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Supporting Data FY 2010 Budget Estimate – May 2009

**DESCRIPTIVE SUMMARIES OF THE**



**RESEARCH, DEVELOPMENT, TEST AND EVALUATION  
Army Appropriation, Budget Activities 1, 2, and 3**

Department of the Army  
Office of the Secretary of the Army (Financial Management and Comptroller)

*Persuasive in Peace, Invincible in War*

**VOLUME I**

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**DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS  
OF THE  
RESEARCH, DEVELOPMENT, TEST AND  
EVALUATION, ARMY  
FY 2010  
BUDGET ESTIMATE  
MAY 2009**

**VOLUME I  
Budget Activities 1, 2 and 3**

**Department of the Army  
Office of the Assistant Secretary of the Army (Financial Management and Comptroller)**

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**4. Performance Metrics.** Performance metrics used in the preparation of this justification book may be found in the FY 2010 Army Performance Budget Justification Book, dated March 2009.

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**FY 2010 RDT&E, ARMY  
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES**

**INTRODUCTION AND EXPLANATION OF CONTENTS**

**1. General.** The purpose of this document is to provide summary information concerning the Research, Development, Test and Evaluation, Army program. The Descriptive Summaries are comprised of R-2 (Army RDT&E Budget Item Justification – program element level), R-2A (Army RDT&E Budget Item Justification – project level), R-3 (Army RDT&E Cost Analysis), R-4 (Schedule Profile), R-4A (Schedule Profile Detail) and R-5 (Termination Liability Funding for MDAPs) Exhibits, which provide narrative information on all RDT&E program elements and projects for FY 2008 through FY 2010.

**2. Relationship of the FY 2010 President’s Budget Submit to the FY 2009 Budget Submitted to Congress.** This paragraph provides a list of program elements restructured, transitioned, or established to provide specific program identification.

**A. Program Element Restructures.** Explanations for these changes can be found in the narrative sections of the Program Element R-2A Exhibits.

<b><u>OLD PE/PROJECT</u></b>	<b><u>NEW PROJECT TITLE</u></b>	<b><u>NEW PE/PROJECT</u></b>
0203759A/122	Army Systems Engineering & Warfighting Technical Support	0604805A/589
0203744A/028	Aerial Common Sensor	0305287A/024
0303140A/50B	DOD Biometrics Program Management	0303140A/5PM
0305208A/D06, D07 & D08	Distributed Common Ground System (DCGS) (MIP)	0305208A/956
0601102A/S15	Science Base/System Biology And Network Science	0601102A/T64
0601102A/S19	Science Base/Combat Casualty Care Research	0601102A/S14
0602120A/140	High Power Microwave Technology	0602705A/EM8
0602270A/442	Tactical Electronic Warfare Applied Research	0602270A/906
0602618A/H03	Robotics Technology	0602120A/TS2
0602787A/878	System Biology and Network Science Technology	0602787A/VB4
0602787A/878 & 879	Warfighter Health Protection & Performance Standards	0602787A/869
0603002A/800 & 819	Warfighter Medical Protection & Performance Studies	0603002A/MM3
0604660A/FC1	Manned Ground Vehicles	0605625A/FC8

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**B. Developmental Transitions.** Explanations for these changes can be found in the narrative sections of the Program Element R-2/R-3 Exhibits.

<b>OLD</b>	<b>NEW PROJECT TITLE</b>	<b>NEW</b>
<b><u>PE/PROJECT</u></b>		<b><u>PE/PROJECT</u></b>
0603103A/D51	Conventional Munitions Demilitarization	0605805A/F24

**C. Establishment of New FY 2010 Program Elements/Projects.** There are no major system new starts. Minor new initiatives for FY 2010 are shown below.

<b><u>TITLE</u></b>	<b><u>PE/PROJECT</u></b>
In-House Lab Independent Research - SMDC	0601101A/F16
Science Base/System Biology And Network Science	0601102A/T64
Minerva	0601103A/V72
Neuroergonomics Collaborative Technology Alliance	0601104A/F17
Robotics Technology	0602120A/TS2
System Biology and Network Science Technology	0602787A/VB4
Suicide Prevention/Mitigation	0602787A/VJ4
Warfighter Medical Protection & Performance Studies	0603002A/MM3
Advanced Kinetic Energy (AKE) 120MM Cartridge	0603639A/652
Gaming Technology in Support of Army Training	0604780A/577
Joint Automated Deep Operations Coordination System (JADOCS)	0203726A/F19

**D. FY 2010 programs for which funding existed in the FY 2009 President's Budget Submit (February 2008), but which are no longer funded in the FY 2010 President's Budget Submit.**

<b><u>PE/PROJECT</u></b>	<b><u>TITLE</u></b>	<b><u>BRIEF EXPLANATION</u></b>
0601102A/S19	T-MED/Soldier Status	Program restructured
0601104A/H56	Advanced Decision Architecture Collaborative Technology Alliance (CTA)	Program completed
0602120A/140	High Power Microwave Technology	Program restructured
0602270A/442	Tactical Electronic Warfare Technology	Program restructured
0602618A/H03	Robotics Technology	Program restructured
0602787A/878	Health Hazardous Military Materiel	Program restructured

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**D. FY 2010 programs for which funding existed in the FY 2009 President's Budget Submit (February 2008), but which are no longer funded in the FY 2010 President's Budget Submit. (Continued)**

<u>PE/PROJECT</u>	<u>TITLE</u>	<u>BRIEF EXPLANATION</u>
0602787A/879	Medical Factors Enhancing Soldier Effectiveness	Program restructured
0603002A/800	Telemedicine Testbed	Program restructured
0603002A/819	Field Medical Protection/Human Performance	Program restructured
0603103A/D51	Explosives Demilitarization Technology	Program transitioned
0603639A/656	FCS Mounted Combat System Ammunition	Program scheduled to be terminated in FY 2010
0603774A/131	Night Vision Systems	Program terminated
0604280A/162	Network Enterprise Domain (JTRS)	FY 2010 funds transferred to the Navy
0604666A/FC7	FCS Spin-Out Technology/Capability Integration	Program restructured
0604804A/L42	Camouflage Systems	Program terminated
0604818A/C39	Tactical Operations Centers (TOCs)	Program restructured
0203759A/122	Joint Battle Command – Platform (JBC-P)	Program restructured
0203744A/028	Aerial Common Sensor (MIP)	Funding moved to a separate MIP program element.
0305208A/D06	Distributed Common Ground System – Army (DCGS-A) Fusion Integration (MIP)	Program restructured
0305208A/D07	DCGS-A Common Modules (MIP)	Program restructured
0305208A/D08	DCSG-A Sensor Integration (MIP)	Program restructured

**3. Classification. This document contains no classified data. Classified/Special Access Programs that are submitted offline are listed below.**

0203801A/DF8/DF9	0603006A/DF7
0203808A	0603009A
0301359A	0603020A
0602122A	0603322A
0603005A/C66	0604328A

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**4. Performance Metrics.** Performance metrics used in the preparation of this justification book may be found in the FY 2010 Army Performance Budget Justification Book, dated March 2009.

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 Summary

Exhibit R-1

May-09

Thousands of Dollars

Summary Recap of Budget Activities	Base & OCO Combined		Base	OCO	Total
	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
Basic research	373,403	437,792	377,260		377,260
Applied Research	1,176,556	1,229,755	781,197		781,197
Advanced technology development	1,319,901	1,400,201	695,217		695,217
Advanced Component Development and Prototypes	1,234,554	1,011,491	908,206		908,206
System Development and Demonstration	5,205,691	5,166,540	4,640,455	18,598	4,659,053
Management support	1,473,406	1,169,880	1,149,112		1,149,112
Operational system development	1,765,991	1,674,525	1,882,888	39,364	1,922,252
Total					
RDT&E, Army	12,549,502	12,090,184	10,434,335	57,962	10,492,297

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Program				Thousands of Dollars				
				Base & OCO Combined		Base	OCO	Total
Line	Element	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
Basic Research								
1	0601101A	01	In-House Laboratory Independent Research	19,706	19,766	19,671		19,671
2	0601102A	01	Defense Research Sciences	164,633	198,103	173,024		173,024
3	0601103A	01	University Research Initiatives	79,544	89,632	88,421		88,421
4	0601104A	01	University And Industry Research Centers	109,520	130,291	96,144		96,144
Total: Basic Research				373,403	437,792	377,260	0	377,260
Applied Research								
5	0602105A	02	Materials Technology	60,261	80,937	27,206		27,206
6	0602120A	02	Sensors And Electronic Survivability	61,180	75,299	50,641		50,641
7	0602122A	02	TRACTOR HIP	4,284	18,131	14,324		14,324
8	0602211A	02	Aviation Technology	42,547	46,898	41,332		41,332
9	0602270A	02	Electronic Warfare Technology	25,564	21,739	16,119		16,119
10	0602303A	02	Missile Technology	67,097	56,747	50,716		50,716
11	0602307A	02	Advanced Weapons Technology	24,354	23,187	19,678		19,678
12	0602308A	02	Advanced Concepts And Simulation	18,489	21,778	17,473		17,473
13	0602601A	02	Combat Vehicle And Automotive Technology	87,144	89,036	55,937		55,937
14	0602618A	02	Ballistics Technology	89,526	87,960	61,843		61,843
15	0602622A	02	Chemical, Smoke And Equipment Defeating Technology	10,248	8,906	5,293		5,293
16	0602623A	02	Joint Service Small Arms Program	6,798	9,102	7,674		7,674
17	0602624A	02	Weapons And Munitions Technology	100,973	102,339	41,085		41,085
18	0602705A	02	Electronics And Electronic Devices	124,115	99,687	61,404		61,404
19	0602709A	02	Night Vision Technology	34,440	46,691	26,893		26,893
20	0602712A	02	Countermine Systems	24,252	32,308	18,945		18,945
21	0602716A	02	Human Factors Engineering Technology	38,604	42,208	18,605		18,605
22	0602720A	02	Environmental Quality Technology	16,651	19,799	15,902		15,902
23	0602782A	02	Command, Control, Communications Technology	42,004	41,218	24,833		24,833
24	0602783A	02	Computer And Software Technology	8,676	6,274	5,639		5,639
25	0602784A	02	Military Engineering Technology	55,216	58,810	54,818		54,818
26	0602785A	02	Manpower/Personnel/Training Technology	15,841	16,358	18,701		18,701
27	0602786A	02	Warfighter Technology	36,752	36,133	27,109		27,109
28	0602787A	02	Medical Technology	181,540	188,210	99,027		99,027
Total: Applied Research				1,176,556	1,229,755	781,197	0	781,197

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Program				Thousands of Dollars				
				Base & OCO Combined		Base	OCO	Total
Line	Element	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
Advanced Technology Development								
29	0603001A	03	Warfighter Advanced Technology	65,489	73,352	37,574		37,574
30	0603002A	03	Medical Advanced Technology	299,436	321,260	72,940		72,940
31	0603003A	03	Aviation Advanced Technology	99,457	106,285	60,097		60,097
32	0603004A	03	Weapons And Munitions Advanced Technology	84,679	109,074	66,410		66,410
33	0603005A	03	Combat Vehicle And Automotive Advanced Technology	242,286	263,879	89,586		89,586
34	0603006A	03	Command, Control, Communications Advanced Technology	11,781	11,544	8,667		8,667
35	0603007A	03	Manpower, Personnel And Training Advanced Technology	6,632	6,830	7,410		7,410
36	0603008A	03	Electronic Warfare Advanced Technology	55,257	62,353	50,458		50,458
37	0603009A	03	TRACTOR HIKE	12,249	14,514	11,328		11,328
38	0603015A	03	Next Generation Training & Simulation Systems	23,292	25,298	19,415		19,415
39	0603020A	03	TRACTOR ROSE	6,306	11,536	14,569		14,569
40	0603103A	03	Explosives Demilitarization Technology	20,916	13,720			0
41	0603105A	03	Military HIV Research	14,490	15,064	6,657		6,657
42	0603125A	03	Combating Terrorism - Technology Development	13,220	13,022	11,989		11,989
43	0603270A	03	Electronic Warfare Technology	41,902	33,086	19,192		19,192
44	0603313A	03	Missile And Rocket Advanced Technology	77,171	76,702	63,951		63,951
45	0603322A	03	TRACTOR CAGE	17,857	12,331	12,154		12,154
46	0603606A	03	Landmine Warfare And Barrier Advanced Technology	30,038	37,534	30,317		30,317
47	0603607A	03	Joint Service Small Arms Program	16,367	8,781	8,996		8,996
48	0603710A	03	Night Vision Advanced Technology	62,618	70,682	40,329		40,329
49	0603728A	03	Environmental Quality Technology Demonstrations	14,611	15,468	15,706		15,706
50	0603734A	03	Military Engineering Advanced Technology	34,581	35,855	5,911		5,911
51	0603772A	03	Advanced Tactical Computer Science And Sensor Technology	69,266	62,031	41,561		41,561
Total: Advanced Technology Development				1,319,901	1,400,201	695,217	0	695,217
Advanced Component Development and Prototypes								
52	0603024A	04	Unique Item Identification (UID)	645	646			0
53	0603305A	04	Army Missile Defense Systems Integration	128,776	90,765	14,683		14,683
54	0603308A	04	Army Space Systems Integration	58,078	47,828	117,471		117,471
55	0603327A	04	Air And Missile Defense Systems Engineering	155,669	118,816	209,531		209,531
56	0603460A	04	Joint Air-To-Ground Missile (JAGM)	51,690				0
57	0603619A	04	Landmine Warfare And Barrier - Adv Dev	19,120	14,186	17,536		17,536
58	0603627A	04	Smoke, Obscurant And Target Defeating Sys-Adv Dev	9,104	3,826	4,920		4,920

