to improve decision quality for leaders and teams. ***FY 2011 Accomplishments:*** Designed and developed a Soldier-organization-information modeling capability for use in real-time military simulation exercises. ***FY 2012 Plans:*** Validate Soldier-organization-information modeling in laboratory and field research; further mature and validate tools and methods developed to train, improve, assess information sharing, decision making as well as collaboration in network-enabled operations that support decision making. ***FY 2013 Plans:*** Will 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.			
Title: Human Performance Modeling ***Description:*** Enhance human performance modeling tools to reduced 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 coordinate with PE 0602786/Project H98. ***FY 2011 Accomplishments:*** Verified networked, collaborative versions of select Soldier centered design tools; compared spatial vision, color vision and motion sensitivity in three discrete retinal regions, and translated those data for use in the ACQUIRE model. Conducted human-observer studies to examine human perceptual performance with prototype low-light cameras, monochrome displays, and objective-lens optics fabricated for: on-chip processing, high-speed video transmission, high resolution, high dynamic range and no-focus digital filtering/closed loop control. ***FY 2012 Plans:***	3.234	3.578	3.490

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Evaluate empirical data on the effects of Soldier Load on physical and cognitive performance to enhance models; create and distribute a protected web-based repository of human performance models used in Manpower and Personnel Integration (MANPRINT) analyses. ***FY 2013 Plans:*** Will investigate Soldier Load physical and cognitive algorithms developed in FY12 and their application to the Human Performance models; and assess a theory-based decision quality metric for the Command, Control, and Communications module for future evaluations of decision effectiveness.			
Title: Vehicle Mobility Systems ***Description:*** 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. ***FY 2011 Accomplishments:*** Devised potential designs to enable secure mobility with reduced manning, indirect vision and drive-by-wire systems; developed techniques for using real-time knowledge of Soldier neuro-cognitive state in optimizing Soldier-system performance and developed guidelines for Soldier state-based crew station design; and transition cognitive state measurement technologies for assessment in operational environments to TARDEC. ***FY 2012 Plans:*** Assess and extend cognitive state modeling and simulation efforts to enhance operational relevance of experimental scenarios and real-time, state-based technologies for improving Soldier-system performance. ***FY 2013 Plans:*** Will 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.	4.750	2.052	3.254
Title: Improved Man-Machine Interfaces ***Description:*** 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 limitationsto address future warrior performance issues. ***FY 2011 Accomplishments:***	5.473	5.978	3.889

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Examined the effects of information management and information flow on individual Soldier performance and team performance in an operational environment. ***FY 2012 Plans:*** Examine effects and impact of rifle and optic remedies for shooting performance decrements associated with full facial protection; conduct research and analysis on the effects of Soldier Load on Soldier physical and cognitive performance. ***FY 2013 Plans:*** Will 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 incementally to lightening the Soldier load.			
Title: Human-Robotic Interaction (HRI) ***Description:*** Design requirements and technologies for supervision and Soldier intervention for multiple semi-autonomous unmanned vehicles (UVs) in an urban environment. ***FY 2011 Accomplishments:*** Simulated supervisory control using ground and aerial UVs for multiple perspectives for robotic missions. Performed Soldier robotic controller interface evaluations in realistic venues. ***FY 2012 Plans:*** Support evaluation of soldier monitoring crew station design as well as develop experimental designs and support final capstone field experiments to evaluate local situational awareness, assisted mobility, and soldier monitoring technologies. ***FY 2013 Plans:*** Will assist with FY13 capstone field assessments by designing supporting experiments to measure and assess local situational awareness for assisted mobility and Soldier monitoring technologies; conduct modeling and simulation studies to examine manned-unmanned teaming concepts to create measures and methods for assessing current and future technology capabilities needed to provide manned-unmanned teaming capabilities.	3.061	5.771	4.712
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. ***FY 2011 Accomplishments:***	1.712	1.800	1.219

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Developed cognitive framework and models depicting influence of socio-cultural factors on Soldier/Commander decision making and communication. ***FY 2012 Plans:*** Continue to develop cognitive framework and models depicting influence of socio-cultural factors on Soldier/Commander decision making and communication. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	20.583	21.767	19.872

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602720A: *Environmental Quality Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	21.704	20.804	20.095	-	20.095	20.216	20.516	22.066	22.268	Continuing	Continuing
048: *IND OPER POLL CTRL TEC*	3.111	2.649	2.173	-	2.173	2.124	2.219	3.080	3.050	Continuing	Continuing
835: *MIL MED ENVIRON CRIT*	5.639	6.165	6.160	-	6.160	6.228	6.309	6.839	6.953	Continuing	Continuing
895: *POLLUTION PREVENTION*	3.746	3.949	4.070	-	4.070	4.144	4.207	4.265	4.338	Continuing	Continuing
896: *BASE FAC ENVIRON QUAL*	5.350	8.041	7.692	-	7.692	7.720	7.781	7.882	7.927	Continuing	Continuing
EM5: *ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)*	3.858	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

FY11 funding increase for high priority effort

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602720A: *Environmental Quality Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	18.364	20.837	20.834	-	20.834
Current President's Budget	21.704	20.804	20.095	-	20.095
Total Adjustments	3.340	-0.033	-0.739	-	-0.739
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.413	-			
• Adjustments to Budget Years	-	-	-0.739	-	-0.739
• Other Adjustments 1	3.753	-0.033	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
048: *IND OPER POLL CTRL TEC*	3.111	2.649	2.173	-	2.173	2.124	2.219	3.080	3.050	Continuing	Continuing

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 of, minimization of, 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 Enduring Portfolio.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Sustainable Ranges and Lands (Previously Titled "Sustainable Ranges and Lands Research and Development")	3.111	2.649	2.173
Description: This effort supports management of operations on ranges and training lands with the intent to reduce constraints and restrictions resulting from environmental regulations. Technologies are targeted both toward solutions for environmental compliance and associated requirements, as well as solutions that will enhance training and testing operations.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Completed development of an archetype chip device for acute toxicity measurement for compounds of military interest and began development of air emission factors associated with wildfire and prescribed-fire burns on range and training lands; investigated ecosystem response to naturally occurring fires and adjusted prescribed fire regimes. ***FY 2012 Plans:*** Design and develop models to project vegetation response to wild and prescribed fire regimes for best land management practices; design and develop methods to integrate simulation capability for efficient and effective management of base camp infrastructure. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	3.111	2.649	2.173

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
835: *MIL MED ENVIRON CRIT*	5.639	6.165	6.160	-	6.160	6.228	6.309	6.839	6.953	Continuing	Continuing

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 Enduring Portfolio.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Military Materials in the Environment (Previously Titled "Military Materials in the Environment Research and Development")	3.223	2.691	2.647
Description: This effort provides a quantitative means to determine the environmental and human health effects resulting from exposure to existing and emerging compounds and materials produced in Army industrial, field and battlefield operations or disposed of through past activities. Results of this research will be integrated into the life cycle analysis process.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Completed a computational biology model for predictive toxicology of MCs; devised computational chemistry methods relating chemical mechanisms to toxicity in soils; completed beta version testing and release of the Training Range Environmental Evaluation and Characterization System for quantitative risk assessments of MC migration from ranges; began developmental methods to incorporate environmental fate and effects into the design of nanomaterials; began analysis of environmental modeling of environmental toxicology and chemistry for composite nanomaterials used in base sustainment and blast and ballistic protection. ***FY 2012 Plans:*** Construct 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. ***FY 2013 Plans:*** Will 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.			
Title: Nanotechnology-Environmental Effects ***Description:*** This effort enables the Army's ability to field advanced nano-based technologies by appropriate identification and assessment of the environmental impacts of nanomaterials. The end result of this research is the development of tools that guide 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. ***FY 2011 Accomplishments:*** Investigated developmental methods to incorporate fate and effects into the design of nanomaterials from the nano-scale or micro-scale to the macro-scale; began analysis of fate and effects in soil and water for composite nanonmaterials supporting base sustainment and blast and ballistic protection. ***FY 2012 Plans:*** Investigate and develop 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. ***FY 2013 Plans:***	2.416	2.496	2.473

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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 (textiles, machinery, vehicles, etc) to inform the development of regulations and life cycle analysis for nanomaterials.			
Title: Green Remediation Technologies ***Description:*** This effort enables the Army to understand the fate and transport of contaminates (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. ***FY 2012 Plans:*** Investigate novel methods to control and remediate Army relevant contaminants while minimizing energy usage, transpiration requirements and volume of waste; research new methods for detection and remediation of depleted uranium on Army lands. ***FY 2013 Plans:*** Will 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.	-	0.978	1.040
Accomplishments/Planned Programs Subtotals	5.639	6.165	6.160

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
895: *POLLUTION PREVENTION*	3.746	3.949	4.070	-	4.070	4.144	4.207	4.265	4.338	Continuing	Continuing

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 Enduring Portfolio.

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

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Pollution Prevention Technologies	3.746	3.949	4.070

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: This effort develops pollution prevention technologies to reduce/eliminate the environmental footprint resulting from the manufacture, maintenance, use and surveillance of Army ordnance and other weapon systems. ***FY 2011 Accomplishments:*** Rocket and Missile Propellants: simulated performance of next generation of environmentally benign propellant compositions; Conventional Ammunition: synthesized gram quantities of novel explosive compositions and conducted screening tests to determine most effective compositions; Pyrotechnics: transitioned sustainable flare, delay and signal formulations to advanced technology development; Heavy Metal Reduction: matured new processes for demonstration on gun barrels and fasteners; Zero Footprint Camp: refined water recycling technologies for demonstration in relevant environment. ***FY 2012 Plans:*** Conventional Ammunition: scale up novel explosive compositions to kilogram quantities and conduct limited performance evaluation; Pyrotechnics: evaluate feasibility of using novel, environmentally benign high-nitrogen molecules in next generation pyrotechnic compositions; Heavy Metal Reduction: mature hexavalent chromium-free stripping agents and surface activation technologies for demonstration on aircraft components and assemblies; Zero Footprint Camp: investigate feasibility of novel water vapor reclamation concepts for use in overseas contingency operations. ***FY 2013 Plans:*** Conventional Ammunition: will develop model for binder interaction and performance in energetic formulations; Pyrotechnics: will conduct limited performance evaluation of environmentally sustainable white smoke; Toxic Metal Reduction: will evaluate hexavalent chromium-free pretreatments in a laboratory environment for use on mixed metal substrates; Zero Footprint Camp: will evaluate promising approaches to reducing water demand and wastewater generation in contingency bases, including demand reduction options, wastewater reuse options and wastewater treatment options.			
Accomplishments/Planned Programs Subtotals	3.746	3.949	4.070

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
896: *BASE FAC ENVIRON QUAL*	5.350	8.041	7.692	-	7.692	7.720	7.781	7.882	7.927	Continuing	Continuing

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 Enduring Portfolio.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Sustainable Ranges and Lands (Previously Titled "Predictive Risk Assessment and Management for Army Ranges and Lands")	5.350	4.247	3.969
Description: This effort provides ecosystem vulnerability assessment, analysis, monitoring, modeling and mitigation technologies to support sustainable use of Army facilities, training lands, firing ranges, and airspace to reduce or eliminate environmental constraints to military missions. This effort targets integrated military land appropriate management and control technologies for selected high priority Army land management issues including Threatened and Endangered Species (TES), Species at Risk (SAR), and invasive species. This effort enables effective management of training lands by understanding the cumulative impacts of training and non-training land use activities on critical natural resources under current and potential future climate conditions.			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Completed a spatially explicit, multi-objective decision support model for management optimization of multiple invasive species accounting for ecological, economic, and training impacts; quantified synergistic and antagonistic interactions between training/ non-military land uses to develop quantitative methods for comparative impact analysis of training and alternative land uses. ***FY 2012 Plans:*** Determine 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. ***FY 2013 Plans:*** Will 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.			
Title: Military Materials in the Environment (Previously Titled "Computational Contaminant Assessment") ***Description:*** 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. ***FY 2012 Plans:*** Investigate 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. ***FY 2013 Plans:*** Will 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.	-	3.794	3.723
Accomplishments/Planned Programs Subtotals	5.350	8.041	7.692

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602720A: *Environmental Quality Technology*	PROJECT EM5: *ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
EM5: *ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)*	3.858	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Environmental Quality applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Research, Development and Engineering Command	3.858	-	-
Description: This is a Congressional interest item. ***FY 2011 Accomplishments:*** Research, Development and Engineering Command			
Accomplishments/Planned Programs Subtotals	3.858	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	24.914	26.075	28.852	-	28.852	29.171	28.036	28.172	27.364	Continuing	Continuing
779: *Command, Control and Platform Electronics Tech*	10.325	10.742	13.086	-	13.086	13.214	12.323	12.407	11.421	Continuing	Continuing
H92: *Communications Technology*	14.589	15.333	15.766	-	15.766	15.957	15.713	15.765	15.943	Continuing	Continuing

Note

FY 13 increased funding for Integrated Decision Manking Capabilities in Dynamic Environments.