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				Base & OCO Combined		Base	OCO	Total
Line	Element	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
59	0603639A	04	Tank And Medium Caliber Ammunition	46,160	40,731	33,934		33,934
60	0603653A	04	Advanced Tank Armament System (ATAS)	127,662	79,350	90,299		90,299
61	0603747A	04	Soldier Support And Survivability	36,851	32,575	31,752		31,752
62	0603766A	04	Tactical Electronic Surveillance System - Adv Dev	14,428	12,235	18,228		18,228
63	0603774A	04	Night Vision Systems Advanced Development	2,519	2,580			0
64	0603779A	04	Environmental Quality Technology - Dem/Val	26,474	15,304	4,770		4,770
65	0603782A	04	Warfighter Information Network-Tactical - Dem/Val	309,081	393,054	180,673		180,673
66	0603790A	04	NATO Research And Development	4,791	5,025	5,048		5,048
67	0603801A	04	Aviation - Adv Dev	8,876	9,822	8,537		8,537
68	0603804A	04	Logistics And Engineer Equipment - Adv Dev	133,007	43,995	56,373		56,373
69	0603805A	04	Combat Service Support Control System Evaluation And Analysis	14,389	17,729	9,868		9,868
70	0603807A	04	Medical Systems - Adv Dev	25,207	30,207	31,275		31,275
71	0603827A	04	Soldier Systems - Advanced Development	26,181	41,616	71,832		71,832
72	0603850A	04	Integrated Broadcast Service	35,846	11,201	1,476		1,476
Total:		Advanced Component Development and Prototypes		1,234,554	1,011,491	908,206	0	908,206
System Development and Demonstration								
73	0604201A	05	Aircraft Avionics	52,802	71,325	92,977		92,977
74	0604220A	05	Armed, Deployable OH-58D	176,132	135,205	65,515		65,515
75	0604270A	05	Electronic Warfare Development	53,809	36,206	248,463	18,598	267,061
76	0604321A	05	All Source Analysis System	7,023	16,411	13,107		13,107
77	0604328A	05	TRACTOR CAGE	17,235	16,752	16,286		16,286
78	0604601A	05	Infantry Support Weapons	59,602	58,064	74,814		74,814
79	0604604A	05	Medium Tactical Vehicles	4,633	1,943	5,683		5,683
80	0604609A	05	Smoke, Obscurant And Target Defeating Sys - Eng Dev	1,302	5,584	978		978
81	0604622A	05	Family Of Heavy Tactical Vehicles	15,016	4,487	7,477		7,477
82	0604633A	05	Air Traffic Control	11,676	14,167	7,578		7,578
83	0604646A	05	Non-Line Of Sight Launch System	246,071	208,009	88,660		88,660
84	0604647A	05	Non-Line Of Sight Cannon	133,139	89,545	58,216		58,216
85	0604660A	05	FCS Manned Ground Vehicles & Common Ground Vehicle	635,846	782,664	368,557		368,557
86	0604661A	05	FCS Systems Of Systems Engineering & Program Management	1,292,514	1,414,756	1,067,191		1,067,191
87	0604662A	05	FCS Reconnaissance (UAV) Platforms	42,772	57,190	68,701		68,701
88	0604663A	05	FCS Unmanned Ground Vehicles	78,826	102,976	125,616		125,616

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Line	Element	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
89	0604664A	05	FCS Unattended Ground Sensors	22,007	17,011	26,919		26,919
90	0604665A	05	FCS Sustainment & Training R&D	724,397	556,301	749,182		749,182
91	0604666A	05	FCS Spin Out Technology/Capability Insertion	84,111	111,032			0
92	0604710A	05	Night Vision Systems - Eng Dev	48,826	116,037	55,410		55,410
93	0604713A	05	Combat Feeding, Clothing, And Equipment	2,417	2,491	2,092		2,092
94	0604715A	05	Non-System Training Devices - Eng Dev	35,361	38,299	30,209		30,209
95	0604741A	05	Air Defense Command, Control And Intelligence - Eng Dev	56,549	22,340	28,936		28,936
96	0604742A	05	Constructive Simulation Systems Development	30,737	26,158	33,213		33,213
97	0604746A	05	Automatic Test Equipment Development	11,546	18,521	15,320		15,320
98	0604760A	05	Distributive Interactive Simulations (DIS) - Eng Dev	19,738	17,717	15,727		15,727
99	0604778A	05	Positioning Systems Development (SPACE)			9,446		9,446
100	0604780A	05	Combined Arms Tactical Trainer (CATT) Core	34,684	30,566	26,243		26,243
101	0604783A	05	Joint Network Management System	2,658	673			0
102	0604802A	05	Weapons And Munitions - Eng Dev	63,434	57,948	34,878		34,878
103	0604804A	05	Logistics And Engineer Equipment - Eng Dev	40,019	38,391	36,018		36,018
104	0604805A	05	Command, Control, Communications Systems - Eng Dev	9,188	9,762	88,995		88,995
105	0604807A	05	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	23,397	45,222	33,893		33,893
106	0604808A	05	Landmine Warfare/Barrier - Eng Dev	172,146	116,687	82,260		82,260
107	0604814A	05	Artillery Munitions - EMD	62,490	79,134	42,452		42,452
108	0604817A	05	Combat Identification	10,866	10,873	20,070		20,070
109	0604818A	05	Army Tactical Command & Control Hardware & Software	109,923	65,317	90,864		90,864
110	0604820A	05	Radar Development	6,828				0
111	0604822A	05	General Fund Enterprise Business System (GFEBs)	108,358	50,142	6,002		6,002
112	0604823A	05	Firefinder	84,546	47,688	20,333		20,333
113	0604827A	05	Soldier Systems - Warrior Dem/Val	1,545	17,730	19,786		19,786
114	0604854A	05	Artillery Systems - Emd	30,603	33,190	23,318		23,318
115	0604869A	05	Patriot/Meads Combined Aggregate Program (CAP)	401,565	429,846	569,182		569,182
116	0604870A	05	Nuclear Arms Control Monitoring Sensor Network	6,980	6,240	7,140		7,140
117	0605013A	05	Information Technology Development	172,374	67,815	35,309		35,309
118	0605450A	05	Joint Air-To-Ground Missile (JAGM)		118,125	127,439		127,439
119	0605625A	05	Manned Ground Vehicle			100,000		100,000
	Total:		System Development and Demonstration	5,205,691	5,166,540	4,640,455	18,598	4,659,053
			Management Support					
120	0604256A	06	Threat Simulator Development	22,912	25,092	22,222		22,222

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				Thousands of Dollars				
Program				Base & OCO Combined		Base	OCO	Total
Line	Element	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
121	0604258A	06	Target Systems Development	15,402	13,453	13,615		13,615
122	0604759A	06	Major T&E Investment	64,536	64,404	51,846		51,846
123	0605103A	06	RAND Arroyo Center	18,618	20,272	16,305		16,305
124	0605301A	06	Army Kwajalein Atoll	180,812	174,024	163,514		163,514
125	0605326A	06	Concepts Experimentation Program	28,873	33,918	23,445		23,445
126	0605502A	06	Small Business Innovative Research	302,958				0
127	0605601A	06	Army Test Ranges And Facilities	349,886	346,431	354,693		354,693
128	0605602A	06	Army Technical Test Instrumentation And Targets	89,281	80,705	72,911		72,911
129	0605604A	06	Survivability/Lethality Analysis	40,693	40,929	45,016		45,016
130	0605605A	06	DOD High Energy Laser Test Facility	8,394	6,813	2,891		2,891
131	0605606A	06	Aircraft Certification	4,623	5,037	3,766		3,766
132	0605702A	06	Meteorological Support To RDT&E Activities	8,153	8,262	8,391		8,391
133	0605706A	06	Materiel Systems Analysis	16,927	16,971	19,969		19,969
134	0605709A	06	Exploitation Of Foreign Items	3,292	3,909	5,432		5,432
135	0605712A	06	Support Of Operational Testing	73,003	74,695	77,877		77,877
136	0605716A	06	Army Evaluation Center	59,347	63,173	66,309		66,309
137	0605718A	06	Army Modeling & Simulation Across Command Collaboration & Integration	5,169	5,308	5,357		5,357
138	0605801A	06	Programwide Activities	72,413	73,504	77,823		77,823
139	0605803A	06	Technical Information Activities	44,484	44,359	51,620		51,620
140	0605805A	06	Munitions Standardization, Effectiveness And Safety	39,812	47,898	45,053		45,053
141	0605857A	06	Environmental Quality Technology Management Support	8,790	5,110	5,191		5,191
142	0605898A	06	Management HQ - R&D	14,841	15,613	15,866		15,866
143	0909999A	06	Financing For Cancelled Account Adjustments	187				0
	Total:		Management Support	1,473,406	1,169,880	1,149,112	0	1,149,112
			Operational System Development					
144	0603778A	07	MLRS Product Improvement Program	42,374	59,552	27,693		27,693
145	0603820A	07	Weapons Capability Modifications UAV	3,766				0
146	0102419A	07	Aerostat Joint Project Office	464,877	355,257	360,076		360,076
147	0203726A	07	Adv Field Artillery Tactical Data System	16,146	16,605	23,727		23,727
148	0203735A	07	Combat Vehicle Improvement Programs	42,809	143,041	190,301		190,301
149	0203740A	07	Maneuver Control System	43,601	37,028	21,394		21,394
150	0203744A	07	Aircraft Modifications/Product Improvement Programs	327,331	459,424	209,401		209,401
151	0203752A	07	Aircraft Engine Component Improvement Program	461	331	792		792
152	0203758A	07	Digitization	10,426	9,502	10,692		10,692

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 Department of the Army  
 FY 2010 RDT&E Program  
 President's Budget 2010

Exhibit R-1

Appropriation: 2040 A RDT&E, Army

May 09

Program				Thousands of Dollars				
				Base & OCO Combined		Base	OCO	Total
Line No	Element Number	Act	Item	FY 2008	FY 2009	FY 2010	FY 2010	FY 2010
153	0203759A	07	Force XXI Battle Command, Brigade And Below (FBCB2)	30,974	23,341			0
154	0203801A	07	Missile/Air Defense Product Improvement Program	29,186	37,747	39,273		39,273
155	0203802A	07	Other Missile Product Improvement Programs	1,832	5,209			0
156	0203808A	07	TRACTOR CARD	16,007	19,536	20,035		20,035
157	0208010A	07	Joint Tactical Communications Program (TRI-TAC)	1,469	917			0
158	0208053A	07	Joint Tactical Ground System	23,313	1,951	13,258		13,258
159	0208058A	07	Joint High Speed Vessel (JHSV)	4,973	2,926	3,082		3,082
160	0301359A	07	Special Army Program					0
161	0303028A	07	Security And Intelligence Activities	27,653	3,190	2,144	7,644	9,788
162	0303140A	07	Information Systems Security Program	52,045	43,053	74,355	2,220	76,575
163	0303141A	07	Global Combat Support System	125,480	104,588	144,733		144,733
164	0303142A	07	SATCOM Ground Environment (SPACE)	45,316	58,902	40,097		40,097
165	0303150A	07	WWMCCS/Global Command And Control System	24,197	12,879	12,034		12,034
166	0303158A	07	Joint Command And Control Program (JC2)	15,655	15,153	20,365		20,365
167	0305204A	07	Tactical Unmanned Aerial Vehicles	188,257	103,930	202,521	29,500	232,021
168	0305208A	07	Distributed Common Ground/Surface Systems	128,334	68,662	188,414		188,414
169	0305287A	07	Base Expeditionary Targeting Surveillance Systems- Combined	7,215				0
170	0307207A	07	Aerial Common Sensor (ACS)			210,035		210,035
171	0702239A	07	Avionics Component Improvement Program	989	1,019			0
172	0708045A	07	End Item Industrial Preparedness Activities	91,305	90,782	68,466		68,466
Total: Operational System Development				1,765,991	1,674,525	1,882,888	39,364	1,922,252
Total: RDT&E, Army				12,549,502	12,090,184	10,434,335	57,962	10,492,297

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4	0601104A	University and Industry Research Centers	106
5	0602105A	MATERIALS TECHNOLOGY	155
6	0602120A	Sensors and Electronic Survivability	166
8	0602211A	AVIATION TECHNOLOGY	189
9	0602270A	Electronic Warfare Technology	199
10	0602303A	MISSILE TECHNOLOGY	209
11	0602307A	ADVANCED WEAPONS TECHNOLOGY	222
12	0602308A	Advanced Concepts and Simulation	228
13	0602601A	Combat Vehicle and Automotive Technology	237
14	0602618A	BALLISTICS TECHNOLOGY	254
15	0602622A	Chemical, Smoke and Equipment Defeating Technology	268
16	0602623A	JOINT SERVICE SMALL ARMS PROGRAM	273
17	0602624A	Weapons and Munitions Technology	278
18	0602705A	ELECTRONICS AND ELECTRONIC DEVICES	294
19	0602709A	NIGHT VISION TECHNOLOGY	315
20	0602712A	Countermine Systems	323
21	0602716A	HUMAN FACTORS ENGINEERING TECHNOLOGY	332
22	0602720A	Environmental Quality Technology	339
23	0602782A	Command, Control, Communications Technology	351
24	0602783A	COMPUTER AND SOFTWARE TECHNOLOGY	362
25	0602784A	MILITARY ENGINEERING TECHNOLOGY	369
26	0602785A	Manpower/Personnel/Training Technology	387
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33	0603005A	Combat Vehicle and Automotive Advanced Technology	549
34	0603006A	Command, Control, Communications Advanced Technology	574
35	0603007A	Manpower, Personnel and Training Advanced Technology	581
36	0603008A	Electronic Warfare Advanced Technology	584
38	0603015A	Next Generation Training & Simulation Systems	596
40	0603103A	Explosives Demilitarization Technology	607
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AVIATION TECHNOLOGY	0602211A	8	189
Advanced Concepts and Simulation	0602308A	12	228
Advanced Tactical Computer Science and Sensor Technology	0603772A	51	691
BALLISTICS TECHNOLOGY	0602618A	14	254
COMPUTER AND SOFTWARE TECHNOLOGY	0602783A	24	362
Chemical, Smoke and Equipment Defeating Technology	0602622A	15	268
Combat Vehicle and Automotive Advanced Technology	0603005A	33	549
Combat Vehicle and Automotive Technology	0602601A	13	237
Combating Terrorism - Technology Development	0603125A	42	617
Command, Control, Communications Advanced Technology	0603006A	34	574
Command, Control, Communications Technology	0602782A	23	351
Countermine Systems	0602712A	20	323
DEFENSE RESEARCH SCIENCES	0601102A	2	15
ELECTRONICS AND ELECTRONIC DEVICES	0602705A	18	294
Electronic Warfare Advanced Technology	0603008A	36	584
Electronic Warfare Technology	0603270A	43	622
Electronic Warfare Technology	0602270A	9	199
Environmental Quality Technology	0602720A	22	339
Environmental Quality Technology Demonstrations	0603728A	49	674
Explosives Demilitarization Technology	0603103A	40	607
HUMAN FACTORS ENGINEERING TECHNOLOGY	0602716A	21	332
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JOINT SERVICE SMALL ARMS PROGRAM	0603607A	47	658
JOINT SERVICE SMALL ARMS PROGRAM	0602623A	16	273
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MILITARY ENGINEERING TECHNOLOGY	0602784A	25	369
MILITARY HIV RESEARCH	0603105A	41	612
MISSILE TECHNOLOGY	0602303A	10	209
Manpower, Personnel and Training Advanced Technology	0603007A	35	581
Manpower/Personnel/Training Technology	0602785A	26	387
Military Engineering Advanced Technology	0603734A	50	683
Missile and Rocket Advanced Technology	0603313A	44	632
NIGHT VISION ADVANCED TECHNOLOGY	0603710A	48	663
NIGHT VISION TECHNOLOGY	0602709A	19	315
Next Generation Training & Simulation Systems	0603015A	38	596
Sensors and Electronic Survivability	0602120A	6	166
University Research Initiatives	0601103A	3	96
University and Industry Research Centers	0601104A	4	106
Warfighter Advanced Technology	0603001A	29	447
Warfighter Technology	0602786A	27	392
Weapons and Munitions Advanced Technology	0603004A	32	533
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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					PE 0601101A In-House Laboratory Independent Research					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	19.706	19.766	19.671						Continuing	Continuing
F16: ILIR-SMDC	.000	.000	.492						Continuing	Continuing
91A: ILIR-AMC	12.820	14.624	14.871						Continuing	Continuing
91C: ILIR-MED R&D CMD	3.865	3.604	3.025						Continuing	Continuing
91D: ILIR-CORPS OF ENGR	1.654	1.334	1.121						Continuing	Continuing
91E: ILIR-ARI	.167	.204	.162						Continuing	Continuing
91J: IN-HOUSE LAB INDEPENDENT RESEARCH - MEDICAL (CA)	1.200	.000	.000						Continuing	Continuing

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

This program element (PE) is utilized to attract and retain top doctoral degreed scientists and engineers at the Army's research organizations. The In-House Laboratory Independent Research (ILIR) program provides a source of competitive funds to Army laboratories to stimulate high quality, innovative research with significant opportunity for payoff to Army warfighting capability. The basic research lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. The ILIR program serves as a catalyst for major technology breakthroughs by giving the laboratory directors flexibility in implementing novel research ideas and nurturing promising young scientists and engineers. This PE supports ILIR at the Army Materiel Command's (AMC) six Research, Development, and Engineering Centers (RDECs) (project 91A); supports ILIR at the six Medical Research and Materiel Command (MRMC) laboratories (project 91C); supports ILIR at the Corps of Engineer's seven Engineer Research, and Development Center (ERDC) laboratories (project 91D); supports research that will develop and validate new techniques in social network analysis as well as training techniques to enhance expertise and adaptability and decrease training time project (91E); and research on high energy lasers and directed energy for air and missile defense (project F16).

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	PE 0601101A In-House Laboratory Independent Research

The work in this PE is performed by the Army Materiel Command (AMC), Ft. Belvoir, VA, Army Medical Research and Materiel Command (MRMC), Ft. Detrick, MD, the Army Corps of Engineers Engineer Research, and Development Center (ERDC), Vicksburg, MS, the Space and Missile Defense Command (SMDC), Huntsville, AL, and the Army Research Institute (ARI), Arlington, VA.

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	21.528	19.832	19.238	
Current BES/President's Budget	19.706	19.766	19.671	
Total Adjustments	-1.822	-.066	.433	
Congressional Program Reductions	.000	-.066		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	.000		
Total Reprogrammings	-1.347	.000		
SBIR/STTR Transfer	-.475	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> F16	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
F16: ILIR-SMDC	.000	.000	.492						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
<p>The objective of this project is to provide funding for In-house Laboratory Independent Research (ILIR) in the Space and Missile Defense Command Technical Center. This basic research on lasers and directed energy lays the foundation for future developmental efforts on high energy lasers and directed energy systems for missile defense by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Army Space and Missile Defense Command (SMDC), Huntsville, AL.</p>										
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
In FY10 will solicit new concepts for basic research efforts with broad applicability to lasers and directed energy for missile defense.						.000	.000	.492		
Total						.000	.000	.492		
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>										
N/A										
<b><u>D. Acquisition Strategy</u></b>										
N/A										
<b><u>E. Performance Metrics</u></b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> 91A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
91A: ILIR-AMC	12.820	14.624	14.871						Continuing	Continuing

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

The project funds basic research within the Army Materiel Command's (AMC) Research, Development, and Engineering Centers and lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge.

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

The work in this program is performed by the Communications and Electronics Research, Development, and Engineering Center (CERDEC), Ft. Monmouth, NJ, the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny, NJ, the Tank and Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA, the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL, and the Edgewood Chemical and Biological Center (ECBC), Aberdeen Proving Grounds, MD within AMC.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Aviation and Missile RDEC Aviation Efforts: In FY08, conducted aerodynamics study on adaptive shape changes (morphing) under airfoil dynamic stall conditions; completed study on high Reynolds number 3D bluff body turbulent boundary layer active separation control with a focus on turbulence measurements; developed and validated adjunct airfoil optimization methods for unsteady flow conditions. In FY09, study advanced airfoil aerodynamics for passive rotor performance improvement, investigate phenomenon and assess computational fluid dynamics modeling using existing data of pitching airfoil double dynamic stall events, investigate the effectiveness of fluidic oscillators to control separation for bluff body flows. In FY10 will conduct dynamic stall testing of advanced active and passive concepts with an emphasis on the fundamental flow physics of unsteady separation of turbulent boundary layers, will develop microscopic particle image velocimetry for identification of flow reversal and separation in unsteady turbulent boundary layers.	1.744	1.769	1.707	
Armaments RDEC: In FY08, conducted basic research into optical properties of black silicon, fatigue suppression in nanotube composites, detonation theory and modeling development for semi-metal energetic material, bolometric infrared detector based on	1.807	1.834	1.636	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research		<b>PROJECT NUMBER</b> 91A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>freestanding single-walled carbon nanotube network, surface enhanced raman spectroscopy of energetic materials on nanostructured substrates, development of shortwave/medium wave/longwave anomaly algorithms for hyperspectral sensors; new nitration methods for high density, high energy materials, sniper detection via multi-mode sensor fusion, and novel synthesis routes of graphene.</p> <p>In FY09, conduct basic research for developing new explosives and smaller warheads for increased lethality and volume reduction, lighter and stronger materials for guns, algorithms for future intelligent munitions using various sensors, and area denial technologies.</p> <p>In FY10, will continue basic research into synthesizing more powerful explosives with IM properties, technologies for detection and neutralization of IEDs/explosives, sensors/sensor fusion for area denial, smaller more lethal warheads and composite materials.</p>				
<p>Tank-automotive RDEC:</p> <p>In FY08, investigated JP-8 ignition and combustion behavior for a high performance military engine; developed new design methodologies for thick section composites using multiple failure theories for improved light-weight material reliability, and developed spectral fractal geometry and linear/non-linear filtering for real time dynamic simulation of Army tactical and combat vehicles.</p> <p>In FY09, record real-time polarization images for robotic vehicle terrain perception and signature countermeasure applications; investigate ultra-wide band (UWB) radar development for localizing mobile robots in battlefield scenarios, and explore fuzzy logic clustering algorithms for robotic vehicle stereovision range perception in difficult urban terrain environments.</p> <p>In FY10, will develop high performance control algorithms for unmanned ground vehicles in a heterogeneous off-road terrain environments; will use fuzzy logic C-mean clustering algorithms for vehicle terrain classification; and will investigate JP-8 heat release combustion chemistry as a function of cetane number and nozzle geometry.</p>	1.288	1.307	1.262	
<p>Natick Soldier Center:</p> <p>In FY08, investigated novel means for controlling nanoscale characteristics through precise morphology control, with potential to impact textiles used in Soldier ensemble, flexible wall shelters, and parachutes.</p> <p>In FY09, utilize morphology control data results to make initial selections of methodology to verify ability to regulate nanoscale characteristics, identify nanomaterials (metal or dielectrics) and develop preliminary design for nanorectenna array for converting visible/near-infrared light to direct current for photonic applications and derive a fundamental</p>	1.420	1.441	1.391	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research		<b>PROJECT NUMBER</b> 91A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
understanding of how immobilization influences the antimicrobial peptide mechanisms of lytic behavior for Soldier protection against pathogens. In FY10 will solicit new concepts for basic research efforts with broad applicability to science and technology that enable advancement of developments such as electro-textiles, multifunctional fibers, advanced nutrient delivery, performance enhancing biomechanics and precision airdrop systems.				
Edgewood Chemical Biological Center: In FY08, solicited new concepts for basic research efforts with broad applicability to point and stand-off detection and identification of chemical vapors and biological aerosols, targeted decontamination, protection, information technology, and obscuration sciences. In FY09, solicit new concepts for basic research efforts with broad applicability to point and stand-off detection and identification of chemical vapors and biological aerosols, targeted decontamination, protection, information technology, and obscuration sciences. In FY10 will solicit new concepts for basic research efforts with broad applicability to science and technology that address chemical and biological vulnerabilities.	1.023	1.036	.925	
Communications-Electronics RDEC: In FY08, investigate fundamental principles needed to enable efficient upgrade of distributed software; investigate a new family of high energy electrochemical materials for advanced batteries; investigate methods of enhancing heat and mass transfer within micro-reactors. In FY09, investigate novel means of creating wideband high-dielectric Electromagnetic Metamaterials using carbon nanotubes for use in designing future generations of antennas; investigate a new family of polymer based electrolyte materials (required to be ionically conductive and both chemically and electro-chemically stable to voltages greater than 5.0 Volts) for advanced lithium high energy electrochemical couples; conduct basic research on the pseudo noise modulation of radar wave forms; develop a novel approach for lower defect IR detector materials by investigating lattice phonons and electrons interactions within a sensor material, such as HgCdTe. In FY10 will investigate new metamaterial to significantly improve antenna signature and power handling capacity and will conduct research in network science to investigate novel neural management tools for optimum network performance; will research separator-electrolyte sub-components for high voltage electrochemical cells; will develop a novel approach for extensions of advanced signal processing from a cooperative regime (known parameters) to a non-cooperative regime.	1.596	1.619	1.443	
Peer reviewed proposal efforts:	1.535	2.894	4.149	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research		<b>PROJECT NUMBER</b> 91A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Proposal efforts will be selected near the start of each fiscal year through competitive applications among the Army laboratories with ILIR funding. Selections are based on an outside independent peer review of the proposals. The intent to provide increased quality and responsiveness in exploring in basic research new technological concepts that are highly relevant to Army needs. This funding will also enhance recruitment, development, and retention of outstanding scientists and engineers engaged in high quality basic research for the Army which will bring a constant flow of new knowledge to our laboratories.</p> <p>In FY08, funded 3 basic research efforts at the Medical Research and Materiel Command and 2 efforts at the Research, Development and Engineering Command.</p> <p>In FY09, solicit new basic research efforts aimed at developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to Army problems.</p> <p>In FY10, will solicit new basic research efforts aimed at developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to Army problems.</p>				
<p>Aviation and Missile RDEC Missile Efforts:</p> <p>In FY08, explored wide bandgap semiconductor photodetectors for advanced ultraviolet seekers. Investigated ultra-wide band chaotic arrays in radar applications. Fabricated transparent metal stacks for applications to negative refraction and sub-wavelength resolution.</p> <p>In FY09, develop THz spectroscopic imager for non-destructive testing and stand-off agent detection. Demonstrate operation of a quantum sensor, for application to sensing electric, magnetic, or microwave fields.</p> <p>In FY10, will solicit new concepts for basic research efforts with broad applicability to science and technology that support exploratory and advanced development for guided missile and rocket systems, directed energy weapons, unmanned vehicles, and related components.</p>	2.407	2.441	2.358	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.283	.000	
<b>Total</b>	<b>12.820</b>	<b>14.624</b>	<b>14.871</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research	<b>PROJECT NUMBER</b> 91A