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, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602782A: *Command, Control, Communications Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	25.573	26.116	26.710	-	26.710
Current President's Budget	24.914	26.075	28.852	-	28.852
Total Adjustments	-0.659	-0.041	2.142	-	2.142
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.299	-			
• Adjustments to Budget Years	-	-	2.142	-	2.142
• Other Adjustments 1	-0.360	-0.041	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
779: *Command, Control and Platform Electronics Tech*	10.325	10.742	13.086	-	13.086	13.214	12.323	12.407	11.421	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project researches components, software and algorithms that enable commanders at all echelons to have better and timelier information and allows them to execute mission command 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 mobile operations.

This project supports Army science and technology efforts in the Command, Control and Communications 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 Army Research, Development, and Engineering Command (RDECOM), Communications - Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Battle Space Awareness and Positioning	2.005	2.150	2.223
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 2011 Accomplishments: Evaluated candidate pos/nav sensors including micro-electrical mechanical and vision based sensors; evaluated integration techniques and navigation enhancing radio technologies for improved urban and indoor position performance.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Develop sensor integration algorithms to combine the selected pos/nav sensors in radios both with and without radio based nav technologies; begin assessing brassboard sensor/radio system/suite in a laboratory environment. ***FY 2013 Plans:*** Will 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.			
Title: Command and Control (C2) On-The-Move (OTM) Enabling Technologies ***Description:*** This effort investigates, designs and codes software to improve the Warfighter's ability to access, use, present and understand relevant mission command information. Work on this effort transitions to PE 0603772A/project 101. ***FY 2011 Accomplishments:*** Expanded machine translation services to include speech-to-speech translation capabilities; integrated additional translation engines for increased language coverage; continued to investigate enhancement of unmanned collaboration and coordination between multiple assets and sensors, more complex unmanned ground vehicle/unmanned aerial system (UGV/UAS) platform behaviors, and mission planning in urban and complex environments to produce technologies capable of dynamic mission management for multiple robotic assets; investigated workflow analyses to identify and assess technology to augment human cognition while performing Battle Command processes and evaluate methods to improve information sharing, decision-making, and collaboration in network-enabled operations; investigated techniques to enable users to share Warfighter composed software via a web-based gallery. ***FY 2012 Plans:*** Refine how human understanding can be measured and improved; refine how large and differing amounts of information can be presented to best align with human processing; continue to improve technologies to enable collaborative mission execution and C2 for near-autonomous and autonomous unmanned systems; investigate and devise techniques to automate portions of the governance and accreditation process for edge-enabled applications; code and integrate intelligent agent technology for language translation services, which will provide automated intelligent reasoning of foreign language data. ***FY 2013 Plans:*** Will 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 Soldeirs 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	8.320	8.592	10.863

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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 Soldiers in small units using hand held devices; investigate architectures and techniques for storage and distribution of software applications for tactical handheld devices.			
Accomplishments/Planned Programs Subtotals	10.325	10.742	13.086

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H92: *Communications Technology*	14.589	15.333	15.766	-	15.766	15.957	15.713	15.765	15.943	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

This project supports Army science and technology efforts in the Command, Control and Communications 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 Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Antenna Technologies	5.550	6.370	5.734
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. Work being accomplished under PE 0602270A/project 906, PE 0603008A/project TR1, and PE 0603270A/project K15 compliments this effort. ***FY 2011 Accomplishments:*** Completed K/Ka/Q multi-beam low profile electronically steered SATCOM components and aperture development; integrated the SATCOM aperture with a drive and tracking system; developed single package Ka/Q band integrated power amplifiers; developed			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
a blue force tracking (BFT) SATCOM antenna and modem architecture; investigated meta-materials for miniaturized antenna technologies; developed conformal antenna systems for ground and air platforms. ***FY 2012 Plans:*** Complete integrated K/Ka/Q band low profile electronically steered SATCOM antenna; integrate single package Ka/Q band integrated power amplifier into the K/Ka/Q band SATCOM antenna; complete development of blue force tracking (BFT) SATCOM antenna and modem; develop wafer scale and distributed antenna components and architecture for very small profile on-the-move SATCOM antennas; assess the Ku Band Simple Manufacturing Array Technology (SMArT) card antenna on an unmanned aerial system; execute antenna performance and ballistic assessment on armor embedded antenna candidates. ***FY 2013 Plans:*** Will 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.			
Title: Wireless Information Assurance (IA) ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed tactical intrusion detection system (IDS) to accommodate the small tactical bandwidth environment along with a common operational picture that provides a homogenous view of the IDS activity on the network. ***FY 2012 Plans:*** Research and code IDS technology to proactively ascertain local threats on tactical host systems and networks using minimal system resources; code technologies to automatically self-inoculate these systems to limit impact and contain spread of malicious activity; devise suitable IDS agent collaboration schemes to ensure that trusted decisions are made in response to malicious behavior; configure IDS agents to share actionable security information with sustaining base assets for further analysis while still allowing the Warfighter to maintain mission focus and continuity while operating at the resource-constrained tactical edge. ***FY 2013 Plans:*** Will 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	2.422	3.331	2.771

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Cognitive Networking ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed and refined a cognitive network design tool set; designed and developed initial protocol function and capability for cognitive networking; conduct modeling and simulation on small scale networks to evaluate protocol functionality. ***FY 2012 Plans:*** Exercise the Cognitive Network Engineering Design Analytic Toolset (CNEDAT) with 10 cognitive radios in a coordinated fashion through a set of assessments; use the CNEDAT to design a cognitive network to meet a set of performance goals or requirements (such as robustness to node or link outage); implement these designs in the radio hardware/software, and under the same set of traffic loads; compare the measured network parameters (i.e., throughput, delay, loss, etc) with those predicted by the design tool; conduct specific experiments in total applied traffic load, and/or various traffic mixes (voice, video, data, imagery, chat) as well as different mobility rates, mobility patterns, and different node/link outages due to simulated jamming and/or node destruction. ***FY 2013 Plans:*** Will 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.	3.690	4.004	4.143
Title: Dynamic Spectrum and Network Technologies ***Description:*** This effort investigates and fabricates components and codes software for radios and network management systems to enable access to spectrum that is unavailable because of current inefficient spectrum management methods. This includes new management and visualization modalities as well as improved radio frequency modulation techniques, devices and software. Work being accomplished under PE 0603008A/project TR1 compliments this effort.	2.927	1.628	3.118

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Expanded the Dynamic Spectrum Access (DSA) policy generation design to include parameters for co-existence operations of DSA enabled radios with tactical communications and Intelligence, Surveillance and Reconnaissance (ISR) systems; integrated the DSA policy generation tool with existing spectrum database. ***FY 2012 Plans:*** Code DSA software and algorithms and add 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. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	14.589	15.333	15.766

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	6.599	8.577	9.830	-	9.830	8.939	9.001	8.911	8.975	Continuing	Continuing
Y10: *COMPUTER/INFO SCI TECH*	6.599	8.577	9.830	-	9.830	8.939	9.001	8.911	8.975	Continuing	Continuing

Note

FY13 funding increased for language translation technologies.

A. Mission Description and Budget Item Justification

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

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

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

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

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	6.768	8.591	8.782	-	8.782
Current President's Budget	6.599	8.577	9.830	-	9.830
Total Adjustments	-0.169	-0.014	1.048	-	1.048
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.066	-			
• Adjustments to Budget Years	-	-	1.048	-	1.048
• Other Adjustments 1	-0.103	-0.014	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
Y10: *COMPUTER/INFO SCI TECH*	6.599	8.577	9.830	-	9.830	8.939	9.001	8.911	8.975	Continuing	Continuing

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 sustains Army science and technology efforts supporting the Command Control and Communications 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 2011	FY 2012	FY 2013
Title: Information Processing	1.130	1.193	1.222
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 2011 Accomplishments: Investigated the concept of social network exploitation and its relationship to communication and information network domains in collaboration with the Network Sciences International Technology Alliance (ITA); and investigated improved social network analysis tools, interfaces, and visualization routines for Army intelligence.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Extend these techniques (network analysis tools, interfaces, and visualization routines for Army intelligence) to parallel architectures/algorithms and evaluate them in relevant tactical exercises, like Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) On-the-Move. ***FY 2013 Plans:*** Will develop scalable decision support and social network analysis algorithms; evaluate network and information visualization software for cellular wireless environments.			
Title: Information Assurance ***Description:*** This effort designs and evaluates software for the protection of information and networks in wireless tactical environments. The goal is to develop software algorithms that detect and defeat malicious activities of adversaries in the bandwidth constrained tactical networks. ***FY 2011 Accomplishments:*** Evaluated secure information flow techniques in mobile tactical networks via simulation/emulation to enhance the reliable delivery of information to the Soldier. ***FY 2012 Plans:*** Continue evaluating techniques for trading off intrusion detection system (IDS) system performance and overall network performance in terms of network security metrics. ***FY 2013 Plans:*** Will design and evaluate new software algorithms and architectures, along with predictive models, for distributed intrusion detection of cyber attacks in bandwidth-constrained environments.	1.000	1.012	1.166
Title: Information Exchange ***Description:*** This effort will investigate and develop software that integrates sensor data from local and external information sources. The goal is to enable tactical users to cooperatively share relevant and timelier tactical information within a distributed wireless environment. ***FY 2011 Accomplishments:*** Designed network service interfaces, refined policy-based information exchange structures, and conducted assessments on policy-based exchange software in an operational command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR On-the-Move environment). ***FY 2012 Plans:***	1.184	1.217	1.249

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Extend experiments to social network analysis, fusion and collection techniques in a wireless distributed fusion environment, and develop metrics for assessing their overall effectiveness within the DCGS-A Cloud architecture. ***FY 2013 Plans:*** Will 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.			
Title: Language Translation ***Description:*** This effort develops and assesses computational multilingual algorithms and software frameworks to enable commanders and troops to bridge language barriers in order to counter adversaries and collaborate with allies. ***FY 2011 Accomplishments:*** Integrated new optical character recognition/machine translation (OCR/MT) evaluation tools and expanded the testbed to accommodate select Net Centric Enterprise Services; evaluated/modified/transitioned best-of-breed language processing tools with PM-Sequoyah (machine foreign language translation system) for the Army and Intelligence Communities. ***FY 2012 Plans:*** Integrate additional tools to automate development of new OCR/MT rapidly from prepared data and develop and evaluate use of mobile applications for language translation functions. ***FY 2013 Plans:*** Will develop and evaluate adaptive OCR/MT workflow analysis software to improve the quality of automated reasoning techniques when applied to HUMINT documents (both foreign and English).	0.525	0.599	1.631
Title: Network Theory ***Description:*** This effort investigates and designs theory based software models to evaluate and validate emerging network protocols and structures. The goal of this effort is to develop software algorithms that maintain effective communications in networks in spite of disruptive effects such as task reorganization, mobility of friendly forces, and adversarial attacks on friendly networks. ***FY 2011 Accomplishments:*** Investigated bio-inspired approaches for robust resilient networking and assess the trade-offs between simplicity, resilience, overhead and performance for heterogeneous tactical networks (work in this area will build on technology transitioned from the Institute for Collaborative Biotechnologies, PE 0601104A/project H05). ***FY 2012 Plans:***	1.760	1.925	1.865