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> 91C	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
91C: ILIR-MED R&D CMD	3.865	3.604	3.025						Continuing	Continuing

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

The objective of this project is to address investigator-driven medical and force health protection basic research initiatives performed at the six US Army Medical Research and Materiel Command laboratories. Research areas address countermeasures against infectious diseases, defense against environmental extremes and operational hazards to health, mechanisms of combat trauma and innovative treatment and surgical procedures, and medical chemical/biological warfare threats.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; US Army Medical Research Institute of Chemical Defense (USAMRICD), Aberdeen Proving Ground, MD; US Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; US Army Institute of Environmental Medicine (USARIEM), Natick, MA; US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and US Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Independent Research Efforts: In FY08 and FY09, the ILIR program funded/funds innovative in-house basic research proposals that focus on research to explore treatments and countermeasures against militarily relevant infectious diseases; defense against environmental extremes and operational hazards to health; and mechanisms of combat trauma and innovative treatment and surgical procedures. In FY10, the program will fund innovative in-house basic research proposals that will focus on research to explore treatments and countermeasures against militarily relevant infectious diseases; defense against environmental extremes and operational hazards to health; mechanisms of combat trauma and innovative treatment and surgical procedures, and medical chemical/biological warfare threats.	2.893	2.829	2.522	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.097	.000	
Peer reviewed proposal efforts: In FY08, solicited new and continuing basic research efforts focused on fundamental questions in medical science that relate to US Army requirements, including increased emphasis on network science.	.972	.678	.503	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research		<b>PROJECT NUMBER</b> 91C	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, continue to solicit new basic research efforts aimed at developing and maintaining a cadre of active basic research scientists who can initiate new research as well as extend results from worldwide research and apply them to Army problems. In FY10, will continue ongoing awarded innovative basic research activities and continue to solicit new innovative medical and force protection basic research efforts in support of Army needs.				
Total	3.865	3.604	3.025	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> 91D	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
91D: ILIR-CORPS OF ENGR	1.654	1.334	1.121						Continuing	Continuing

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

This project funds In-house Laboratory Independent Research (ILIR) in the areas of geospatial research and engineering, military engineering, and environmental quality/installations at the seven laboratories within the Corps of Engineer's Engineering Research and Development Center.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.024	.000	
Geospatial Research and Engineering/Military Engineering/Environmental Quality and Installations: In FY08, investigated nanoparticle and molecular dynamics for chemical and biological networked sensing and assess infrasound ability to characterize infrastructure. In FY09, conduct research to determine factors influencing partitioning and ecological risk of military unique nanomaterials in the environment. In FY10 will investigate reduction potentials for military compounds through the application of computationally feasible approximations for predicting reduction-oxidation reaction potentials of explosives and their environmental transformation products. Will determine whether mineral surfaces or surface chemical processes can be exploited to promote the adsorption and transformation of nitroaromatic compounds and other explosives munitions on military training, testing and demolition ranges.	1.524	1.145	1.121	
Peer reviewed proposal efforts: Proposal efforts will be selected near the start of each fiscal year through competitive applications among the Army laboratories with ILIR funding. Selections are based on an outside independent peer review of the proposals. The intent to provide increased quality and responsiveness in exploring in basic research new technological concepts that are highly	.130	.165	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research		<b>PROJECT NUMBER</b> 91D	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
relevant to Army needs. This funding will also enhance recruitment, development, and retention of outstanding scientists and engineers engaged in high quality basic research for the Army which will bring a constant flow of new knowledge to our laboratories. In FY08: sought new and continuing basic research efforts focused on fundamental questions in science that relate to U.S. Army requirements such as network science. In FY09, solicit new and continuing basic research efforts in areas such as next generation remote sensing through exploitation technologies for low-oblique image data.				
Total	1.654	1.334	1.121	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> 91E		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
91E: ILIR-ARI	.167	.204	.162						Continuing	Continuing	
<b><u>A. Mission Description and Budget Item Justification</u></b>											
<p>This project provides funding for In-house Laboratory Independent Research (ILIR) in the Army Research Institute. This project supports basic research in the Cognitive and Neural Sciences is focused on theories, approaches, and models from the Behavioral and Social Sciences that have the highest potential to improve human performance. Improved recruiting, selection, assignment, training, leader development, performance, performance assessment, organizational dynamics, and retention are the goals.</p> <p>Work in this project is performed by the Army Research Institute.</p>											
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Army Research Institute:            In FY08, demonstrated that formal and emergent leaders possess more accurate perceptions of informal advice, but not friendship networks than do non-leaders; individuals' perceptions of leadership ability predict advice, but not friendship partners; and friendship, but not advice relationships occur among individuals of congruent leadership ability.            In FY09, identify training strategies that will help Soldiers recognize challenges that require novel solutions and to adapt their behavior to overcome such challenges.            In FY10, will begin longitudinal modeling of career performance using latent curve analysis.</p>								.167	.199	.162	
Small Business Innovative Research/Small Business Technology Transfer Program								.000	.005	.000	
Total								.167	.204	.162	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>											
N/A											
<b><u>D. Acquisition Strategy</u></b>											
N/A											
<b><u>E. Performance Metrics</u></b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601101A In-House Laboratory Independent Research					<b>PROJECT NUMBER</b> 91J	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
91J: IN-HOUSE LAB INDEPENDENT RESEARCH - MEDICAL (CA)	1.200	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for In-House Laboratory Independent Research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Nanotechnologies Initiative - Linear and nonlinear optics in metal-based metamaterials in the sub-wavelength regime: optics at the nano-scale.							.384	.000	.000	
Nanotechnology Initiative - Probing the electron transfer and mechanical properties of metal-filled single walled carbon nanotubes.							.536	.000	.000	
Nanotechnology Initiative - Designing morphology controlled polymer blends by nanoparticle mediated thermodynamic stabilization.							.280	.000	.000	
Total							1.200	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					PE 0601102A DEFENSE RESEARCH SCIENCES					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	164.633	198.103	173.024						Continuing	Continuing
F20: ADV PROPULSION RSCH	2.185	3.321	3.348						Continuing	Continuing
F22: RSCH IN VEH MOBILITY	.532	.556	.567						Continuing	Continuing
H42: MATERIALS & MECHANICS	2.385	6.311	6.040						Continuing	Continuing
H43: RESEARCH IN BALLISTICS	6.018	8.129	8.252						Continuing	Continuing
H44: ADV SENSORS RESEARCH	3.971	6.192	6.377						Continuing	Continuing
H45: AIR MOBILITY	2.237	2.341	2.373						Continuing	Continuing
H47: APPLIED PHYSICS RSCH	2.752	2.876	2.955						Continuing	Continuing
H48: BATTLESPACE INFO & COMM RSC	6.578	8.891	11.434						Continuing	Continuing
H52: EQUIP FOR THE SOLDIER	.936	.978	1.035						Continuing	Continuing
H57: Single Investigator Basic Research	54.802	63.871	64.988						Continuing	Continuing
H66: ADV STRUCTURES RSCH	1.609	1.711	1.818						Continuing	Continuing
H67: ENVIRONMENTAL RESEARCH	.809	.909	.946						Continuing	Continuing
	.407	.424	.000						Continuing	Continuing

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>							<b>DATE: May 2009</b>				
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>						
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					PE 0601102A DEFENSE RESEARCH SCIENCES						
H68: PROC POLLUT ABMT TECH											
S04: MIL POLLUTANT/ HLTH HAZ	.679	.709	.000							Continuing	Continuing
S13: SCI BS/MED RSH INF DIS	10.271	10.896	10.536							Continuing	Continuing
S14: SCI BS/CBT CAS CARE RS	4.410	6.186	6.539							Continuing	Continuing
S15: SCI BS/ARMY OP MED RSH	6.200	9.525	7.120							Continuing	Continuing
S19: T-MED/SOLDIER STATUS	.695	.751	.000							Continuing	Continuing
T14: BASIC RESEARCH INITIATIVES - AMC (CA)	26.609	24.319	.000							Continuing	Continuing
T22: SOIL & ROCK MECH	2.144	2.221	2.311							Continuing	Continuing
T23: BASIC RES MIL CONST	1.612	1.713	1.770							Continuing	Continuing
T24: Signature Physics and Terrain State Basic Research	1.412	1.452	1.521							Continuing	Continuing
T25: Environmental Science Basic Research	5.365	6.116	7.958							Continuing	Continuing
T61: Basic Research Initiatives - MRMC (CA)	3.675	4.386	.000							Continuing	Continuing
T63: ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH	.000	1.495	1.230							Continuing	Continuing

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R-1 Line Item #2

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>							<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					
T64: SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE	.000	.000	1.285						Continuing	Continuing
305: ATR RESEARCH	2.201	2.307	2.378						Continuing	Continuing
31B: INFRARED OPTICS RSCH	2.415	2.552	2.676						Continuing	Continuing
52C: MAPPING & REMOTE SENS	2.597	2.698	2.788						Continuing	Continuing
53A: BATTLEFIELD ENV & SIG	2.818	3.002	3.216						Continuing	Continuing
74A: HUMAN ENGINEERING	2.937	5.028	5.703						Continuing	Continuing
74F: PERS PERF & TRAINING	3.372	6.237	5.860						Continuing	Continuing

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

This program element (PE) fosters fundamental scientific knowledge and contributes to the sustainment of US Army scientific and technological superiority in land warfighting capability and military problems related to long-term national security needs, provides new concepts and technologies for the Army's future force, and provides the means to exploit scientific breakthroughs and avoid technological surprises. The PE fosters innovation in Army niche areas (such as lightweight armor, energetic materials, night vision) and areas where there is no commercial investment due to limited markets (e.g., vaccines for tropical diseases). It also focuses university single investigator research on Army areas of interest, such as high-density compact power and novel sensor phenomenologies. The in-house portion of the program capitalizes on the Army's scientific talent and specialized facilities to transition knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry.

Projects not specifically addressed through R2a exhibits include Research in Vehicle Mobility that focuses on research within the advanced military ground vehicle mobility/propulsion areas (project F22); environmental research that focuses on research on innovative environmentally-friendly technologies for the future with particular emphasis on energetics processing, surface protection for armaments and tactical vehicles, Soldier support systems, non-stockpile chemical warfare site remediation and decontamination of biological warfare agents (project H67); processes and pollution abatement technology focuses on in-situ explosive biodegradation mechanisms and direct analysis and identification of explosives degradation pathways in contaminated soils and mechanisms of neurotoxicological effects in mammals caused by exposure to RDX and MNX (project H68); military pollutant/health hazards focuses on research is to increase knowledge in the area of toxicology effects of military relevant compounds on mammals as well as endangered species (project S04); S19

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES
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- T-Medical/Soldier Status that focuses on fundamental science and technology for improved training methods for battlefield medical personnel that includes measurement of tissue properties to permit more accurate simulation of the human body, and development of predictive algorithms for heart and respiration rate (project S19).

The work in this PE is coordinated and integrated between four primary contributors: 1) the Army Research, Development, and Engineering Command (RDECOM); 2) the US Army Engineer Research and Development Center (ERDC); 3) the Army Medical Research and Materiel Command (MRMC) laboratories; and 4) the Army Research Institute for Behavioral and Social Sciences (ARI). The basic research program is coordinated with the other Services via Defense Basic Research Advisory Group and other inter-Service working groups.

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

Work in this PE is primarily managed by: the US Army Research Laboratory (ARL), Adelphi, MD and RDECOM, Aberdeen, MD; the Medical Research and Materiel Command (MRMC), Ft. Detrick, MD; the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS; and the US Army Research Institute for the Behavioral and Social Sciences (ARI), Arlington, VA.