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Investigate and evaluate techniques for controlling the behavior of hybrid networks using a measure of information quality to enhance the overall network performance for improved decision making. ***FY 2013 Plans:*** Will 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.			
Title: Heterogeneous Computing and Computational Sciences ***Description:*** This effort researches and develops software algorithms to allow information processing across different computing hardware platforms. The goal of this research is to provide high performance computing (HPC) equivalent processing capabilities to the Soldier on the battlefield. ***FY 2011 Accomplishments:*** Investigated scalable interface algorithms for implementing heterogeneous computing systems on battlefield applications of robotics information decision aids and biometric applications. ***FY 2012 Plans:*** Continue investigating scalable interface algorithms on heterogeneous computing systems for battlefield and biometric applications. ***FY 2013 Plans:*** Will 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.	1.000	1.000	1.033
Title: Material Modeling-Force Protection ***Description:*** This effort designs and evaluates software to improve parallel processing for computational intensive physics. Intent is to create a computational science environment to assist researchers from different disciplines to work collaboratively and to exchange models and results. ***FY 2012 Plans:*** Explore 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. ***FY 2013 Plans:***	-	1.631	1.664

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Will design new parallel computational science environment architecture, as well as theory and implementation strategies for coupling multi-physics modeling software; will evaluate new data models and formats for using petascale data from multi-physics applications to enable higher resolution/fidelity simulations.			
Accomplishments/Planned Programs Subtotals	6.599	8.577	9.830

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	73.346	80.190	70.693	-	70.693	66.914	63.432	62.648	64.600	Continuing	Continuing
855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*	16.660	17.329	15.486	-	15.486	16.497	16.389	16.451	18.021	Continuing	Continuing
H71: *Meteorological Research for Battle Command*	5.476	6.147	6.298	-	6.298	6.361	6.441	6.468	6.492	Continuing	Continuing
T40: *MOB/WPNS EFF TECH*	36.282	40.986	34.166	-	34.166	29.214	25.564	25.574	25.749	Continuing	Continuing
T41: *MIL FACILITIES ENG TEC*	6.730	7.294	6.433	-	6.433	6.466	6.584	5.766	5.894	Continuing	Continuing
T42: *Terrestrial Science Applied Research*	4.990	5.236	5.101	-	5.101	5.142	5.190	5.167	5.167	Continuing	Continuing
T45: *ENERGY TEC APL MIL FAC*	3.208	3.198	3.209	-	3.209	3.234	3.264	3.222	3.277	Continuing	Continuing

Note

FY13 Funding realigned to higher priority efforts

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 emplacable 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 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army	DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*

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

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

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

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	79.189	80.317	78.856	-	78.856
Current President's Budget	73.346	80.190	70.693	-	70.693
Total Adjustments	-5.843	-0.127	-8.163	-	-8.163
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.678	-			
• Adjustments to Budget Years	-	-	-8.163	-	-8.163
• Other Adjustments 1	-5.165	-0.127	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*	16.660	17.329	15.486	-	15.486	16.497	16.389	16.451	18.021	Continuing	Continuing

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 (C3) 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 2011	FY 2012	FY 2013
Title: Terrain Analysis for Signal and Sensor Phenomenology (Previously titled - Terrain Analysis for Signal and Signature Phenomenology)	2.637	2.832	0.750
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 for radical, effective active remote sensing to 'tag' features, items and people of interest; these capabilities are based upon full			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
waveform light detection and ranging (LiDAR) sensor systems and an array of other sensor phenomenology for optimal data detection, identification and classification. ***FY 2011 Accomplishments:*** Matrix test chemical, biological, radiological, nuclear and explosives reporters, which are engineered materials that emit signals when triggered by a target molecule; conducted laboratory and field trials under real environmental conditions to optimize reporter selection for incorporation into a nano-material tool kit. ***FY 2012 Plans:*** Develop data collection and processing algorithms for novel and advanced full waveform Geiger-mode light detection and ranging (LIDAR) data output for improved terrain analysis. ***FY 2013 Plans:*** Will evolve an Army Geospatial Enterprise capability supporting mission and battle command functions and processes.			
Title: Imagery and GeoData Sciences ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed urban mapping tools and techniques, including modeling complex buildings, roofs, building interiors, and subterranean features. ***FY 2012 Plans:*** Develop new feature extraction workflows that combine multi-source high-resolution imagery with elevation data to address tactical data gaps; provide capability to evolve and transition an Army geospatial enterprise supporting mission and battle command functions and processes. ***FY 2013 Plans:*** Will 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.	3.002	3.225	3.220
Title: Geospatial Reasoning	3.345	3.534	3.528

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: This effort develops and evaluates software analysis tools and methods to provide impact and context of the effects of the physical terrain, human terrain and environmental conditions on military operations. This analysis examines and models these effects upon unit tactics, equipment and Soldiers' performance. ***FY 2011 Accomplishments:*** Developed geospatially-enabled decision support aids to meet uncertain adaptive threats and develop techniques to increase the rate at which large volumes of geospatial data and products are disseminated. ***FY 2012 Plans:*** Develop rapid, field-accessible terrain analysis tools for urban and complex environments; develop urban and complex environment sensor placement decision support tools; create an integrated game-board of landscapes and relationships supporting Intelligence Preperation of the Battlefield (IPB) for Civil Military Operations (CMO). ***FY 2013 Plans:*** Will 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.			
Title: Geospatial and Temporal Information Structure and Framework (Previously titled - Geospatial Infostruture & Framework)	4.501	5.646	7.988
Description: This effort designs and evaluates geospatial data and information architecture to ensure content and representation of data and actionable geospatial information for operational decision making. Success in meeting these objectives advances the Army's ability to network the force to achieve information dominance. ***FY 2011 Accomplishments:*** Incorporated weather effects and cultural feature analysis to support unmanned systems command and control; develop a framework for describing elements of political, military, economic, social, infrastructure, and information domains and linking to temporal and spatial analysis. ***FY 2012 Plans:*** Develop 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. ***FY 2013 Plans:*** Will 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			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
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.			
Title: Geo-Enabled Mission Command Enterprise (Previously titled - Geo-Enabled Battle Command Enterprise) ***Description:*** This effort explores and advances components and methods that optimize the utility of the Army Geospatial Enterprise (AGE) to the total Army. ***FY 2011 Accomplishments:*** Extended common geospatial architecture and services to support geospatial analysis tools and linkages to command and control for U.S. and coalition force applications. ***FY 2012 Plans:*** Develop a geospatial architecture allowing input of user-generated content into the information system to enhance the decision-making battle command process.	3.175	2.092	-
Accomplishments/Planned Programs Subtotals	16.660	17.329	15.486

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H71: *Meteorological Research for Battle Command*	5.476	6.147	6.298	-	6.298	6.361	6.441	6.468	6.492	Continuing	Continuing

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, and route planning to maximize stealth and efficiency, web enabled tactical decision aids, and also modeling of environmental impacts for combat simulations and war games.

Work in this project supports the Army S&T Command, Control, Communications (C3) 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 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, Tactical Airspace Integration System, and Product Manager for Robotics Unmanned Sensors.

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 2011	FY 2012	FY 2013
Title: Atmospheric Modeling (Previously titled - Weather Modeling)	2.144	2.401	2.460
Description: This effort develops high resolution, short-range forecasting and high resolution atmospheric modeling capabilities for mountainous, urban and forest complex terrain.			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Completed a full physics version of the Weather Running Estimate-Nowcast (WRE-N) model for Distributed Common Ground Station - Army (DCGS-A) Nowcasting, and verified the accuracy improvements in the 3Dimensional Wind Field (3DWF) and Atmospheric Boundary Layer Environment (ALBE) models achieved by applying an immersed boundary method and parameterizations of unresolved turbulence in high resolution urban and complex terrain. ***FY 2012 Plans:*** Develop computational optimization methods for the ABLE model using advances in high performance computing to produce a very high resolution meteorological model for use in urban and complex terrain; and improve the WRE-N model at kilometer and sub-kilometer scales validated with the data resulted from the model accuracy assessment studies. ***FY 2013 Plans:*** Will 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 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.			
Title: Atmospheric Diagnostics (Previously titled - Weather Diagnostics) ***Description:*** This effort develops diagnostic technologies and methods to improve the acquisition of environmental data such as temperature, humidity, wind speed and direction for use in decision aids that enhance and protect autonomous and semi-autonomous systems. ***FY 2011 Accomplishments:*** Implemented methods for optimizing aircraft routing in adverse weather conditions and integrated Atmospheric Impacts Routing 4-dimensional visualization, situational awareness tools, and weather decision support systems to improve the safety and efficiency of unmanned and manned aviation; experimentally validated applications of wide band acoustic information processing to improve the characterization of local atmospheric parameters and to detect, locate and identify sources of emitted and reflected acoustic sources. ***FY 2012 Plans:*** Develop 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 develop analysis tools to fuse thermal and infrared polarimetric images, so as to achieve increased target detection. ***FY 2013 Plans:***	1.687	1.896	1.942

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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; will 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.			
Title: Atmospheric Prediction for Local Areas (Previously titled - Weather Prediction) ***Description:*** This effort designs and evaluates software models and sensors to improve local characterization and prediction of atmospheric conditions in urban and complex terrain by directly integrating boundary layer meteorological (MET) measurements into high resolution models and decision aids and verifies these improvements with field measurements. ***FY 2011 Accomplishments:*** Completed testing of coupled 3Dimensional Wind Field (3DWF) and Weather Running Estimate-Nowcast (WRE-N) models for transition to the DCGS-A Weather Services; employed active LIDAR with passive spectral sensing systems for environmental characterization; and extended the Local Rapid Evaluation of Atmospheric Conditions (L-REAC) system to integrate additional hazard models that will improve decisions on evacuation versus shelter in place and safe routing of emergency responders ***FY 2012 Plans:*** Integrate real time networked environmental sensors and produce optimized sensor placement recommendations from the L-REAC system; and complete accuracy studies of coupled microscale wind model with WRE-N for transition to DCGS-A. ***FY 2013 Plans:*** Will 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.	1.645	1.850	1.896
Accomplishments/Planned Programs Subtotals	5.476	6.147	6.298

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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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 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
T40: *MOB/WPNS EFF TECH*	36.282	40.986	34.166	-	34.166	29.214	25.564	25.574	25.749	Continuing	Continuing

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, Command, Control, Communications (C3), and Soldier Portfolios.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Adaptive Protection	6.470	6.469	6.623
Description: This effort investigates, creates, and validates technologies that address Army protection capability shortfalls; and where feasible, enhance Current Force capabilities through spiral development technology insertions.			
FY 2011 Accomplishments: Designed and developed a computational protection testbed for validated high-performance modeling to predict and evaluate protective material and system response to blast and ballistic loads. Developed and evaluated force protection technologies for use in remote outposts or in other expeditionary modes, where there is little access to engineering equipment and explore options			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
for use of organic materials in conjunction with light-weight, blast and penetration resistant composite materials and detection capabilities. This work was performed in collaboration with PE 0603005A/221 and activities in PE 0602618A and PE 0602105A. ***FY 2012 Plans:*** Investigate and validate novel layered protective systems to include overhead protection from direct and indirect fire that must defeat large-caliber rockets, vehicle borne-improvised explosive devices (IEDs), human borne-IEDs, and shoulder-fired rockets; mature 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. ***FY 2013 Plans:*** Will provide force protection and assessment technologies for structures located in contingency-based environments for 300 to 6000 person camps. Will 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. Will 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.			
Title: Austere Entry and Maneuver ***Description:*** This effort investigates, designs, and creates tools and technologies that address theater access and strategic responsiveness capability shortfalls and that overcome tactical maneuver constraints to support movement and maneuver in the battle space. ***FY 2011 Accomplishments:*** Provided modeling solutions of physical and operational conditions (i.e. wetland, mudflats, or shallow rivers) that provide improved logistics and force projection capability for austere entry and maneuver. ***FY 2012 Plans:*** Design and begin 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. ***FY 2013 Plans:*** Will create physics-based, multi-scale wave, current, and water-depth forecasting capability. Will create algorithms to predict the impact of the environment on the transport of military equipment and personnel into austere entry points. Will 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.	1.197	1.992	7.543
Title: Scalable Weapons Effects	4.454	5.792	2.959

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: This effort provides a prediction capability for effects from scalable, selectable, and adaptive weapons that can destroy target function and/or neutralize attributes while limiting damage to surrounding structures/personnel. ***FY 2011 Accomplishments:*** Participated in demonstrations of small, medium and large caliber scalable weapons against urban structure and bunker targets. Provided ballistic data to validate and finalize prediction capabilities developed in for the use of scalable weapons. This work is performed in collaboration with PE 0602618A/H80, PE 0602105A/H84, PE 0602624A/H18/AH28, PE0603004A/232, PE 06022303A/214. ***FY 2012 Plans:*** Complete development and investigate the performance of the shoulder launched wall breaching system against reinforced concrete, triple block, and concrete masonry units; complete weapon back-blast simulation methods to address safety concerns about firing in confined urban spaces. This work will be performed in collaboration with PE 0602618A/H80, PE 0602105A/H84, PE 0602624A/H18/AH28, PE0603004A/232, PE 06022303A/214. ***FY 2013 Plans:*** Will begin to create an integrated modeling and simulation capability to predict the penetration and damage effects from threat weapons. This will enable 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.			
Title: Environmental Impacts on Sensor Performance (Previously titled - Near Surface Effects) ***Description:*** This effort investigates, designs, and creates physics-based, multiscale numerical models of the geo-environment and synthetic environments representing geo-environment impacts on various sensor modalities and systems. These enable such things as development of sensors and sensor algorithms for object or target detection, for sensor-target pairing, and for intelligent autonomous navigation and tactical behaviors in unmanned ground systems. This effort further investigates, designs, and creates non-line-of-site and beyond- line-of-sight sensing and communications for sensors and disadvantaged users in remote areas, including optimizing coupling of sensors to soil for understanding surface and subsurface activities. This effort supports persistent surveillance and detection capabilities. ***FY 2011 Accomplishments:***	8.229	9.691	3.014

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Provided novel automated target recognition algorithms for electro-optical, infrared, radar and multi-modal sensors. Developed and validated parameter estimation models to approximate terrain surface properties for false alarm reduction. Integrated sensor perception in unmanned systems for improved autonomous performance. ***FY 2012 Plans:*** Provide 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; complete new perception algorithms of terrain to enable adaptive tactical behavior technologies for unmanned ground vehicles; investigate technologies and methods leading to use of sensors above the soil surface with equivalent sensitivity as buried sensors thus allowing for adaptive use in variable environments; research methodologies for characterizing sensor performance in areas where there is limited ground truth data. ***FY 2013 Plans:*** Will 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.			
Title: NORAD-NORTHCOM Surveillance Research ***Description:*** 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.). ***FY 2011 Accomplishments:*** Mature capability to image subsurface voids, or tunnels, up to thirty feet below surface. Conduct experiments using technologies and sensor fusion capabilities to characterize tunnel features, (such as axes of approach and cross sections) and movement of contraband. ***FY 2012 Plans:*** 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.	3.560	2.042	-
Title: Deployable Force Protection ***Description:*** This effort researches, designs, and creates rapidly deployable detection, assessment, passive protection and active defensive technology-enabled capabilities to meet critical capability gaps for troops operating remotely at smaller bases or integrated with local communities. The needs at these smaller bases (less than 300 persons, not all U.S. troops) are unique	11.403	10.000	12.962

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013

based on constraints in transportability, manpower, organic resources, lack of hardening of structures, resupply, and training for example. Moreover, lack of interoperability and scaleability consume manpower and take away from time to 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.

FY 2011 Accomplishments:

This effort moved from PE 0602784A Project T41 to this Project T40 in FY11. Developed integrated system constructs for base protection technologies at smaller bases that often operate in remote locations or are near/with local populations and have a less overt security posture. The integrated designs include interoperable systems that are reliable, transportable by smaller vehicles or sling-load, use minimal power and energy, and have low manpower requirements for set-up and operation. Technologies pursued address detection of threats, assessment of activities and signals, and passive and active defense capabilities. Investigated means to increase sensor detection capabilities for layered defense of the operational environment, including electro-optical, infrared, seismic and acoustic. Developed designs for sustainable power and energy. This effort moves to PE 0602784A/T40 in FY12. These efforts support deployable force protection activities in PE 0603734A, PE 0603313A, PE 062786A, and PE 0603125A.

FY 2012 Plans:

Perform research to address high priority capability gaps in force protection needs for smaller bases operating in remote areas or integrated with local communities; continue research on previously selected technologies to improve designs based on user assessment and feedback; will design and begin 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.

FY 2013 Plans:

Will 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-site, 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,

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
passive protection against enemy threats, and active defense to improve design and performance based on user assessment and feedback.			
Title: Materials Modeling ***Description:*** This effort investigates and leverages physics-based computational models and laboratory experiments to understand the relationships between the chemical and micro-structural composition of material and performance characteristics when used in protecting facilities. ***FY 2011 Accomplishments:*** This effort moved from PE 0602784A Project T41 to this Project T40 in FY11. Investigated and developed foundational knowledge of nano- and macro-scale physical, chemical, and mechanical properties of materials as well as understanding of the fate (i.e. movement, binding and degradation) of the materials once in the environment to research and develop designs that scale well for production and manufacturing; this research also focused on composite materials with exceptional properties such as tensile strength and resistance to cracking and penetration; the goal is to increase performance and decrease volume and weight while keeping the environment safe. This work moves to PE 0602784A/T40 in FY12. This work is coordinated with Nanotechnology/ Fate and Effects effort in PE 0602720A/Project 835. ***FY 2012 Plans:*** Continue 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. ***FY 2013 Plans:*** Will 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.	0.969	1.000	1.065
Title: Joint Integrated Base Defense ***Description:*** This funding is intended to support the stand-up of a Joint Program Office. ***FY 2012 Plans:***	-	4.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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)	FY 2011	FY 2012	FY 2013
This funding is intended to support the stand-up of a JPO. The funding is expected to be reprogrammed to a non-S&T PE by FY12 to support the efforts of the JPO.			
Accomplishments/Planned Programs Subtotals	36.282	40.986	34.166

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
T41: *MIL FACILITIES ENG TEC*	6.730	7.294	6.433	-	6.433	6.466	6.584	5.766	5.894	Continuing	Continuing

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 Enduring 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 2011	FY 2012	FY 2013
Title: Multi-functional materials in support of Defeat of Emerging Adaptive Threats (DEFEAT)	1.649	0.899	-
Description: This effort assesses and develops self healing technologies; evaluates protective systems; and assesses the use of novel materials in multi-functional structural protection.			
FY 2011 Accomplishments: Conducted evaluations of multi-layered protective systems and performed protection laboratory assessment; and developed decision tools for user community.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Complete 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 will PE transition to 0603734A project T08 supporting Army Technology Objective DEFEAT.			
Title: Adaptive and Resilient Installations (Previously titled "Facility Modeling and Simulation") ***Description:*** This effort develops sustainable, cost efficient and effective facilities; and provides technologies and techniques for achieving resilient and sustainable installation and base operations. ***FY 2011 Accomplishments:*** Developed sensor integration sub-models to incorporate into a facility life-cycle model designed to reduce uncertainty in infrastructure costs and maintenance; developed sensor fusion algorithms for facility life-cycle model; conducted evaluations of multi-layered protective systems and protection decision/assessment tools. ***FY 2012 Plans:*** Design and develop a computational framework for expanding to net-centric regional management of facilities with emerging resiliency concepts; design of 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. ***FY 2013 Plans:*** Will develop and validate algorithms and models that represent the complex adaptive systems for energy, water, waste, and protection impacting forward operating base operations. Will 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.	2.418	3.400	3.400
Title: Social/Cultural Behavior (Previously titled "Socio-Cultural Modeling") ***Description:*** This effort provides technologies which support analysis of socio-cultural and facility issues in forward base operations, including urban environments. Technology development efforts will include means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations. ***FY 2011 Accomplishments:*** Developed models relating socio-cultural and cultural geographic factors to human behaviors to inform decision making in Counter-Insurgency Operations, Stability and Support Operations, and nation building; developed means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations. ***FY 2012 Plans:***	2.663	2.995	3.033

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Extend the development of dynamic socio-cultural models for estimating host population response to military operations; will develop information framework linking socio-cultural data to Army tasks. ***FY 2013 Plans:*** Will provide computer-aided analysis and reasoning tools and ability to model, simulate and forecast socio-cultural issues and needs. Will predict the perceptions and actions and reactions of indigenous population groups in relation to on-going or planned military operations.			
Accomplishments/Planned Programs Subtotals	6.730	7.294	6.433

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
T42: *Terrestrial Science Applied Research*	4.990	5.236	5.101	-	5.101	5.142	5.190	5.167	5.167	Continuing	Continuing

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 (C3) 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 2011	FY 2012	FY 2013
Title: Terrain State	1.401	2.012	2.053
Description: This effort investigates improved 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 2011 Accomplishments: Designed weather effects physical security sensor planning tool integrated with passive protection systems.			
FY 2012 Plans: Incorporate an optimal sensor placement and selection model including stationary and moving surveillance platforms into the Environmental Awareness for Sensor and Emitter Employment model supporting integration of many different sensors in the battlespace; develop a framework to achieve effective persistent monitoring of targets of interest, ground and airborne, providing			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
timely knowledge of multi-modality sensor performance in dynamic complex weather-affected terrain and adverse weather conditions. ***FY 2013 Plans:*** Will 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.			
Title: Signature Physics ***Description:*** This effort investigates the dynamics of electromagnetic, acoustic and seismic signatures in response to changing terrain state and complex terrain features and geometry. 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 planning/rehearsal. ***FY 2011 Accomplishments:*** Defined normal and anomalous sensor data features (statistical properties) as a function of the geospatial and socio-cultural context; leveraged the Warfighter's understanding of important features and contextual cues; and developed street-level simulation of sensor data across a wide range of modalities and urban terrain contexts to develop signal propagation rules for fusion and anomaly recognition. Developed re-usable, object-oriented, software tools for cross-modality sensor performance modeling, high-level fusion including operational environment context, and emplacement recommendations that can be readily incorporated into Army command and control and terrain analysis systems. ***FY 2012 Plans:*** Design and develop random sampling approaches for uncertainties across multiple sensing modalities and establish quantifiable approaches for the value of increased terrain and weather resolution on signal propagation predictive skill; develop 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. ***FY 2013 Plans:*** Will 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.	3.589	3.224	3.048
Accomplishments/Planned Programs Subtotals	4.990	5.236	5.101

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
T45: *ENERGY TEC APL MIL FAC*	3.208	3.198	3.209	-	3.209	3.234	3.264	3.222	3.277	Continuing	Continuing

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 Enduring 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 2011	FY 2012	FY 2013
Title: Systems Response to Threats	0.980	-	-
Description: This effort investigates and validates technologies necessary for secure, energy efficient, sustainable military installations, emphasizing energy and utility systems protection from, and in response to, evolving threats such as chemical, biological and radiological attacks. ***FY 2011 Accomplishments:*** Evaluated sensing ability with encapsulation and re-suspension after freeze drying to assess improving the stability of the complex using chemical preservatives and encapsulation with silica.			
Title: Adaptive and Resilient Installations (Previously Titled "Installation Modeling and Simulation")	2.228	3.198	3.209
Description: This effort investigates and develops technologies necessary for energy efficient and sustainable military installations, emphasizing energy and utility systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Developed a computational framework for non-linear network simulation to predict performance and optimize integration of installation energy systems. ***FY 2012 Plans:*** Mature 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:*** Will validate thermal models and long term thermal performance prediction of phase change materials and emerging materials for mitigation of energy losses in building envelopes. Will 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.			
Accomplishments/Planned Programs Subtotals	3.208	3.198	3.209

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602785A: *Manpower/Personnel/Training Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	18.982	18.917	17.781	-	17.781	18.007	17.801	18.019	18.144	Continuing	Continuing
790: *Personnel Performance & Training Technology*	18.982	18.917	17.781	-	17.781	18.007	17.801	18.019	18.144	Continuing	Continuing

Note

FY11 funding decrease for higher priority effort.