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	165.020	176.959	169.627	
Current BES/President's Budget	164.633	198.103	173.024	
Total Adjustments	-.387	21.144	3.397	
Congressional Program Reductions	.000	-7.656		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	28.800		
Total Reprogrammings	2.588	.000		
SBIR/STTR Transfer	-2.975	.000		

**Change Summary Explanation**

FY09 increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> F20	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
F20: ADV PROPULSION RSCH	2.185	3.321	3.348						Continuing	Continuing

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

This project funds research to increase the performance of small air-breathing engines and power trains to support improved system mobility, reliability, and survivability, and ultimately serve to reduce the logistics cost burden for the future. Problems addressed include the need for greater fuel efficiency and reduced weight in these propulsion systems. Technical barriers to advanced propulsion systems are the inadequacy of today's materials to safely withstand higher temperature demands, the lack of capability to accurately simulate the flow physics and the mechanical behavior of these systems, including the engine and drive train. The Army is the lead Service in these technology areas (under Project Reliance) and performs basic research in propulsion, as applicable to rotorcraft and tracked and wheeled vehicles. Technical solutions are being pursued through analysis, code generation, and evaluations to improve engine and drive train components and investigate advanced materials. Component level investigations include compressors, combustors, turbines, energy sources and conversion, injectors, pistons, cylinder liners, piston rings, gears, seals, bearings, shafts, and controls.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Reliable Small Engines for Unmanned Systems: Develops improved tools and methods to enhance the reliability and fuel efficiency of small engines for air and ground vehicles and to enable the use of heavy fuels. In FY09, investigate high priority engine technology shortfalls associated with small unmanned aerial systems (UAS) that can also benefit emerging robotic platforms and energy generation platforms with similar power requirements. Conduct research to establish a small engine-class analytical database and tools. In FY10, will utilize validated suite of system simulation tools to identify and improve component and system operation of current and potential Army small engine applications.	.000	.996	1.030	
Thermal Materials: Investigates new materials needed to withstand the higher temperature regimen of advanced high performance engines, and evaluates improved tools and methods that will accurately simulate the flow physics and the	2.185	2.303	2.318	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> F20	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>mechanical behavior of future engines and drive trains which will contribute to the design of more fuel efficient and reliable propulsion systems.</p> <p>In FY08, formulated life prediction models for low conductivity thermal barrier coatings to improve the turbine design process and completed the face gear dynamic load prediction modeling computer code to improve the transmission design process.</p> <p>In FY09, investigate synchronized speed control shifting algorithms that could enable variable speed helicopter transmissions and formulate diagnostic fault detection methods to improve the safety and reliability of helicopter transmissions.</p> <p>In FY10, will investigate optimum fiber architecture needed to fabricate uncooled turbine components for increased fuel efficiency and develop improved sand trajectory modeling methodology to improve the safety, durability, and reliability of turbine engines.</p>					
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.022	.000
Total			2.185	3.321	3.348
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> F22	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
F22: RSCH IN VEH MOBILITY	.532	.556	.567						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
<p>This project conducts research in support of advanced military vehicle technology with emphasis on advanced propulsion, sophisticated vehicle dynamics and simulation, and advanced track and suspension concepts. Advanced propulsion research will dramatically improve power density, performance and thermal efficiency for advanced adiabatic diesel engines, transient heat transfer, high temperature materials and thermodynamics. This project also supports state-of-the-art simulation technologies to achieve a more fundamental understanding of advanced high-output military engines. The subject research is directed at unique, state-of-the-art phenomena in specific areas such as: 1) non-linear ground vehicle control algorithms, using off-road terrain characteristics; and 2) instantaneous diesel engine optimizations, using advanced analytical and experimental procedures. This work is performed at the Tank and Automotive Research, Development and Engineering Center.</p>										
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Program							.000	.009	.000	
<p>Advanced mathematical algorithms for improved vehicle efficiency:            In FY08 explored JP-8 versus DF-2 combustion differences, performed terrain assessment through a novel three dimensional optical technique, investigated physics-based human modeling.            In FY09, further investigate JP-8 versus DF-2 combustion differences, expand physics based human modeling effort for vehicle-human interaction dynamics, and explore improved vehicle-terrain methodologies.            In FY10, will develop engineering models for JP-8 ignition and combustion profiles, will explore reduced chemical kinetics JP-8 ignition models, will further explore vehicle-human interaction dynamics, and will improve vehicle-terrain modeling methods.</p>							.532	.547	.567	
Total							.532	.556	.567	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>										
N/A										
<b><u>D. Acquisition Strategy</u></b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
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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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H42	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H42: MATERIALS & MECHANICS	2.385	6.311	6.040						Continuing	Continuing

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

This project funds the Army's basic research in materials science, which includes research into key phenomena enabling the creation and production of revolutionary materials that will provide higher performance, lighter weight, lower cost, improved reliability, and environmental compatibility for Army unique applications. The current approach of using materials to gain added functionality for Army systems is to use a layered approach, whereby each layer provides added capability (i.e. ballistic, chemical/biological, signature, etc.) but ultimately makes the system too heavy and too expensive. Technical solutions are being pursued through understanding the fundamental aspects of chemistry and microstructure that influence the performance and failure mechanisms of ceramics, advanced polymer composites, and advanced metals, with the goal of creating hierarchically organized materials systems that possess multifunctional attributes at greatly reduced weight and cost. These advanced materials will enable revolutionary lethality and survivability technologies for the future. This research supports materials technology applied research in PE 0602105A, project H84.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Materials research and processing at small scale: In FY09, research concept of materials by design which will conduct material modeling studies to enable bottom-up armor materials design. Research methods relating processing to materials microstructure that feeds ballistic property models with focus of the effort largely on ceramics. In FY10, will perform materials research to relate properties observed at small scale to microstructure; and will perform research relating ballistic model output to processing, properties and microstructure.	.000	1.734	1.816	
High deformation rate materials: In FY09, investigate engineered scalable materials for armor applications using nanoscale building blocks; characterize their properties and feed ballistic modeling efforts to rapidly screen for performance. Create underpinning understanding to enable the engineering of expedient materials.	.000	2.224	1.838	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate the relationships existing between high rate properties and prior processing; and will characterize nanoscale materials using high resolution microscopic analytical methods for feedback to processing and modeling research for protection materials.				
Microscopic/Nanostructural Materials: Devise new materials and design capabilities, based upon fundamental concepts derived at the microscopic and nano-structural levels, for the future force. In FY08, implemented and validated models for fragmentation, reactive materials, and ballistic penetration; enhanced processing and non-destructive evaluation for improved armor ceramics; used directed assembly to embed functionality into polymer materials; and validated multifunctional material performance. In FY09, perform comprehensive materials characterization for damage-tolerant sub-micron SiC ceramic materials, and develop 1st-generation phenomenological constitutive and failure model for SiC-N ceramic materials for armor. In FY10, will research grain boundary engineering of ceramics to improve fracture tolerance at low and high rates; and will characterize materials using a combination of electron microscopy and crystallographic orientation tools to identify optimum microstructures for ballistic protection.	2.385	2.262	2.386	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.091	.000	
<b>Total</b>	<b>2.385</b>	<b>6.311</b>	<b>6.040</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H43: RESEARCH IN BALLISTICS	6.018	8.129	8.252						Continuing	Continuing

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

This project seeks to improve the understanding of the chemistry and physics controlling the propulsion, launch, and flight of gun launched projectiles and missiles, and to understand the interaction of these weapons with armored targets. This research results in basic new knowledge, which allows the formulation of more energetic propellants, more accurate and non-lethal/lethal projectiles and missiles, and advanced armors for increased survivability of Army combat systems. This effort supports the Office of the Secretary of Defense Advanced Energetics Initiative to mature the fundamental technologies required to transition the next generation of energetic materials into field use. This research supports survivability and lethality technology applied research in PE 0602618A, project H80.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Armor research: In FY09, investigate modeling and simulation of ballistic impact events to include modeling materials response with enhanced failure models that capture realistic behavior with minimum parameterization; create fundamental ceramic/glass model and develop mesoscale approaches. For electromagnetic armor technology create physics based models to address coupling ballistic and electrodynamics models for solid mechanics, computational fluid dynamics, and material failure models; and validate model predictions. In FY10, will develop models for armor plate acceleration that do not utilize explosive materials; will obtain laboratory derived mesoscale modeling parameters for ceramic materials to enable modeling of ceramic armor materials at the micro-structural level; and will begin the study of a thermodynamically-consistent equation of state theory.	.000	1.967	2.017	
Launch and flight of gun launched projectiles and missiles: Improve the fundamental understanding of the mechanisms controlling the launch and flight of gun launched projectiles and missiles, and understand the interaction of these weapons with armored targets.	2.544	2.564	2.661	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> H43	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, quantified damage in select ceramics using destructive and non-destructive techniques; devised reactive material ignition model; devised a controlled fragmentation model; and implemented models for urban structural material failure in continuum codes.</p> <p>In FY09, devise 1st-generation physically consistent phenomenological constitutive and failure model for select damage-tolerant ceramics; implement both controlled fragmentation and reactive material ignition models into a continuum mechanics code; and model effects of secondary debris on humans and compare model results with actual human injury data obtained from the medical community.</p> <p>In FY10, will identify the controlling mechanisms through modeling and validation that are responsible for the ballistic effectiveness of ceramic materials; will expand the reactive material ignition model to include a variety of reactive materials with different terminal effects; and will adjust the urban material failure model to account for numerous urban construction materials.</p>				
<p>National Advanced Energetics Initiative: Expand and confirm physics-based models and validation techniques to enable design of novel insensitive propellants/explosives with tailored energy release for revolutionary Future Force survivability and weapons effectiveness.</p> <p>In FY08, simulated energy transfer and conversion within shocked and heated energetic materials formulations; fabricated and characterized reduced sensitivity nano-engineered energetic materials; derived theoretical descriptions and produced hyper-energetic polymeric nitrogen; characterized structural bond energy release materials; and refined models to include hot fragment impact, shear ignition sensitivity, emerging multiphase fluid dynamics, thermo-mechanical coupling, and reactive materials initiation.</p> <p>In FY09, design smart, molecularly engineered energetics; design insensitive, nano-reactive energetic materials/structural energetic composites; differentiate initiation reactions caused by conductive versus shear stimuli; explore turbulent mixing and combustion in late-time energy release; and characterize sensitivity and performance of insensitive warhead explosive fills and validate refined propellant models.</p> <p>In FY10, will provide new theoretical descriptions, quantum mechanical models, and real-time, in-situ validation measurements of energy storage and release mechanisms in non-traditional condensed phase materials such as structural nano-reactives, metastable polymeric, strained crystals, and diamond-like explosives.</p>	2.600	2.580	2.647	
<p>Extramural research in non-lethal (NL) control methods to exploit potentially innovative approaches that offer unique battlefield and homeland defense capabilities.</p>	.874	.883	.927	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, exploited advances in biotechnology to develop more refined modeling and validation techniques to ascertain the effects of blunt trauma and impulse loading at the cellular level. Attempted to coherently combine multiple optical fibers to enhance high intensity laser output at kilowatt levels. In FY09, focus research efforts on bridging gaps that link these governing mechanisms and lay the groundwork for the prediction of overall response, including human functions such as cognitive and physical performance. Attempt to demonstrate man-portable microwave sources operating at 94 GHz for active denial and crowd control, intending to leverage the development of the micro-machined sources. In FY10, will conduct research on high rate response of biological materials, cause of injury, and injury mechanisms for development of novel protection concepts. Will research energy flow processes at interfaces to develop precise control of explosive effects. Will focus on the analysis and understanding of hyper-spectral image data and the development of rigorous mathematical models and hierarchical statistical techniques to characterize ballistic impacts.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.135	.000	
Total	6.018	8.129	8.252	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H44: ADV SENSORS RESEARCH	3.971	6.192	6.377						Continuing	Continuing

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

This project funds basic research to produce future generations of sensors with capabilities beyond those currently being employed. Technical barriers include the fundamental speed and bandwidth limitations of current materials and devices, the efficiency of current algorithms, current computing architectures, organic material lifetimes, the understanding of the fundamental concepts of quantum cryptography, and spatial resolution of current radio frequency (RF) sensors. The technical approach is to exploit large scale electromagnetic (EM) models to predict and explain target and clutter scattering behavior, digital and image processing modules and algorithms, beam propagation and material modeling of nonlinear optical effects, hazardous material detection, remote sensing and intelligent system distributive interactive simulations, unique sensor development, sensor data fusion, and battlefield acoustic signal processing algorithms. Research performed under this project supports survivable sensor systems, organic thin film transistor (OTFT) technology and organic light emitting diode technology for affordable rugged flexible displays, and hazardous material monitoring, both point and remote. Payoffs include low cost compact flexible displays for the Soldier and for the Army, improved radar signal processing techniques that will allow existing systems to improve spatial resolution, improved ultra wideband (UWB) radar technology for detection of explosives including mine detection, through the wall sensing and robotics perception, improved sensor approaches and signal processing techniques for enhanced acoustic/seismic sensing systems in noisy environments, distributed sensor data fusion in ad hoc networks, improved cryptography techniques, and hazardous material and event sensing. This project also funds research in the development of biologically inspired materials for use as sensors as well as for power generation and storage.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.079	.000	
Biologically-inspired sensing and power generation: In FY09, conduct research to advance novel biologically inspired sensor methodologies for biological hazards detection and bio-inspired routes to assembly of electronic structures. Research bio-inspired materials for lightweight, portable energy generation and storage.	.000	1.980	2.031	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate bacteria that remediate energetic materials and produce small organic molecules useful as fuels, bio-inspired structural materials for energy absorption, bioinspired batteries, and biologically directed assembly of electronic structures.				
Improving sensor capabilities: create more survivable/secure systems and displays, and improve hazardous material monitoring. In FY08, developed methods to mitigate sensitivity of imaging radar to multipath-induced false alarms; conducted limited error rate analyses to assess the potential for compromising quantum systems; researched distributed spatial and temporal processing and data fusion algorithms for networks of heterogeneous and possibly mobile sensor nodes; investigated new magnetic sensor technologies for personnel detection; produced final Surface Enhanced Raman Scattering hazardous material sensing assessment report, implemented & filed a patent on a novel class of OTFTs, and developed novel conducting organic materials to improve Organic Light Emitting Diodes (OLED) efficiency. In FY09, research target & clutter scattering to support radar detection of concealed targets; evaluate completed signal processing algorithms for networks of heterogeneous sensor nodes; assess biologically-inspired techniques for advanced photonic structures, and continue to improve high conducting films to integrate with OLED and OTFT development. In FY10, will integrate conductive organic materials and high stability OLED with flexible backplanes and investigate non-linear spectroscopic methods for trace-level detection of hazardous chemicals. Will implement initial distributed sensor data fusion approaches for adhoc networks, will enhance EM scattering models of rooms to include building infrastructure for through-the-wall sensing and perception research, will fabricate and test sample metamaterial antennas.	2.435	2.471	2.618	
Adaptive, active, and intelligent optical systems for high-data-rate military communications and directed energy applications: In FY08, researched potential configurations for small agile adaptive apertures for high-bandwidth optical communications and directed energy applications, and defined conformal adaptive optical components for Gigabit free-space laser communications and directed energy configurations. In FY09, research parameters and define the operational envelope for the use of ultra short (femtosecond) laser illumination for the Army's active imaging and directed energy applications. In FY10, will explore long range atmospheric laser beam propagation paths for military reconnaissance, laser communications, and directed energy applications.	1.536	1.662	1.728	
<b>Total</b>	3.971	6.192	6.377	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H45: AIR MOBILITY	2.237	2.341	2.373						Continuing	Continuing

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

This project supports basic research in aerodynamics for manned and unmanned rotary wing aircraft. The goal of this effort is to develop improved tools and methods to analyze, evaluate, and test rotorcraft unique aerodynamic properties in conventional helicopter and tilt rotor aircraft. The efforts in this project will result in a better understanding of rotorcraft aeromechanics and will result in improved performance, safety and, ultimately, improved combat effectiveness of the manned and unmanned rotorcraft in the future force. This project supports the future force by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing aircraft.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.044	.000	
Rotary Wing Aerodynamics: In FY08, began development of new methods for accurate aeroelastic stability prediction. Explored rotor fuselage interactions for complex configurations using advanced computational fluid dynamics methods. Investigated aeromechanics issues for high altitude rotors. In FY09, develop improved modeling methods for active rotors using national full-scale aerodynamic complex validation data, assess capability of state-of-the-art turbulence models for capturing rotorcraft flow physics such as intersecting and vortical flows, and develop improved dynamic stall models for comprehensive analysis. In FY10, will investigate interacting vortex wakes for tandem rotors, will identify the high speed aeromechanics boundaries of compound helicopter configurations, and will examine the adequacy of one dimensional beams versus three dimension finite elements to model rotor structural components in aeromechanics analyses.	2.237	2.297	2.373	
Total	2.237	2.341	2.373	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H47: APPLIED PHYSICS RSCH	2.752	2.876	2.955						Continuing	Continuing

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

This project performs basic research on electronic materials and structures as well as energetic batteries and fuel cells to enable higher performance and more efficient electronic systems. This includes nanoelectronic devices for low-power and high-frequency applications; sensors, emissive nonlinear and nanophase electrode, and electronic materials; thin heterostructure systems where quantum confinement effects are important; advanced batteries and more efficient fuel cells for hybrid power; and the manipulation of cold atoms on a chip for application to very sensitive sensors and ultra-stable atomic clocks. These investigations will impact the development of power sources and specialty electronic materials for the Army's future force, including improved wide band gap semiconductor performance in electric vehicles and advanced radar systems. Applications of cold atom chips include gyroscopes and accelerometers for inertial navigation units, gravitational sensors for detecting underground facilities, very-low-phase noise precision oscillators for low-velocity Doppler radar, and atomic clocks denied global positioning system (GPS) environments for possible space applications. Technical barriers affecting performance, weight, cost, and power consumption will be addressed.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
This research focuses on nanoelectronic devices and sensors; materials for advanced batteries; fuel cells and reformers for Soldier and vehicle power; electronic materials structures and defects of high-temperature wide-band-gap semiconductors for high-power electronic applications; cold-atom chip devices for advanced sensors and ultra-stable atomic clocks; and integration of nanoenergetics and micro electro mechanical system (MEMS) for fuzing and microrobotic applications. In FY08, investigated carbon nanotube (CNT) and other nanowire-based active electronic devices, explored thermal characteristics of relevant nanostructures, and transported atoms to an atom chip chamber; investigated regenerable sulfur sorbents for JP8 reformation and materials for high power Li-ion batteries. In FY09, investigate system insertion for nanoelectronic devices and sensors and failure mechanisms for wide-bandgap electronic devices; attempt measurements of a cloud of cold atoms on an atom chip; and develop capability for creation	2.752	2.841	2.955	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
of bio-inspired materials for batteries and fuel cells. Formulate electrode/electrolyte systems based on fundamental understanding of their interface. In FY10, will attempt to load and launch cold atoms into an atom waveguide. Will integrate nanoporous energetic silicon with MEMS acceleration switch; will investigate functionalization of nanoelectronic devices for chemical detection and implement functionalization protocols. Will use computer modeling and simulation to guide design of reformer components.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.035	.000	
Total	2.752	2.876	2.955	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H48	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H48: BATTLESPACE INFO & COMM RSC	6.578	8.891	11.434						Continuing	Continuing

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

This project supports basic research to enable intelligent and survivable command and control, communication, computing, and intelligence (C4I) systems for the future force. As the combat force structure becomes smaller and operates in more dispersed formations, information systems must be more robust, intelligent, interoperable, and survivable if the Army is to retain both information and maneuver dominance. This research supports the Army's new Network Science initiative and in the process addresses the areas of information assurance, the related signal processing for wireless battlefield communications, document and speech machine translation, and intelligent systems for C4I. Major barriers to achieving the goals are the inherent vulnerabilities associated with using standardized protocols and commercial technologies while addressing survivability in a unique hostile military environment that includes highly mobile nodes and infrastructure, bandwidth-constrained communications at lower echelons, resource-constrained sensor networks, diverse networks with dynamic topologies, high-level multi-path interference and fading, jamming and multi-access interference, levels of noise in speech signals and document images, new low-density languages, and information warfare threats. The intelligent systems for C4I research will focus on providing the agent technology capabilities that will produce highly relevant tactical events for mounted or dismounted commanders, leaders and soldiers; improve the timeliness, quality and effectiveness of actions; and speed the decision-making process of small teams operating in complex natural or urban terrain.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Design and implement a laboratory scale common information-processing infrastructure, inclusive of service oriented architecture for networking processes that aids in the transformation of data into actionable intelligence to support decision-making under uncertainty. In FY08, investigated the application of information mediation service techniques to produce fused actionable intelligence for military mission planning and execution such that data providers, including robotic sensors, Soldiers, and agency-based data systems, were connected using service oriented architecture networking techniques and information agents. Investigated pose recognition from imagery to determine location in GPS-denied areas.	1.396	1.453	1.522	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, evaluate 3-D scene reconstruction and pose recognition for enhanced situational awareness, along with information mediation improvements to the military operational and tactical decision and planning process. In FY10, will extend scene recognition algorithms to mobile platforms to support biologically inspired collaborative behaviors. Will investigate local and global policy aware information exchange and information exploitation algorithms in collaboration with the Network Science CTA initiative.				
Network Science Technology Experimental Center. Investigate fundamental network behaviors utilizing high performance computing software that enables the design and analysis of mobile ad hoc networks at sufficient levels of fidelity and with sufficient speed to understand network centric warfare (NCW) technologies in the full range of conditions in which they will be employed. Investigate and devise scalable software tools that significantly extend the capabilities to perform simulation, emulation and validation of mobile ad hoc networks. Devise a software environment that will enable the eventual integration and linking of the simulation-emulation-validation cycle. In FY10, will devise advanced computing based tools to accelerate scenario/model development, coupling of different models, verification and validation (V&V), and enhanced multi-disciplinary collaboration through common user interfaces, scalable library routines, pre-processing, scalable optimization routines, and post-processing analysis tools.	.000	.000	1.776	
Perform research to provide communications capability for a fully mobile, fully communicating, and situationally aware force operating in a highly dynamic, wireless, mobile networking environment populated by hundreds to thousands of networked nodes. In FY08, refined scalable algorithms to incorporate technologies in sensor radios. In FY09, perform laboratory analysis to incorporate technologies in mobile radio units. Develop scaling laws for mobile ad hoc and sensor networks under military constraints. In FY10, will perform validation analysis to extract tractable models of network behavior to enhance military network design tools.	1.587	1.651	1.728	
Study the behavior of mobile ad-hoc networks (MANETs) as part of the Army's Network Science initiative. Emphasis is on mobile communications networks research with the Army's University Affiliated Research Center, the Institute for Collaborative Biotechnology at the University of California - Santa Barbara. In FY08, designed formal models, abstractions, and metrics for mobile ad hoc networking and extended them to simulations, and conducted scalability analyses and design models of mobile ad hoc routing protocols and their functional concepts, incorporating biological paradigms where applicable.	.970	.994	1.016	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, conduct component-based performance modeling and analysis of routing protocols and design networking protocols that adapt to varying operating environments in order to optimize performance. In FY10, will develop and compare component based analytical models with executable models to enable the design of robust tactical networks.</p>						
<p>Perform research in protecting information in highly mobile wireless tactical environments with severe bandwidth, energy, and processing constraints and operating without reliance on centralized security services. In FY08, designed and evaluated intrusion detection algorithms on mobile ad hoc networking protocols, including under hostile conditions, using formal methods to represent protocols. In FY09, design and evaluate analytically and via simulation/emulation, robust classes of algorithms that will provide a dynamic architecture that will support detection of attackers under conditions of mobility. In FY10, will refine and evaluate the dynamic security services architecture for mobile tactical networks for assured Soldier communications.</p>			1.605	1.668	1.747	
<p>Establish formal methods for bridging language barriers in tactical environments, incorporating state of the art techniques in machine translation and natural language processing. In FY08, investigated, evaluated, and implemented service oriented architecture (SOA) concepts required to transition language technologies to Deployable Harmony Document Exploitation (DOCEX) System (DHDS) and Distributed Common Ground System-Army (DCGS-A). In FY09, explore multi-engine machine translation architectures for processing and exploiting multi-media, multi-language (e.g. Arabic, Farsi, and Swahili) sources. In FY10, will develop and assess novel metrics for evaluating new multi-engine machine translation architectures.</p>			1.020	1.061	1.112	
<p>Advanced Computing. In FY09, research in advanced computing algorithms and techniques addresses implementation issues for mobile networking, machine based language translation, and information processing infrastructure. Research computer based modeling, simulation and data analysis techniques for the study of scientific phenomena and engineering designs. In FY10, will investigate algorithms, approaches, and methodologies for battle command applications that exploit emerging mobile hybrid computing architectures. Battle command applications will include large-scale battlefield network modeling; real-time algorithms to assist network emulations; comprehensive data representation, models and analysis techniques; information fusion of different data types; engineering design based approaches.</p>			.000	1.987	2.533	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.077	.000	
Total	6.578	8.891	11.434	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H52	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H52: EQUIP FOR THE SOLDIER	.936	.978	1.035						Continuing	Continuing

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

This project supports basic research to achieve technologies for the Soldier of the future which focus on core technology areas that include mathematical modeling, physical and cognitive performance, polymer science/textile technology, nanotechnology, biotechnology, and combat ration research. Effort is targeted on enhancing the mission performance, survivability, and sustainability of the Soldier by advancing the state-of-the-art in the sciences underlying human performance, clothing, and protective equipment to defend against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and ration shortfalls.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Equipment for the Soldier: In FY08, investigated novel markers useful in high sensitivity pathogen detection for ration safety; examined utility function theory to understand behavioral principles and provided a framework for analyzing and predicting long-term acceptance and use of future Soldier system mission gear. In FY09, screen multiple isolates for advancement to biofilm formation for rapid screening of foods for pathogenic bacteria; and address selected behavioral principles most likely to impact long term acceptance and use results. In FY10, will use novel computational methodologies to understand techniques necessary to simulate dynamics/interactions of fluid structure systems undergoing topology change as would be found in parachutes, parafoils and flexible structures.	.936	.978	1.035	
Total	.936	.978	1.035	

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

N/A

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H57	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H57: Single Investigator Basic Research	54.802	63.871	64.988						Continuing	Continuing