A. Mission Description and Budget Item Justification

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

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602785A: *Manpower/Personnel/Training Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	22.198	18.946	19.258	-	19.258
Current President's Budget	18.982	18.917	17.781	-	17.781
Total Adjustments	-3.216	-0.029	-1.477	-	-1.477
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.340	-			
• Adjustments to Budget Years	-	-	-1.477	-	-1.477
• Other Adjustments 1	-2.876	-0.029	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
790: *Personnel Performance & Training Technology*	18.982	18.917	17.781	-	17.781	18.007	17.801	18.019	18.144	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Personnel	5.687	5.372	5.415
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.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Conducted longitudinal (i.e., multiyear) research to validate non-cognitive measures and the extent to which they predict a Soldier's on-going job performance and continued success in the Army. ***FY 2012 Plans:*** Developing non-cognitive measures to identify potential successful Officers (e.g., awarding ROTC scholarships). ***FY 2013 Plans:*** Will 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.			
Title: Training ***Description:*** 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. ***FY 2011 Accomplishments:*** Researched innovative training methods and technology based on learning sciences; refined tools/methods for rapid training development to increase relevancy and timeliness of training; designed and developed methods of diagnostic evaluation of individual and unit performance; and developed cost-effective concepts to integrate live and simulated training in emerging large-scale distributed environments. ***FY 2012 Plans:*** Developing training performance measurement techniques for large scale-distributed training environments and for units training at home station; and identifying strategies to create training tailored to the individual Soldier needs. ***FY 2013 Plans:*** Will create training that adapts to the needs of the trainee; tools that effectively deliver and assess training within technology enabled learning environments; training approaches and tools (e.g., diagnostic tools, collective training groups, pedagogical interventions) that improve units' ability to develop and manage training.	9.229	9.293	8.045
Title: Leader Development ***Description:*** 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. ***FY 2011 Accomplishments:*** Refined techniques and strategies for developing the influence skills of leaders, with particular focus on military advisory training (i.e., training those who are training international partners); developed and refined a model of multi-team system performance	4.066	4.252	4.321

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
characteristics and effectiveness for joint, interagency, intergovernmental, and multinational (JIIM) teams; and developed measures of socio-cultural capabilities for operational environments. ***FY 2012 Plans:*** Developing innovative methods to train skills to operate across a variety of cultures; and identifying emerging battle command and staff skills for full spectrum operations. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	18.982	18.917	17.781

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602786A: *Warfighter Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	26.972	46.261	28.281	-	28.281	29.146	27.809	28.000	28.681	Continuing	Continuing
283: *AIRDROP ADV TECH*	2.475	2.365	2.140	-	2.140	2.157	2.270	2.293	2.716	Continuing	Continuing
E01: *Warfighter Technology Initiatives (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing
H98: *CLOTHING & EQUIPM TECH*	19.033	19.571	18.892	-	18.892	19.609	18.009	18.015	18.228	Continuing	Continuing
H99: *JOINT SERVICE COMBAT FEEDING TECHNOLOGY*	5.464	5.505	5.748	-	5.748	5.802	5.860	5.921	5.936	Continuing	Continuing
VT4: *EXPEDITIONARY MOBILE BASE CAMP TECHNOLOGY*	-	2.346	1.501	-	1.501	1.578	1.670	1.771	1.801	Continuing	Continuing

Note

FY12 funding increase is a congressional add.

A. Mission Description and Budget Item Justification

This program element (PE) investigates and develops technologies which improve Soldier and Small Combat Unit survivability, sustainability, mobility, combat effectiveness, and field quality of life. 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). 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 as a System Integrated Concepts Development Team, and the DoD Combat Feeding Research and Engineering Board.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*		R-1 ITEM NOMENCLATURE PE 0602786A: *Warfighter Technology*			
B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	27.746	29.835	28.180	-	28.180
Current President's Budget	26.972	46.261	28.281	-	28.281
Total Adjustments	-0.774	16.426	0.101	-	0.101
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.432	-			
• Adjustments to Budget Years	-	-	0.101	-	0.101
• Other Adjustments 1	-0.342	-0.074	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
283: *AIRDROP ADV TECH*	2.475	2.365	2.140	-	2.140	2.157	2.270	2.293	2.716	Continuing	Continuing

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 2011	FY 2012	FY 2013
Title: Airdrop/Aerial Delivery Research and Technology	1.734	2.365	2.140
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 2011 Accomplishments: Researched and evaluated performance of adaptive Guidance Navigation and Control (GN&C) software and wind sensor technology to incorporate into on-board airborne guidance unit (AGU) enabling wind updates to be transmitted to the AGU for parafoil flight pattern adjustment.			
FY 2012 Plans: Explore 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 MFF operations; complete assessment of oxygen requirements for extended range, high altitude MFF operations; develop a medium fidelity engineering model of the Army's new T11 parachute system steady state descent.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will evaluate decelerator design refinements and application of advanced sensors to decrease serious injuries and fatalities during mass tactical aerial insertion; will conduct preliminary investigation of parafoil shape while in-flight to increase performance parameters.			
Title: Enabling Airdrop Research and Technologies ***Description:*** Beginning in FY13, this effort will be captured in the Airdrop/Aerial Delivery Research and Technology effort. This effort investigates technologies for enhanced payload extraction and subsequent gliding capabilities. ***FY 2011 Accomplishments:*** Verified and validated both physics and engineering based aerial delivery models; investigated methods to increase the airfoil glide ratio, which allows the jumper/cargo to exit the aircraft further from the target. These methods include the optimization of parafoil canopy design, such as variations in canopy size, shape, materials, and suspension lines. In FY12 funding will transition to Precision Aerial Delivery Enhancements.	0.741	-	-
Accomplishments/Planned Programs Subtotals	2.475	2.365	2.140

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602786A: *Warfighter Technology*	PROJECT E01: *Warfighter Technology Initiatives (CA)*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
E01: *Warfighter Technology Initiatives (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Technology Applied Research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Power Generation Research	-	16.474	-
Description: This is a Congressional Interest Item.			
FY 2012 Plans: Congressional add funding for Power Generation Research.			
Accomplishments/Planned Programs Subtotals	-	16.474	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H98: *CLOTHING & EQUIPM TECH*	19.033	19.571	18.892	-	18.892	19.609	18.009	18.015	18.228	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates and evaluates components and materials that have potential to 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 network centric warfare technologies and human science investigation to identify and develop methods to assess human cognitive responses to sensory, physical, cognitive, and affective stimuli and stressors.

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

Work in this PE is fully coordinated with PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0603001A (Warfighter Advanced Technology), PE 0602787A (Medical Technology Initiatives) and PE 0602716A (Human Factors Engineering Technology).

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

Work in this project is performed by the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Soldier Blast and Balistic Protection	5.428	7.196	6.533
Description: 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.			
FY 2011 Accomplishments: Investigated and conducted trade analysis of parameters which could lead to lighter weight ballistic and blast protective systems for individuals and shelters; constructed and evaluated initial soft armor and composite armor components using emerging materials (from PE 0602105A/project H84 or others) and geometry data from the Integrated Casualty Estimation Method modeling			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
tool; transitioned enhanced survivability analysis and modeling tools to materiel developers and Product Managers to aid in future requirements, design, and acquisition decisions. ***FY 2012 Plans:*** Develop methodology to characterize multidirectional bending/ flexing behavior of multi-layer armor material systems, apply human flexure findings to digital human models and investigate advanced armor material and configurations to accommodate body flexure; develop reduced weight material concepts for head and face protection and research emerging ballistic and blast protective materials for application to shelter systems. Conduct 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. ***FY 2013 Plans:*** Will 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.			
Title: Soldier Vision Protection and Enhancement ***Description:*** This effort focuses on technologies which provide eye protection from battlefield threats. ***FY 2011 Accomplishments:*** Developed and evaluated against the baseline variable transmission eyewear technologies, material properties and methods to integrate glare, laser flash and dazzle protection into eyewear. ***FY 2012 Plans:*** Begin integration of eye protection and variable transmission technologies into a single lens design with multiple levels of light transmission control. ***FY 2013 Plans:*** Will 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.	2.416	2.543	2.611
Title: Soldier and Small Unit Modeling and Analysis ***Description:*** 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	2.260	1.437	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
PE 0602716A/Project H70 (Human Factors Engineering Technology) and PE 0602784A/Project H71 (Military Engineering Technology.) ***FY 2011 Accomplishments:*** Linked models and simulations and provided data analysis to examine the issue of Soldier load; developed counterinsurgency scenarios for Soldier and SCUs; analyzed SCUs logistics supply chain and capability to sustain themselves in austere environments; modeled SCUs combat effectiveness utilizing notional capabilities compared to the current capabilities of Force Provider systems; analyzed fuel and water systems, cost/benefits of unmanned sensors for stand-off recognition and intelligence gathering. ***FY 2012 Plans:*** Analyze the utility of tailorable/modular/scalable body armor and recommend optimal configurations to ensure the proper balance of protection and Soldier load for any given missions and scenario. Continue to conduct analyses to support Expeditionary Mobile Base Camps as Combat Outposts (COPs) that will allow SCUs to sustain themselves in austere environments.			
Title: Measurement, Prediction and Improvement of Soldier Performance ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed an initial set of standard cognitive metrics for quantifying and evaluating Soldier performance under stressed and non-stressed task situations based on cognitive task analysis and human experimental studies; conducted human research to quantify the influence of contextual variables (e.g., physical fatigue) on cognitive processes involved in performing squad-level infantry tasks. ***FY 2012 Plans:*** Mature and validate cognitive metrics for quantifying and evaluating Soldier performance affected by contextual variables; conduct human research to identify mitigation strategies for performance decrements; provide 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. ***FY 2013 Plans:***	3.484	2.950	4.212

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Will 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; and conduct operational human performance effectiveness modeling and simulation analyses for optimal body armor/load configurations for individual Soldiers and Small Units.			
Title: Advancements in Fibers, Textiles and Materials for Soldier Protection ***Description:*** Beginning in FY13, this effort is renamed from Multifunctional Fibers, Textiles and Material for the Soldier to Advancements in Fibers, Textiles and Materials for Soldier Protection. This effort focuses on technologies that aid in the design and evaluation of multifunctional protective materials and concealment concepts for Soldier clothing, equipment and shelters. ***FY 2011 Accomplishments:*** Investigated modeling and control of low cost electrospinning processes to produce micro/ nanostructure fibrous materials; applied analytical methods to design and fabricate multifunctional fibers for advanced flame, thermal and concealment/signature protective textiles and composite concepts. ***FY 2012 Plans:*** Assess 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; integrate selected novel FR protective materials into fibers and research new FR characterization methodologies and modeling of layered FR materials to determine the physical properties controlling FR performance; determine the effect of enhanced process control on electrospun materials, and evaluate performance for a wide range of operational conditions; and investigate textile properties effecting signature reduction and performance evaluation techniques for a wide range of operational conditions and sensors. ***FY 2013 Plans:*** Will 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 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.	5.445	5.445	5.536
Accomplishments/Planned Programs Subtotals	19.033	19.571	18.892

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H99: *JOINT SERVICE COMBAT FEEDING TECHNOLOGY*	5.464	5.505	5.748	-	5.748	5.802	5.860	5.921	5.936	Continuing	Continuing

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 performed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA.