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

This extramural research project discovers and exploits new scientific opportunities and technology breakthroughs, primarily at universities, to improve the Army's Transformational Capabilities. Current technologies are unable to meet the operational requirements of the future force. The Army Research Office of the Army Research Laboratory (ARL) maintains a strong peer-reviewed scientific research program through which leap-ahead technological solutions may be discovered, matured, and transitioned to overcome the technological barriers associated with next generation capabilities. Included are research efforts for increasing knowledge and understanding in fields related to long-term future force needs in the physical sciences (physics, chemistry and biology), the engineering sciences (mechanical sciences, electronics, materials science and environmental science (atmospheric and terrestrial sciences)), and mathematical and information sciences (mathematics, computer, and information sciences) and network science. Targeted research programs in nanotechnology, smart structures, multifunctional and microminiature sensors, intelligent systems, countermeasure, compact power, and other mission-driven areas will lead to a Future Force that is more strategically deployable, more agile, more lethal, and more survivable. The breadth of this basic research program covers approximately 900 active, ongoing research grants and contracts with leading academic researchers and approximately 1,600 graduate students yearly, supporting research at nearly 250 institutions in 50 states.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Basic research in mathematical and computer sciences is the backbone for performing complex, multi-system analysis, modeling and understanding simulation, and information systems. Advancements in mathematical and computer sciences have a direct impact on enhancing the warfighters' decision-making, situation awareness, command and control, as well as on the overall performance of weapon, intelligence, transportation and logistics systems. In FY08, continued efforts focused on devised intelligent processing systems to improve fusion of hard (sensor)/soft (human) information, and also devised new architectures to exploit the network centric nature of the fusion problem. The advancements made in hard/soft fusion results in better operational situational awareness, more informed decision making, and more effective mission planning, training and simulation.	9.944	11.982	12.477	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, devise tools for design of heterogeneous swarms for desired emergent behavior, which leads to better system design or control design for military systems such as UAVs, UGAs, or robotics.</p> <p>In FY10, will demonstrate the effectiveness of the devised products and tools on swarming and sensor fusion in laboratory test-beds. These results will lead to computer techniques designed to identify attacks against information systems, protecting information systems from attacks, and on devising techniques for inherently hardened software. New understanding and knowledge gained will directly contribute to the development of robust and resilient information systems that address the processing and delivery of authentic, secure, reliable, and timely information to the warfighters, regardless of threat conditions.</p>				
<p>Basic research in environmental science possesses three areas: (i) atmospheric science research to measure, model, and theoretically understand the nighttime atmospheric boundary layer; (ii) terrestrial science research to enable the Army to operate effectively in all military operating environments by understanding fundamental terrain and land-based phenomena; and (iii) military habitation science, basic research to allow military power projection that meets operational needs in a sustainable manner.</p> <p>In FY08, environmental science focused on the development of analysis techniques in scale, resolution, and formats for boundary layer wind fields; investigations of energy and mass transfer processes between the atmosphere, the land surface and sub-surface; and improving landmine/unexploded ordinance (UXO) sensing.</p> <p>In FY09, investigate environmental effects on geophysical techniques used remotely to sense both the surface and shallow subsurface and understanding relationships between surface and subsurface characteristics of the soil system, with a focus on soil moisture through a multi-agency R&amp;D initiative. Military habitation science focuses on basic research to support resource reuse and transformation, energy recovery, and energy conversion at base camps.</p> <p>In FY10, will address Army-unique atmospheric operational needs and will investigate automated terrain navigation by autonomous vehicles and will use geographic information systems (GIS)-based approaches for cognitive understanding and utilization of geospatial information, analysis, representation, and modeling of multiple types of geospatial data.</p>	1.985	1.887	2.131	
<p>Basic research in molecular, physiological, and systems biology to improve Soldier performance, to protect Soldiers, and to create new Army materiel and capabilities.</p> <p>In FY08, focused on lower cost technologies for bioremediation, on new biomaterials and technologies for better Soldier protection, and on novel biotechnologies for improved Soldier performance and reduced Soldier casualties.</p> <p>In FY09, the focus is on exploiting the multidisciplinary interface of bionanoengineering to engineer bioinspired nanodevices with novel capabilities, to use biomimetics to create new protective materials, and to understand and engineer</p>	3.970	5.753	5.829	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>countermeasures to the molecular and physiological factors that impair Soldier cognitive and physical performance. Undertake a systems biology approach to bioremediation focused on the few microbial species capable of degrading toxic halogenated pollutants, investigate modulating the effects of oxidative stress on Soldier health and performance, investigate the biophysics and modeling of spore germination and inactivation for effective biowarfare countermeasures, and explore other species sense and computing capabilities for novel algorithms usable in automated and remote military systems. Study the use of synthetic materials and molecular circuits capable of promoting tissue regeneration, develop tools in synthetic biology to construct genetic programmable circuits that can serve as the basis for chemical and biological sensing, use noninvasive human state sensors, correlate physiological signals with behavioral functions and human performance, and model and engineer relevant microbial species for the optimal synthesis of energy for military specific needs.</p> <p>In FY10, this basic research will be continued with a concurrent transition towards field use.</p>				
<p>Basic research in electronics and photonics for situational awareness, communications, information processing, electro-magnetic warfare, and power efficiency.</p> <p>In FY08, completed model for insights into high power quantum dot lasers for IR countermeasures. Demonstrated increased power at terahertz frequencies for chem/bio (CB) detection and imaging radar applications. Determined frequency limitations of polymer nano-composites, black silicon, and carbon nanotube infrared detectors. Determined required excitations to induce changes in specific biomolecules for advanced nano-architectures.</p> <p>In FY09, devise small tactical antennas operating across high frequency bands; determine feasibility of quartz oscillator infrared detectors; create methods to control magnetization dynamics in nanostructures for high speed electronics; improve mid-IR lasers based on antimonide type-I quantum well lasers in 2-3 micron range; and determine the optical/magnetic properties of doped GaN semiconductors for magnetic semiconductor applications.</p> <p>In FY10, will generate small avalanche photodiode arrays of the (Ga,In)(As,Sb) family providing low noise/high gain for night vision applications in mid infrared spectral region; will show feasibility of electrically-injected room temperature continuous-wave mid-infrared semiconductor lasers based on group IV-VI lead salt materials for optical communications; demonstrate optical subwavelength sensing on biomolecules for CB analysis; and show proof of concept for a single-chip 2.4GHz transceiver on silicon with integrated antenna for improved radio communications.</p>	11.913	12.465	12.981	
<p>Basic research in physics for precision guidance, superior optics, signature management properties, ultra-sensitive sensors, quantum computing, and secure communications.</p>	7.943	9.123	9.501	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, extended negative-index materials at visible frequencies; advanced flat lens and sub-wavelength imaging concepts; developed instrumentation for optical lattice emulation of advanced materials; devised tunable microwave (10 - 100 GHz) devices for communications and imaging RADAR; started a thrust in biological assembly of quantum electronics; and fabricated superconducting and ion trap systems to advance quantum information technology.</p> <p>In FY09, will devise flat lenses and sub-wavelength imaging for ultralight optical components and detection of pathogens; will explore physics of attosecond light pulses for remote spectroscopy, armor fatigue analysis and "seeing through the wall"; will conduct optical lattice simulation of magnetism and high temperature superconductivity; will study artificially layered oxides for remote passive sensors and ultra-low power electronics; will devise multi-modal plasmon enhanced environmental sensors, elucidate decoherence in quantum computation platforms and extend ion trap qubit fidelity to solve "unsolvable" problems.</p> <p>In FY10, will demonstrate ultra-light negative-index optical components; will simulate intractable condensed matter theories with optical lattices; will devise ultra cold chemistry concepts heralding novel chemical synthesis routes; will engineer artificial oxides to stimulate a second electronics revolution; and will explore cross-platform qubit entanglement.</p>				
<p>Basic research in mechanical and material sciences for survivable armor, more lethal anti-armor, improved mobility, and flexible displays for Soldier systems.</p> <p>In FY08, obtained full flow field diagnostics around an oscillating rotor blade under realistic helicopter flow conditions; performed precise experiments and detailed simulations to understand the dynamic response and failure of multilayered micro-electro-mechanical systems (MEMS) at both the material and structural levels; discovered new high-pressure states of metallic glass for advanced armor and anti-armor materials systems; and synthesized and demonstrated functional transmembrane proteins in robust nano-structured thin films for Soldier protection applications.</p> <p>In FY09, validate chemical kinetic mechanisms for alternative hydrocarbon-based fuels at high temperature and pressure in diesel and turbine engine applications. Research new materials for armor and Soldier protection, and improve techniques to predict material failures.</p> <p>In FY10, will investigate topological optimization strategies to devise tools to optimize structures based on damage tolerance. Will validate new vorticity-based computational methods for rotorcraft flows capable of convecting the wake without the deleterious effects of numerical diffusion for improved model accuracy. Will research implementation of reduced hydrocarbon combustion kinetics codes into engine models for future fuel flexible engines and devise physical understanding of hypergolic ignition to enable gel-propellant rocket propulsion.</p>	11.691	12.191	12.696	
	1.399	2.105	2.193	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Basic research to gain an understanding of the fundamental aspects of how networks develop, function, and adapt to the environmental and the rate of information flow in manmade and naturally occurring networks. This understanding will have a direct impact on net-centric force operations, such as better communication system design and operations, or more efficient logistics or communications support.</p> <p>In FY08, performed basic research to identify the common elements of various kinds of networks to create a base understanding for a science of networks. The work was aimed at devising theoretical models that can explain and predict network behavior; research developed experimental/theoretical/computational models that investigate the layered structure of social networks of importance to the Army.</p> <p>In FY09, examine mechanisms by which different layers interact with one another. In particular, a universal representation of information (information theory, metrics, topology, etc.) within physical, biological, and social networks is constructed to enable network interfacing and control across multiple scaled networks. Moreover, the barriers to network control across multiple scales is addressed in this general information context. The goal is to gain a deep understanding of network systems that provides a basis for their properties.</p> <p>In FY10, will define and conduct 1st order laboratory experiments and simulation to refine our representations.</p>				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	1.471	.000	
<p>Basic research in chemical sciences for advanced energy control, protective materials, and threat detection. Advanced energy control will provide light-weight, reliable, compact power sources for the soldier and more effective, lower vulnerability propellants and explosives for tailored precision strikes with minimum collateral damage. Protective materials will shield soldiers and their platforms from ballistic, chemical, and biological threats; and reduce signatures for identification by the enemy while providing clear identification by friendly forces. Threat detection will provide advance warning of explosive, chemical, and biological weapons and dangerous industrial chemicals.</p> <p>In FY08, research focused on fuel reformers, molecular control for chem/bio/explosive detection, and new initiatives on chemical information theory for armor materials.</p> <p>In FY09, research focuses on nano-particle material repair, optical limiting, fuel cell catalysts and membranes, structure/function for protective membrane transport, and reactive surfaces for decontamination.</p> <p>In FY10, research will focus on functionalized morphology, novel reactive monomers, environmentally stable self-assembled materials, and reactions in extreme media.</p>	5.957	6.894	7.180	
<b>Total</b>	54.802	63.871	64.988	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H66: ADV STRUCTURES RSCH	1.609	1.711	1.818						Continuing	Continuing

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

This project funds basic research for improved tools and methods to enable the structural health monitoring capabilities and condition-based maintenance for rotorcraft and ground vehicles. This research also enables the design and use of composite structures that can better address the cost, weight, performance, and dynamic interaction requirements of future platforms identified by the Army Modernization Strategy. Ultimately, these technologies result in safer, more affordable vehicles with a greatly reduced logistics footprint. This project is a joint Army/NASA effort that includes structures technology research into: structural integrity analyses; failure criteria; inspection methods which address fundamental technology deficiencies in both metallic and composite Army rotorcraft structures; use of composite materials in the design and control of structures through structural tailoring techniques; rotorcraft aeroelastic modeling and simulation; helicopter vibration (rotating and fixed systems); and the design and analyses of composite structures with crashworthiness as a goal. The problems in structures are inaccurate structural analysis and validation methods to predict durability and damage tolerance of composite and metallic rotorcraft structures and inadequate structural dynamics modeling methods for both the rotating and fixed system components to address reliability issues for future aircraft. The technical barriers include a lack of understanding of failure mechanisms, damage progression, residual strength, high-cycle fatigue, the transfer of aerodynamic loads on the rotor to the fixed system, and impact of these unknown loads on aircraft components. Technical solutions are focused on: advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, long-term investigation of integrated stress-strength-inspection, advanced methods for rotor system vehicle vibratory loads prediction, improved methods to predict vehicle stability, and improved analyses to address Army Aviation requirements. These advancements will extend service life, reduce maintenance costs, enhance durability, and reduce the logistics footprint of existing and future Army vehicles. As agreed under Project Reliance, this is the only project for rotorcraft and ground vehicle structures basic research within DoD.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Structural Analysis and Vibration Methods: This research devises new structural analysis and validation methods to more accurately predict durability and damage tolerance of composite and metallic rotorcraft structures, and evaluates structural dynamics modeling methods to address critical reliability issues in the rotating and fixed system components of future aircraft.	1.609	1.711	1.818	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> H66	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, researched lightweight damage tolerant structures for future large airframes, analyzed computational fluid dynamic methods to support unsteady low Reynolds number aerodynamic models for flapping wing microsystems. In FY09, evaluate multibody-compatible thin-walled elastic finite element methods to enable aeroelastic predictions for small-scale air vehicle systems. In FY10, will complete characterization testing for materials used in finite element models for delamination fatigue life prediction, and will validate life prediction tools for dynamic rotorcraft sub-components.				
Total	1.609	1.711	1.818	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H67	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H67: ENVIRONMENTAL RESEARCH	.809	.909	.946						Continuing	Continuing

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

The objective of this project is to focus basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army production base and weapon systems as well as non-stockpile chemical warfare (CW) site remediation. The pollution prevention work invests in next generation manufacturing, maintenance, and disposal methods that will result in significantly reducing the usage of hazardous and toxic substances and their associated costs. The goal is to decrease the overall life-cycle costs of Army systems by 15-30% through the application of advanced pollution prevention technologies. The CW remediation efforts concentrate on the application of biotechnology in the characterization and physical clean up of agent contaminated soils and groundwater and reduced corrosive and more environmentally benign decontamination of biological warfare (BW) agents on field equipment and weapon systems. The goal is to reduce the cost of remediating a site by at least 50% versus the use of conventional methods. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. Pollution prevention thrusts include: environmentally acceptable, advanced, non-toxic processes to manufacture lightweight alternative structural materials to enhance weapon system survivability; clean synthesis of more powerful and improved energetic compounds to eliminate the use of hazardous materials and minimize the generation of wastes; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces.

This project is linked to the Army Environmental Requirements Technology Assessment (AERTA) requirements. The program element contains no duplication with any effort within the Military Departments.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the defense Technology Area Plan (DTAP).