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

Work in this project is led, performed, and/or managed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA, and this project has collaborative efforts with the US Army Research Institute for Environmental Medicine.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Joint Combat Feeding Equipment Technologies	2.273	1.617	2.321
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.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Developed recycling technology concepts for greywater (non-industrial wastewater) generated from field food sanitation systems for the Food Sanitation Center; and completed concept development of self-powered appliances with next generation high efficiency thermoelectric modules to reduce reliance on JP8. ***FY 2012 Plans:*** Investigate innovative mission-specific, man portable feeding technologies; evaluate high efficiency thermoelectric powered appliances to reduce reliance on JP8 and other power sources to operate kitchen appliances; investigate novel heating technologies that will allow the Warfighter to self heat a wider range or rations, including group rations, in a variety of environmental conditions without kitchen equipment. ***FY 2013 Plans:*** Will 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.			
Title: Ration Stabilization, Packaging, Novel Nutrient Delivery, and Food Safety Technologies ***Description:*** Beginning in FY13, this effort is renamed from Ration Stabililation 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. ***FY 2011 Accomplishments:*** Explored shelf-stable pocket bread formulas and production parameters; evaluated the efficacy of carbon dioxide treatment of fresh fruits and vegetables and antimicrobial effects on ration components; and demonstrated nanotechnology-based carriers (ration component) for enhancing micronutrient stability in food items of military rations. ***FY 2012 Plans:*** Explore the integration of antioxidants into various ration components to improve the overall health of the Warfighter; develop new baked food items that will increase the variety of baked goods available in military rations; develop ration components that increase the Warfighter appetite satisfaction rate relative to ration size to support Soldier mental and physical performance. ***FY 2013 Plans:*** Will 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.	1.656	1.930	3.427
Title: Ration Packaging and Food Safety Technologies	1.535	1.958	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: 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. ***FY 2011 Accomplishments:*** Investigated compatibility and integration issues with printed electronic display applications on packaging structures for ration condition assessment; evaluated electrochemical measurements generated by an antibody-antigen reaction with conductive membranes for more rapid and reliable detection of pathogens in foods. ***FY 2012 Plans:*** Conduct exploratory research on bioactive packaging materials which can detect and kill pathogens present in a food product to protect the Warfighter's health; and evaluate ration packaging microencapsulation technologies that enhance barrier protection and packaging integrity resulting in higher ration quality and reduced waste.			
Accomplishments/Planned Programs Subtotals	5.464	5.505	5.748

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VT4: *EXPEDITIONARY MOBILE BASE CAMP TECHNOLOGY*	-	2.346	1.501	-	1.501	1.578	1.670	1.771	1.801	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project matures and demonstrates fully integrated holistic expeditionary base camp (EBC) capabilities with mission-specific plug and play components, subsystems and modules designed to 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.

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

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

Work in this project is led, performed and/or managed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA and fully coordinated with PE 0602786A (Warfighter Technology), PE 0602784A and 0603734A (Military Engineering) PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603125A (Combating Terrorism Technology Development) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Expeditionary Base Camp Component Technologies	-	2.346	1.501
Description: Identify and improve component interoperability and mature and scale component technologies for an integrated holistic base camp concept.			
FY 2012 Plans: Develop a database of physical measurements (size, weight, volume); human metrics (manpower, cognitive load); and interfaces (power, network) and assess technical performance and maturity of technologies (i.e., level of ballistic, environmental and/or chem-bio protection); capture key data regarding mission planning from deploying units and component limitations from returning			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Soldiers; investigate data and prioritize critical new or improved capabilities through simulations and war-gaming, develop test protocols for technology assessment, and define design and technical performance criteria for achievable capability sets. ***FY 2013 Plans:*** Will 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.			
Accomplishments/Planned Programs Subtotals	-	2.346	1.501

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602787A: *MEDICAL TECHNOLOGY*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	96.360	105.762	107.891	-	107.891	106.338	89.714	86.344	78.045	Continuing	Continuing
869: *Warfighter Health Prot & Perf Stnds*	33.669	38.679	38.907	-	38.907	37.133	33.674	29.988	30.333	Continuing	Continuing
870: *DOD MED DEF AG INF DIS*	15.448	16.842	18.987	-	18.987	19.246	19.397	19.520	19.631	Continuing	Continuing
873: *HIV EXPLORATORY RSCH*	8.924	9.377	8.986	-	8.986	8.976	8.969	8.963	-	Continuing	Continuing
874: *CBT CASUALTY CARE TECH*	16.778	17.017	19.821	-	19.821	19.714	16.446	16.481	16.565	Continuing	Continuing
FH2: *FORCE HEALTH PROTECTION - APPLIED RESEARCH*	10.406	9.122	6.279	-	6.279	6.316	6.436	6.523	6.568	Continuing	Continuing
VB4: *SYSTEM BIOLOGY AND NETWORK SCIENCE TECHNOLOGY*	1.135	4.741	4.802	-	4.802	4.839	4.792	4.869	4.948	Continuing	Continuing
VJ4: *SUICIDE PREVENTION/ MITIGATION*	10.000	9.984	10.109	-	10.109	10.114	-	-	-	Continuing	Continuing

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 and funded in seven projects.

Project 869 refines knowledge and technologies (such as screening tools and preventive measures) for post-traumatic stress disorder and mild traumatic brain injuries, physiological monitors to protect Soldiers from injuries due to exposure to hazardous environments and materials, and 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 diagnosis, 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.
Project 873 conducts research on the human immunodeficiency virus (HIV), which causes Acquired Immunodeficiency Syndrome (AIDS). Work in this area includes refining improved identification methods to determine genetic diversity of the virus, 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army	DATE: February 2012
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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.
Project FH2 conducts research to support applied research directed toward the sustainment of a healthy force of Warfighters from accession through retirement.
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.
Project VJ4 examines over a planned five-year period to examine 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.

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

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 assure safety and, where possible, effectiveness (i.e., efficacy) prior to approving controlled clinical trials where these early (previously unproven in humans) drugs, vaccines, and medical devices are tested in humans. These clinical trials are conducted in three phases (Phase 1, 2, and 3) to prove safety and effectiveness of the drug/vaccine/device for the targeted disease/condition. Each successive clinical trial includes more voluntary study subjects. This PE focuses on identifying candidate solutions on research and refinement of technologies such as product purification, formulation and assay refinement; and involves preclinical testing in animals and early human clinical testing (Phase 1 safety and Phase 2 expanded safety and efficacy). The EPA also requires thorough testing of products, such as repellents and insecticides

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army					DATE: February 2012
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B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	96.797	105.929	105.289	-	105.289
Current President's Budget	96.360	105.762	107.891	-	107.891
Total Adjustments	-0.437	-0.167	2.602	-	2.602
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.119	-			
• Adjustments to Budget Years	-	-	2.602	-	2.602
• Other Adjustments 1	1.682	-0.167	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
869: *Warfighter Health Prot & Perf Stnds*	33.669	38.679	38.907	-	38.907	37.133	33.674	29.988	30.333	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research to prevent and protect Soldiers from training and operational injuries, the refinement of mechanisms for detection of physiological and psychological health problems, the evaluation of hazards to head, neck, spine, eyes, and ears, the standards for rapid return-to-duty, and the determination of 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) Physiological Health
(2) Environmental Health and Protection
(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 the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; U.S. Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments	2.376	3.567	2.038
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.			
FY 2011 Accomplishments:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Developed low-oxygen training guidelines based on analysis of low-oxygen exposure studies; performed biomedical modeling to define individual differences affecting heat regulation; developed methods and models to predict core temperature using identified thermal parameters. ***FY 2012 Plans:*** Develop altitude acclimatization and work performance models for altitudes between 7,000 and 14,000 feet. ***FY 2013 Plans:*** Will 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. These results may be included as components in the altitude and work performance models.			
Title: Physiological Health - Nutritional Sustainment and Fatigue Interventions ***Description:*** This effort evaluates methods for managing and controlling the effects of nutrition and fatigue on Soldier operational performance. ***FY 2011 Accomplishments:*** Developed nutritional countermeasures (supplements taken to counter or offset injury or trauma) for diminished bone health in response to operational stress; defined impact of micronutrient status on performance and immune function during military training; demonstrated protective effects of probiotics (dietary supplements) for sustaining digestive and immune function during operational stress; demonstrated effectiveness of nutritional supplements for promoting fat loss in overweight Warriors; conducted study to determine changes in sleep brain activity on Soldiers in theater; conducted a study to determine extent to which sleep duration impacts resilience/sensitivity to combat experiences. ***FY 2012 Plans:*** Investigate whether there is any association between disturbances in nutritional health and the prevalence of Warfighter psychological disorders; determine the impact of weight status on risk of musculoskeletal injury; define the muscle metabolic responses to energy deficit for development of treatment interventions; determine impact of nutritional status on blast recovery; demonstrate effectiveness of a non-prescription medication for promoting fat loss in overweight Warriors. ***FY 2013 Plans:*** Will 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 will lead to interventions designed to protect Warfighters from environmental hazards. Will define the effects of metabolic energy availability on cognitive performance; determine if 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;	3.862	3.670	6.086

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
refine a cognitive (mental processing) model to predict differential rates of recovery following various chronic sleep restriction operational scenarios. These results will increase predictive capability against the effects of fatigue. Will determine the effects of physiological (human mechanical, physical and biochemical functions) factors, such as genetic makeup, sleep history and personality on individual differences in physiological resiliency.			
Title: Injury Prevention and Reduction - Neurosensory Injury Prevention ***Description:*** This effort 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. ***FY 2011 Accomplishments:*** Determined head injury thresholds in boxers and paratroopers for risk assessment and development of biomedically-valid criteria for use in materiel development; completed eye injury dose-response modeling for vulnerability assessments using the instrumented headform system; extended laser injury diagnostics to animal models; used improved headforms, assessed ear protection strategies with simulated battle sounds and conducted assessments of vulnerability models for jobs that define job-specific strategies and interventions; conducted comparative analysis of foam and preformed eartips for use with the Communications Earplug. ***FY 2012 Plans:*** Determine thresholds of operationally relevant blunt head injury; complete additional eye injury dose-response modeling for the instrumented headform system; assess 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); develop biomedically-based injury mechanism criteria to define auditory risk potential; examine both biophysical and animal models of blast to characterize the nature and extent of effects on the eye. ***FY 2013 Plans:*** Will 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 will assess the effectiveness of existing and newly developed hearing protection/enhancement strategies during continuous and impulse noise combat operations that will predict 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; assess military ocular (eye) trauma from blast or lasers and outcomes that leads to the prevention and effective mitigation of battlefield eye injuries.	7.423	7.176	8.824
Title: Injury Prevention and Reduction - Musculoskeletal Injury Prevention	4.644	5.212	6.937

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Description: This effort evaluates and assesses the effects of repetitive motion during military operations and training on the human body. Also allows for the prediction of injuries as a result of continuous operations and muscle fatigue. This effort 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 ***FY 2011 Accomplishments:*** Developed recovery assessment tests that are used to develop return-to-duty recommendations after musculoskeletal injury; refined and validated the training, overuse, and injury prediction model to incorporate stress fracture data. ***FY 2012 Plans:*** Develop and validate a model that will identify relationships among multi-sensory and musculoskeletal injuries; develop and implement an injury risk methodology for remediation and prevention in an effort to mitigate lost duty-time due to musculoskeletal injury; develop strategies to evaluate predictions and generalizations of musculoskeletal injuries. ***FY 2013 Plans:*** Will refine a mounted Soldier injury performance assessment battery; assess the physical performance requirements and determine minimal acceptable standards for muscle/skeletal injury for the dismounted Soldier. These results will provide data for an improved injury risk analysis capability for the Soldier.			
Title: Injury Prevention and Reduction - Injury Return to Duty Standards: ***Description:*** 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. ***FY 2011 Accomplishments:*** Developed measures of effectiveness for interventions with baseline criteria for Warriors with brain, eye, and hearing injury; developed preliminary techniques and technologies to accelerate and assist Wounded Warriors in rapid return to military duty. ***FY 2012 Plans:*** Develop strategies to validate if hearing following blast or blunt trauma is a predictor of mild Traumatic Brain Injury (mTBI); evaluate the human vestibular system (system which contributes to our sense of balance and spatial orientation) as a predictor of mTBI from blast and blunt trauma. ***FY 2013 Plans:*** Will evaluate impulse noise measurement techniques to assess the potential for acoustic (hearing) injury to Soldiers. These results will provide an increased predictive capability for acoustic trauma. Will determine the effect of a low level repeated blast	2.787	2.598	3.752

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
exposure environment on vestibular function (balance and movement). These results will lead to the refinement of medical guidelines that will prevent impaired Soldiers from being prematurely returned to duty.			
Title: Psychological Health - Psychological Resilience ***Description:*** This effort refines, validates, and disseminates early interventions to prevent and reduce combat-related behavioral health problems, including symptoms of post-traumatic stress disorder (PTSD), depression, anger problems, anxiety, substance abuse, post-concussive symptoms, and other health risk behaviors. This effort also assesses and refines interventions to enhance and sustain resilience throughout the Warfighter's career. ***FY 2011 Accomplishments:*** Finalized assessments of components of Advanced Battlemind; determined lessons-learned from post-deployment health assessments and healthcare utilization to determine outcomes of psychological disorders. ***FY 2012 Plans:*** Establish key targeted skills that leaders employ to effectively build resilience and handle behavioral health issues in their units. Develop training content for these leader skills. Conduct studies to assess efficacy of new advanced resilience training modules post-deployment and deliver validated training. Validate enhanced resilience training techniques and assess optimal training delivery strategies. Assess post-deployment reintegration strategies. Develop and assess efficacy of spouse resilience training to enhance mental health and reintegration. Provide evidence-based guidance for adequate resourcing of mental health services for military families. ***FY 2013 Plans:*** Will finalize assessment of post-deployment reintegration strategies; conduct studies to show the effectiveness of behavioral health and resiliency skills for leaders; conduct studies to evaluate the efficacy of behavioral health and resiliency skills for leaders. These results will be used to refine preventive and treatment interventions to enhance the psychological resilience of the Warfighter.	5.219	10.843	6.566
Title: Psychological Health & Resilience - Suicide Prevention and Treatment of PTSD ***Description:*** This effort supports investigation of methods to treat PTSD in a military population and identifies causative and preventive factors in military suicides. ***FY 2011 Accomplishments:*** Conducted a laboratory study to determine effects of PTSD on objectively measured sleep and neurocognitive performance; conducted studies to assess effectiveness of suicide interventions on suicide behavior. ***FY 2012 Plans:***	5.133	3.917	3.270

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Conduct 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); assess effectiveness of increasing suicide awareness training with decreasing suicide-related behaviors and intentions. ***FY 2013 Plans:*** Will refine specific interventions for the most effective means of treating deployment-related PTSD. These interventions include medications, psychotherapy, and complementary alternative medicine approaches. Will 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. Will determine efficacy 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.			
Title: Psychological Health & Resilience - Concussion/Mild Traumatic Brain Injury (mTBI) Interventions ***Description:*** This effort refines and evaluates methods to detect and treat concussion as well as identify and evaluate the effects of cognitive deficits in Soldiers during operations. ***FY 2011 Accomplishments:*** Assessed the utility of neuropsychological measures for tracking/monitoring recovery rate from concussion; conducted a study to determine predictive value of a neuropsychological test for subsequent pos-concussive symptoms; conducted a study to determine changes in sleep parameters coincident with concussion and correlated this data with changes in neuropsychological performance. ***FY 2012 Plans:*** Determine if concussion/mTBI-related neurocognitive performance deficits predict other objective neurophysiological indicators of functional capability; assess impact of neurocognitive measures for tracking/monitoring recovery rate and for providing guidance for the determination of return-to-duty status. ***FY 2013 Plans:*** Will refine an evidence (data)-based comparative analysis of the foremost neurocognitive (functions of the brain) tests for assessment of mild traumatic brain injuries in Soldiers; conduct an assessment to determine which post-concussion syndrome (PCS) symptoms are due to sleep disturbance; refine guidance on drug interventions to improve psychological and neurophysiological functioning post concussion. These results will lead to the refinement of more effective interventions following concussive injury.	2.225	1.696	1.434
Accomplishments/Planned Programs Subtotals	33.669	38.679	38.907

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C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
870: *DOD MED DEF AG INF DIS*	15.448	16.842	18.987	-	18.987	19.246	19.397	19.520	19.631	Continuing	Continuing

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, 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 improved 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 (symbiotic relationship between two organisms) Diseases
(2) Vaccines for Preventing Malaria
(3) Bacterial Threats
(4) Diagnostics and Disease Transmission Control
(5) Viral Threats

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 U.S. Food and Drug Administration (FDA) to justify approval for a product to enter into future human subject testing. Additional non-clinical studies are often needed in Applied Research even after candidate products enter into human testing during Advanced Technology Development, usually at the direction of the FDA, to assess potential safety issues. Drug and vaccine refinement bears high technical risk. Of those candidates identified as promising in initial screens, the vast majority are eliminated after additional safety, toxicity, and/or effectiveness testing. Similarly, vaccine candidates have a high failure rate, as 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 in coordination with the Naval Medical Research Center. 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.

Promising medical countermeasures identified in this project are further matured under PE 0603002A, project 810.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

Efforts in this project support the Soldier Portfolio and the principle area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Drugs to Prevent/Treat Parasitic Diseases (harmful effects on host by an infecting organism)	3.769	3.925	4.337
Description: This effort conducts assessments and improves candidate drugs coming from the DoD discovery program and from other collaborations for prevention and treatment of malaria to counter the continuing spread of drug resistance to current drugs. Conducts assessments in animal models of currently available drugs for use against cutaneous leishmaniasis (a skin-based disease transmitted by sand flies). This program selects the most effective and safe candidates for continued refinement and possible clinical testing.			
FY 2011 Accomplishments: Synthesized promising compounds in larger quantities to support preclinical studies. Drugs against malaria and/or leishmaniasis were further screened in animal tests for toxicity and effectiveness. Completed testing and prepared for FDA application for clinical testing in humans.			
FY 2012 Plans: Undertake 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-select for advancement to clinical studies in human.			
FY 2013 Plans: Will evaluate selected compounds for anti-parasitic effectiveness in animal models to further down-select for human trials; validate new malaria and leishmania models for predicting drug effectiveness and toxicity for future drug testing.			
Title: Vaccines for Prevention of Malaria	3.182	4.634	4.522
Description: This effort conducts studies to investigate new candidate vaccines for preventing malaria and selects the best candidate(s) for continued refinement. A highly effective vaccine would reduce or eliminate the use of anti-malarial drugs and would minimize the progression and impact of drug resistance to current/future drugs.			
FY 2011 Accomplishments:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Down-selected among the vaccine candidates based on results from safety and effectiveness studies in animals; prepared for vaccine testing in locations where the disease occurs naturally. ***FY 2012 Plans:*** Select candidate antigens (substance that when introduced into the body stimulates the production of an antibody) for further evaluation in preclinical testing and advance those candidates demonstrating effectiveness in primate testing toward further development. ***FY 2013 Plans:*** Will 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.			
Title: Diagnostics and Disease Transmission Control: ***Description:*** This effort designs and prototypes new medical diagnostic and surveillance tools for the field, focusing on bedside and field-deployable diagnostic systems. Refine 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. ***FY 2011 Accomplishments:*** Developed super-attractant traps that remove biting insects from localized areas; conducted proof-of-concept testing of passive insect repellent systems; optimized hospital-based diagnostic devices for selected infectious disease agents to be transitioned to the Joint Biological Agent Identification System (JBAIDS) platform; increased repositories of clinical samples and reagents needed to develop and validate multiple new disease-specific diagnostic devices. ***FY 2012 Plans:*** Develop and optimize a multi-drug resistant organism diagnostic tool in collaboration with a commercial partner; transition the dengue virus diagnostic test for the JBAIDS platform to advanced development following preclinical trials; determine the next group of pathogens for which to develop rapid diagnostic tools with commercial partnership. ***FY 2013 Plans:*** Will refine diagnostic tools that provide on-the-spot identification of biting insects/tick/mites and their human/animal pathogen infection status; evaluate new non-pesticidal technologies for insects population control; refine data package to obtain FDA clearance on the dengue JBAIDS assay; evaluate next generation diagnostic system platforms.	2.070	1.709	1.949
Title: Viral Threats Research ***Description:*** This effort designs and laboratory tests new vaccine candidates against Hhuman Immunodeficiency Virus (HIV), dengue and other hemorrhagic fever viruses such as hantaviruses (cause of Korean hemorrhagic fever) and other lethal viruses	3.244	2.989	3.726

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
(i.e., Lassa fever and Crimean-Congo hemorrhagic fever), and assess other non-vaccine technologies to protect against such lethal viral diseases. Efforts also include establishment and maintenance of clinical trial sites worldwide. ***FY 2011 Accomplishments:*** Developed proof-of-concept molecular vaccines for viruses of military importance and supported vaccine candidate development by providing necessary laboratory and animal tests; provided laboratory support for dengue fever vaccine testing in humans. ***FY 2012 Plans:*** Continue to develop proof-of-concept molecular vaccines for viruses of military importance; conduct effectiveness studies to develop 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. ***FY 2013 Plans:*** Will 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. Will 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; produce vaccines for various HIV subtypes and complete evaluation in animals.			
Title: Bacterial Threats ***Description:*** 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). ***FY 2011 Accomplishments:*** Prepared an alternative E. coli vaccine for testing in humans; evaluated alternative Shigella constituents as potential vaccine candidates in animals; tested lead candidate Campylobacter vaccine in animals; continued to evaluate scrub typhus for drug resistance, identified new proteins as candidate vaccine components, and evaluated vaccine delivery methods in animals. ***FY 2012 Plans:*** Determine level of protection of alternative E. coli vaccine in animal challenge studies (animal vaccinated and challenged with bacteria causing diarrhea); perform animal and toxicology studies on alternative (Invaplex-AR) Shigella vaccine; conduct human clinical trials on 12 to 24 healthy volunteers to determine safety of best lead candidate Campylobacter vaccine; perform	3.183	3.585	4.453

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
animal wound infection studies on several candidate products to prevent wound infection and biofilm (thin resistant layer of microorganisms that helps bacteria survive in wounds) formation. ***FY 2013 Plans:*** Will 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; 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.			
Accomplishments/Planned Programs Subtotals	15.448	16.842	18.987

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
873: *HIV EXPLORATORY RSCH*	8.924	9.377	8.986	-	8.986	8.976	8.969	8.963	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research on the human immunodeficiency virus (HIV), which causes acquired immunodeficiency syndrome (AIDS). Work in this area includes refining improved identification methods to determine genetic diversity of the virus, and evaluating and preparing overseas sites for future vaccine trials. Additional activities include refining candidate vaccines for preventing HIV and undertaking preclinical studies (studies required before testing in humans) to assess vaccine for potential to protect and/or manage the disease in infected individuals.

This program is jointly managed through an Interagency Agreement between the U.S. Army Medical Research and Materiel Command 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 the Walter Reed Army Institute of Research (WRAIR) and the Naval Medical Research Center (NMRC), Silver Spring, MD, and their overseas laboratories. The Henry M. Jackson Foundation (HMJF), located in Rockville, MD provides support for FDA testing and other research under a cooperative agreement.

Efforts in this project support the Soldier Portfolio and the principle area of Military Relevant Infectious Diseases to include HIV.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: HIV Research Program	8.924	9.377	8.986
Description: This effort assesses new HIV vaccine candidates and worldwide vaccine test sites, tracks HIV disease outbreaks, and analyzes the genetic attributes of HIV threat.			
FY 2011 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Tested the new East African subtype-based candidate vaccine in animals; identified and characterized new HIV infections; developed new field sites in Tanzania and Nigeria for future testing of vaccine candidates in humans; identified manufacturing processes with multiple combinations of vaccine candidates. ***FY 2012 Plans:*** Characterize and develop new populations at high risk of being infected with HIV for clinical evaluation of potential vaccine candidates at overseas sites; study the impact of human genetics on HIV vaccine development, disease acquisition, and disease progression; manufacture vaccines for various HIV subtypes present worldwide and complete testing in animals; evaluate and implement methods of disease prevention through clinical research. ***FY 2013 Plans:*** Will 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; 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.			
Accomplishments/Planned Programs Subtotals	8.924	9.377	8.986

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
874: *CBT CASUALTY CARE TECH*	16.778	17.017	19.821	-	19.821	19.714	16.446	16.481	16.565	Continuing	Continuing

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, eye injuries, and face trauma.

Research involves extensive collaboration with multiple academic institutions to refine treatments for combat wounds through the Armed Forces Institute of Regenerative Medicine. 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 U.S. Food and Drug Administration regulations, which governs testing in animals to assess safety, toxicity, and effectiveness prior to conducting 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 the U.S. Army Institute of Surgical Research (USAISR), the U.S. Army Dental Trauma Research Detachment (USADTRD), Fort Sam Houston, TX; the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.

Efforts in this project support the Soldier Portfolio and the principle areas of Combat Casualty Care and Clinical and Rehabilitative Medicine.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Damage Control Resuscitation	7.404	5.155	5.003
Description: This effort develop and refine knowledge products (such as 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. ***FY 2011 Accomplishments:*** Completed identification and characterization of frozen and freeze-dried blood substitutes and expanders; completed testing of interventions to stop internal bleeding and transitioned most promising candidates to safety and effectiveness testing in human subjects; continued to identify and assess potential ways to control blood clotting; began investigation of treatment interventions to mitigate effects of head injury on resuscitation; began to evaluate products to treat intracavitary (non-compressible) or junctional (compressible) hemorrhage; completed animal study of blood components and Complement Inhibitors (a series of disease-fighting proteins and their reactions in the body). ***FY 2012 Plans:*** Initiate 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. ***FY 2013 Plans:*** Will 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. A diagnostic for coagulopathy of trauma (uncontrollable bleeding due to injury) will be transitioned to 6.3 and advanced development when sufficiently validated, then FDA approval for its use will be sought.			
Title: Combat Trauma Therapies	3.168	1.634	1.949
Description: This effort conducts research to enhance the ability to diagnose, stabilize, and accelerate wound healing and repair of damaged tissue for casualties with survivable wounds to the face and head, extremities, and brain. ***FY 2011 Accomplishments:*** Continued poly-trauma studies (multiple injuries) of PBBI in large animals; completed oral surgical dressing study; continued to develop therapeutic strategies (drugs, stem cells and brain cooling) to manage TBI. ***FY 2012 Plans:*** Develop local antibiotic delivery that can be used with Negative Pressure Wound Therapy; conduct studies of pre- vs. post-deployment dental classification; conduct research in skin, muscle, and bone repair. Work related to neuroprotection research			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
moves to the TBI program. Regenerative efforts in craniomaxillofacial trauma (soft tissue and skeletal injuries to the face, head and neck) moves to the Clinical and Rehabilitative Medicine Research Program. ***FY 2013 Plans:*** Will 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 begin to characterize biofilm diagnostics, dispersal agents, and therapies.			
Title: Combat Critical Care Engineering ***Description:*** This effort refines diagnostic and therapeutic medical devices as well as associated algorithms, software, and data-processing systems for resuscitation, stabilization, life support, and surgical support that can be applied across the pre-hospital, operational field setting, and initial definitive care facilities. ***FY 2011 Accomplishments:*** Evaluated algorithms being developed to control devices delivering oxygen under conditions of varying rates and levels of respiration, as well as for ability to track resuscitation in real-time; continued testing devices for use in intensive care units. ***FY 2012 Plans:*** Develop 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. ***FY 2013 Plans:*** Will further refine algorithms to track blood loss under conditions of heat, cold, dehydration, varying rates of blood loss, etc. to determine possible causal relationships.	1.409	0.751	1.525
Title: Clinical and Rehabilitative Medicine ***Description:*** This effort conducts laboratory and animal studies on regenerating skin, muscle, nerve, and bone tissue, as well as studies regarding ocular and visual system traumatic injury for the care and treatment of battle-injured casualties. ***FY 2011 Accomplishments:*** Conducted studies using relevant animals to evaluate the most promising treatments for repairing traumatic eye injuries; continued regenerative medicine studies addressing ways to construct a nerve conduit scaffold to provide a guide for nerve regeneration; evaluated engineered cartilage; studied methods to reduce post-burn injury progression by use of inflammation inhibitors and agents to prevent cell death; explored the use of stem cells to repair soft and hard tissue defects. ***FY 2012 Plans:***	4.797	7.694	8.798

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Evaluate novel drug delivery, diagnostic and/or tissue repair strategies for eye injury; and evaluate candidate strategies for maxillofacial (head, neck, face and jaw) reconstruction, including wound-healing control and tissue engineering/regeneration techniques to restore facial features. Continue development and standardization of animal models for an artificial means for guiding nerve regeneration; continue studies of chronic bone defect and burn repair; continue studies of soft tissue repair strategies; continue development and testing of experimental stem cell therapies and scaffolds (tissue-engineered grafts) in animal models. ***FY 2013 Plans:*** Will continue to refine novel drug delivery, diagnostic and tissue repair strategies including stem cell therapies utilizing knowledge deliverables from FY 2012; further refine animal models to assess soft and hard tissue regeneration technologies; continue studies of burn, 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. Building on promising approaches from FY 2012, by continuing the evaluation of candidate strategies for maxillofacial (head, neck, face and jaw) reconstruction, including wound-healing control and tissue engineering/regeneration techniques to restore facial features.			
Title: Traumatic Brain Injury ***Description:*** 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. ***FY 2012 Plans:*** Realign neuroprotection research from the Combat Trauma Therapies task area to the TBI task area. Continue 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. ***FY 2013 Plans:*** Will further investigate selective brain cooling and non-embryonic stem cells derived from human amniotic fluid as non-traditional therapies for TBI.	-	1.783	2.546
Accomplishments/Planned Programs Subtotals	16.778	17.017	19.821

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
FH2: *FORCE HEALTH PROTECTION - APPLIED RESEARCH*	10.406	9.122	6.279	-	6.279	6.316	6.436	6.523	6.568	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research to support applied research directed toward the sustainment of a healthy force of Warfighters from accession through retirement. This research focuses on enhanced protection of Soldiers against health threats in military operations and training. Stressors that adversely affect individual Soldier health readiness are identified and studied to refine interventions that will protect Soldiers and improve their health and performance in stressful environments. This is follow-on research that extends and applies findings from over a decade of research on Gulf War Illnesses and other chronic multi-symptom illnesses that have suspected nerve and behavioral alterations due to environmental contaminants and deployment stressors. Key databases include the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases allow us to evaluate interactions of psychological stress and other deployment and occupational stressors that affect Warfighter health behaviors.

Force Health Protection applied research is conducted in close coordination with the Department of Veterans Affairs. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services working on Army projects.

Research conducted in this project focuses on the following three areas:

(1) Physiological Response and Blast and Blunt Trauma Models of Thoracic (chest) and Pulmonary (lung) Injuries
(2) Millennium Cohort Research
(3) Biomarkers of Exposure and Environmental Biomonitoring

Promising efforts identified in this project are further matured under PE 0603002A, project FH4.

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

Work in this project is performed by the U.S. Army Center for Environmental Health Research, Fort Detrick, MD; the Naval Health Research Center (NHRC), San Diego, CA; and the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

Efforts in this project support the Soldier Portfolio and the principle area of Combat Casualty Care.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Title: Millennium Cohort Research	3.943	4.393	4.068
Description: This effort supports a long-term study of Soldiers that includes psychological, physical, and spiritual impacts of military service throughout their lifetime. The Millennium Cohort and Deployment Health Task area employs a prospective epidemiological (study of health-event patterns in a society), surveillance research 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 lifecycle of military servicemen and women. ***FY 2011 Accomplishments:*** Conducted analyses to determine resilience factors for PTSD symptoms over time; conducted analysis to determine factors that influence resistance to depression symptoms over time and enhance mental resilience in deploying forces; conducted death analysis with specific interest in modifying factors for post-combat suicide. ***FY 2012 Plans:*** Develop 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. ***FY 2013 Plans:*** Will 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; 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 will lead to the formulation of strategies designed to mitigate the adverse psychological effects of military deployments.			
Title: Biomarkers of Exposure and Environmental Biomonitoring	4.581	3.002	0.757
Description: This effort supports refinement and evaluation of methods to detect environmental contamination and toxic exposure during military operations. ***FY 2011 Accomplishments:*** Evaluated biomarkers of exposure to additional Militarily Relevant Chemicals; evaluated and accelerated discovery methods for new biomarkers; optimized individual toxicity sensor performance and minimized system components to comply with logistical deployment requirements for use in the final increment of the Environmental Sentinel Biomonitor. ***FY 2012 Plans:*** Provide rapid toxicity identification for industrial and agricultural chemicals in Army field drinking water supplies; complete and submit prototype toxicity sensors for evaluation based on the U.S. Environmental Protection Agency's			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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 2011	FY 2012	FY 2013
Technology Testing and Evaluation Program. ***FY 2013 Plans:*** Will conduct assessment of high priority Army research needs in nano-material characterization, exposure assessment, toxicity studies, or risk assessment. This will provide Soldiers with exposure risk health assessment to the potential health hazards associated with nano-materials in the environment.			
Title: Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injury ***Description:*** This effort supports modeling and assessment of the combined effects of blast, impact, and ballistic trauma on the chest and lung system. ***FY 2011 Accomplishments:*** Refined combined thoracic (chest) blunt trauma/physiology models against combined thoracic blunt trauma and inhalation large animal exposure tests; combined thoracic blast trauma model with performance decrement models to develop an integrated tool for survivability assessment and health hazard analysis. ***FY 2012 Plans:*** Develop software that evaluates the combined physiological effects of toxic gas exposure; assess software that estimates lung, heart, and rib injury from blunt trauma due to debris impact (secondary blast injury); assess increased functionality and support end-users for health hazard assessment, survivability assessment, and personal protection evaluation and improvement. ***FY 2013 Plans:*** Will 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 will provide Commanders with a single assessment tool for a myriad of health hazards. This will also provide the Commander with an enhanced capability to assess injury-related risk for the Warfighter.	1.882	1.727	1.454
Accomplishments/Planned Programs Subtotals	10.406	9.122	6.279

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VB4: *SYSTEM BIOLOGY AND NETWORK SCIENCE TECHNOLOGY*	1.135	4.741	4.802	-	4.802	4.839	4.792	4.869	4.948	Continuing	Continuing

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 the U.S. Army Medical Research and Materiel Command, Fort Detrick, MD.

Efforts in this project support the Soldier Portfolio and the principle area of Systems Biology/Network Sciences.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Systems Biology	1.135	4.741	4.802
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 2011 Accomplishments:*** Refined experimental model systems, identified markers for prediction of multi-organ failure resulting from heat injury, and developed supporting computational models of regulatory systems of heat injury. ***FY 2012 Plans:*** Refine experimental systems for assessment and enhancement of computational models for identifying pharmacological interventions for heat stroke-caused multi-organ failure. ***FY 2013 Plans:*** Will 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)). Will refine and begin validating a computational			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
platform and mathematical models for biological responses to toxicity, disease, and injury. Will identify candidate biomarkers for adverse host responses.			
Accomplishments/Planned Programs Subtotals	1.135	4.741	4.802

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012
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)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
VJ4: *SUICIDE PREVENTION/ MITIGATION*	10.000	9.984	10.109	-	10.109	10.114	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds research over a planned five (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 principle area of Military Operational Medicine.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Suicide Prevention/Mitigation	10.000	9.984	10.109
Description: This effort conducts research to better understand the apparent increase in suicide deaths and nonfatal attempts among Active Duty Soldiers, as well as identify improved prevention/intervention methods for individuals at risk for suicide based on data-driven recommendations. The efforts would be utilized to decrease suicide rates in both military populations as well as in the general public.			
FY 2011 Accomplishments: Continued to conduct research to better understand the apparent increase in suicide deaths and nonfatal attempts among active duty Soldiers; continued epidemiological (population-based) studies to identify determinants of suicidal behaviors and potential modifiable risk factors; continued to develop better methods for preventing suicidal behaviors based on data driven recommendations to mitigate or prevent suicidal behaviors.			
FY 2012 Plans: Continue epidemiological (population-based) studies to further identify determinants of suicidal behavior as well as potential modifiable risk factors; collect data for suicide-death case control study; conduct research efforts to assist in improved			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
identification of individuals at greatest risk for suicide as well as to validate screening measures and enhance prevention/ intervention methods. ***FY 2013 Plans:*** Will continue epidemiological (population-based) studies to further identify determinants of suicidal behavior and potential modifiable risk factors; will collect data for suicide-death case control study; will conduct research efforts to assist in improved identification of individuals at greatest risk for suicide, validate screening measures, and enhance prevention/intervention methods.			
Accomplishments/Planned Programs Subtotals	10.000	9.984	10.109

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

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.