Work is under the direction of the U.S. Army Armament, Research, Development and Engineering Center.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Industrial pollution prevention: In FY08, modeled processing of smart blended polymer nanocomposite and oxygen scavenger formulations; investigated green methodologies for manufacturing reduced sensitivity RDX (RS-RDX); studied ion-assisted biased deposition of adherent pollution-free gun bore coatings, (4) solvent-less process for crystallization of energetic materials; (5) environmentally safe fire-retardant polymers from enzymes and (6) environmentally friendly repair resins.	.809	.906	.946	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES			<b>PROJECT NUMBER</b> H67	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, develop environmentally benign approaches to nitration reaction in microreactors (ARDEC), conduct modeling, processing, and characterization of highly layered polymer films (NSRDEC), investigate new physical vapor deposition technologies for new ordnance coatings (Benet Labs), develop polysiloxane nanocomposites for environmental and human safe flame-retardant materials (NSRDEC), conduct research on anaerobic hydrogen production from a variant of clostridium phytofermentans (ECBC), investigate bio-based gel coats with zero hazardous air pollutant contents for composites applications (ARL), and research ammonium perchlorate replacements (AMRDEC).</p> <p>In FY10, will continue efforts in FY09 that were selected by the Peer Panel during the Gate Reviews in September 2009 and conduct research on additional new yet undetermined projects.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.003	.000	
Total			.809	.909	.946	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> H68	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H68: PROC POLLUT ABMT TECH	.407	.424	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project provides fundamental understanding of the physical, chemical and biological properties and mechanisms that control the degradation and treatment of hazardous wastes on military installations. This research is used to obtain basic technical information necessary for the design of treatment systems for both cleanups of existing hazardous waste sites and control of future hazardous waste generation. Wastes of concern include explosives, propellants, chemical agents and smokes. This project supports applied research efforts in Program Element (PE) 0602720A, Projects AF25 and DO48.</p> <p>Work in this project is performed by the Army Corps of Engineers Engineer Research and Development Center.</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Degradation and treatment of hazardous waste:                      In FY08 determined which reduction-oxidation (redox) reaction potentials were favorable for cyclotrimethylenetrinitramine (RDX) degradation under environmentally relevant anaerobic conditions. Initiated studies to determine use of bacterial models to fill gaps in basic understanding of how explosives react with biological molecules in biological cells.                      In FY09, conduct redox system experiments to determine RDX degradation enzymatic processes. Initiate mineralization rates and mass balance studies. Complete explosive exposures and cellular assays, and initiate proteomic and genomic analyses.</p>							.407	.419	.000	
Small Business Innovative Research/Small Business Technology Transfer Program							.000	.005	.000	
Total							.407	.424	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES	<b>PROJECT NUMBER</b> H68

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> S04	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S04: MIL POLLUTANT/HLTH HAZ	.679	.709	.000						Continuing	Continuing

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

This project provides basic research in innovative, less costly, and less time consuming toxicity assessment methods for determining potential human health and environmental effects of military-unique hazardous wastes and chemicals, including explosives, propellants, and smokes. These new testing techniques will help to prioritize hazardous waste and waste treatment technologies and screen new Army chemicals for potential toxic effects. The work is conducted at U.S. Army Center for Environmental Health Research (CEHR) and U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM). Work in this project is performed by the Army Corps of Engineers Engineer Research and Development Center.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Program	.000	.008	.000	
Human health and environmental effects research: In FY08, initiated research involving neurotoxicants and neurotransmission within specific soil organism to gain fundamental knowledge of network of interactions for future predictive risk models. Continued investigations of adsorption and retention of explosives onto sediments with both weathered surfaces and fresh mineral surfaces created by fracturing. Completed detailed soil sample surface characterization to determine distribution of materials in the range soils. In FY09, complete measurements of the fundamental aspects of control-fractured versus un-fractured mineral surface affects on the fate and transport of explosives. Continue the study of neurotoxicants on neurotransmitter pathway related gene expression in a gene regulatory network. Utilize systems biology, toxicogenomics, computational modeling and bioinformatics in the approach.	.679	.701	.000	
Total	.679	.709	.000	

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

N/A

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> S13	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S13: SCI BS/MED RSH INF DIS	10.271	10.896	10.536						Continuing	Continuing

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

This project supports basic research that provides for healthy, medically protected Soldiers. This project funds basic research leading to medical countermeasures for naturally occurring diseases impacting military operations. Basic research provides understanding of the mechanisms that make organisms infectious and the effective human body response which prevents disease. Understanding the biological characteristics of infectious organisms also enables the development of point-of-care and laboratory-based diagnostic tools. Understanding of disease transmission by insects and other organisms helps in developing new interventions to prevent disease. Infectious disease threats from malaria, diarrhea, and dengue (a severe debilitating disease transmitted by mosquitoes), which are common in Africa, Central, European, Southern, and/or Pacific Commands, are the highest priorities for basic research.

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

- (1) Prevention/Treatment of Parasitic (symbiotic relationship between two organisms) Diseases: Conduct basic research to better understand the biology of malaria and Leishmania (a skin-based disease transmitted by sand flies) parasites, and to gain the necessary foundation for discovering medical countermeasures to protect military personnel from infection. Malaria, which can cause fatal and chronic disease, is the most significant military infectious disease threat. Since the malaria parasite becomes resistant to drugs over time, it is necessary to continually search for parasite weaknesses that can be exploited with new, effective, user-friendly drugs and vaccines. A highly effective vaccine could reduce/eliminate the use of anti-malarial drugs and the development of drug resistance to current/future drugs.
- (2) Bacterial Threats: Conduct research to better understand the biology of bacterial organisms and their effects on humans and how to prevent wound infections, diarrhea and scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics).
- (3) Viral Threats: Conduct research to better understand highly lethal or incapacitating viruses, including those that cause hemorrhagic diseases (leakage of blood from vessels), such as dengue hemorrhagic fever and hantaviruses (Korean hemorrhagic fever). Basic research includes understanding risk of disease prevalence to the Warfighter, viral biology (including structure, function, lifecycle, and interactions with the environment), the disease process, and interaction with the human body.
- (4) Diagnostics and Disease Transmission Control: Conduct research to investigate the biology of biting insects (including Leishmania-infected sand flies and mosquitoes) and other organisms that transmit disease (called disease vectors) and their control. Expand medical diagnostic and disease surveillance capabilities in the field. This research will help to direct new interventions into preventing disease transmission.

Work is managed by the US Army Medical Research and Materiel Command. The Army is responsible for programming and funding all DoD naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> S13	
<p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories.</p>				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p><b>Diagnostics and Disease Transmission Control:</b>                      In FY08, conducted basic research to investigate the biology of insect vectors, including vector identification and assembly of insect identification aids for use by Preventive Medicine Units (PMUs) focusing on US Southern Command and Pacific Command regions. Studied biology of insects to better understand ways to control them through novel repellents or insect attractants and insecticides.                      In FY09, explore the biology of disease carrying insects and methods of control to expand medical diagnostic and disease surveillance capabilities with a focus on providing new approaches. Complete preparation of the PMU identification guides for SOUTHCOM and PACOM.                      In FY10, will conduct studies on the diversity, description and classification of medically-important insects, including mosquitoes, ticks and spiders as the scientific foundation for a web-based guide to identification. Will explore new designs for devices to collect insects, and will assess medical threats from disease-carrying insects in deployed areas.</p>	2.462	1.823	1.651	
<p><b>Viral Threats Research:</b>                      In FY08, performed long-term studies to understand how naturally induced changes in the dengue virus impact the virus's ability to cause disease.                      In FY09, conduct basic research to understand hemorrhagic viral diseases and other lethal viruses of military importance. Assess emerging viral threats for their potential to impact military operations and to determine whether any identified new threat requires further study.                      In FY10, will conduct basic research to better understand the biological basis of disease and protection in humans from naturally occurring viruses of military importance. Will develop a better understanding of which parts of the immune system are needed to provide a protective response in humans.</p>	1.109	1.794	1.653	
<p><b>Bacterial Threats:</b>                      In FY08, conducted basic research to expand discoveries and studies of those bacterial components that are integral in the disease process and assessed them as potential vaccine or other countermeasure candidates. Assessed proteins from the scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics) organism to better define their role in causing disease and use as potential vaccine targets.</p>	1.000	.930	1.474	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, identify proteins and other components produced by diarrheal organisms for their role in disease and possible use as a vaccine component. Study bacterial disease factors affecting the health and illness in selected overseas populations at potential candidate vaccine test sites. In FY10, will assess and improve selected proteins and other components identified from diarrheal causing bacteria as potential components of candidate vaccines. Conduct exploratory studies to evaluate methods to prevent wound infection from combat injuries.				
Small Business Innovative Research/Small Business Technology Transfer Program	.000	.149	.000	
Prevention/Treatment of Parasitic (symbiotic relationship between two organisms) Diseases: In FY08, used molecular technology and computer modeling to discover new approaches to address malaria, screened thousands of drugs for antimalarial activity and assessed potential for development as new antimalarial drugs, and searched for new malaria proteins as drug targets and vaccine candidates. In FY09, apply established medicinal chemistry techniques and computer modeling for Structure-Based Drug Design (SBDD) to discover candidate drugs to prevent or treat malaria infection. Employ bioinformatics to identify genes and proteins to help in the discovery of malaria vaccine components. In FY10, will apply new tools for discovery of promising compounds as potential leads to new classes of anti-malarial drugs and for potential vaccine components.	5.700	6.200	5.758	
Total	10.271	10.896	10.536	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> S14	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S14: SCI BS/CBT CAS CARE RS	4.410	6.186	6.539						Continuing	Continuing

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

This project funds basic research to understand the basic mechanisms of severe trauma to advance treatment and surgical procedures to save lives and improve medical outcomes for the Soldier. Experimental models are developed to support in-depth trauma research studies. It includes studies of predictive indicators and decision aids for life support systems; studies to heal and repair burned tissue, Traumatic Brain Injury (TBI), sight, and face trauma; and transplant technology. Such efforts will minimize lost duty time from and provide military medical capabilities for far-forward medical/surgical care of injuries. Starting in FY10, S19 (T-Medical/Soldier Status) funding is merged into project S14.

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

- (1) Hemorrhage (bleeding) Control, Blood, and Resuscitative Fluids: Conduct studies of genetic pathways and metabolic mechanisms associated with bleeding to understand the relationships between the human immune processes and blood clotting in trauma. In FY10 and FY11, funding shifts to the Damage Control Resuscitation area.
- (2) Damage Control Resuscitation: Conduct studies of genetic pathways and metabolic mechanisms associated with blood clotting to understand the relationships between the human immune processes and bleeding in trauma; this research area starts in FY10.
- (3) Combat Trauma Therapies: Conduct studies of trauma to tissues and organs, and ways to mitigate and/or repair this damage. Research will address cellular repair/growth mechanisms to treat Traumatic Brain Injury (TBI), eye and facial/maxillary (jaw bone) trauma, and burns.
- (4) Combat Casualty Bioinformatics and Simulation: Conduct basic research to develop improved training simulators and approaches for novel patient monitoring solutions using computational biology (interdisciplinary field that applies computer science, applied mathematics, and statistics to address solutions to biology problems). In-house modeling and simulation research ended in FY08 and is now conducted by the Program Executive Office, Simulation, Training, and Instrumentation (PEO-STRI). The bioinformatics area will be funded by the Combat Critical Care Engineering research area in FY11.
- (5) Combat Critical Care Engineering: Conduct basic science studies of vital sign responses to trauma as predictors of medical outcomes and as a basis for developing life saving interventions. This research area starts in FY11.
- (6) Clinical and Rehabilitative Medicine: Conduct basic studies of mechanisms of tissue growth to gain an understanding that will allow us to assist the healing or transplantation process; this research area starts in FY10.

Promising results identified in this project are further matured under PE 0602787A, project 874.

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.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES	<b>PROJECT NUMBER</b> S14		
<p>Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.</p>				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Damage Control Resuscitation: In FY08 and FY09, funding was within the Hemorrhage Control, Blood, and Resuscitation Fluids program area. In FY10, will extend survival studies to determine the biochemical and genetic relationships between blood clotting and inflammation -- factors causing death following severe bleeding.</p>	.000	.000	1.058	
<p>Clinical and Rehabilitative Medicine: Combat casualty care was transferred from project S13. In FY10, will explore different innovative regenerative tissue strategies, including scaffold-like tissue mats containing blood vessels, cell based therapies to augment regenerative tissue, approaches that yield a pool of responding cells that can be cued biologically to specific cell types, and ways to reduce severe scarring that can lead to impaired movement.</p>	.000	.000	3.582	
<p>Combat Trauma Therapies: In FY08, studied the effect of novel neuroprotection therapies on cellular responses to injury, continued to examine delayed cell death mechanisms leading to malfunction of brain electrical impulses using penetrating ballistic-type brain injury (PBBi), and began basic research on tissue reengineering, focusing on cellular-level mechanisms of tissue growth. In FY09, expand PBBi studies to a larger animal model; continue exploring cellular mechanisms of tissue growth through Armed Forces Institute of Regenerative Medicine (AFIRM); and begin basic science exploration of a single dose wound healing therapeutic. In FY10, will realign AFIRM to the Regenerative Medicine program area; will conduct PBBi protein and gene regulation and neuroprotection mechanism studies; will investigate PBBi biomarkers as surrogate markers to show effectiveness of neuroprotection drugs; will refocus dental disease research to repair of maxillofacial bone and soft tissue injury repair; and will begin research in eye trauma to understand the cellular and neuronal mechanisms of eye injuries.</p>	3.604	5.674	1.899	
<p>Combat Casualty Bioinformatics and Simulation: In FY08, refined the diagnosis of severe bleeding; modified and developed new algorithms for real-time qualification of vital-sign data; and developed and started testing hardware/software for real-time collection, qualification, and diagnosis of trauma data.</p>	.584	.000	.000	
<p>Hemorrhage Control, Blood, and Resuscitative Fluids:</p>	.222	.393	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES			<b>PROJECT NUMBER</b> S14	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, investigated genetic determinants associated with differences in survival from hemorrhage (bleeding) in an animal model. In FY09, more definitive procedures will be used to locate the exact gene(s) involved in animals that demonstrated survival to assist in identifying new forms of treatment for severe hemorrhage. In FY10, this work will be funded under the Damage Control Resuscitation area.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.119	.000	
Total			4.410	6.186	6.539	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> S15	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S15: SCI BS/ARMY OP MED RSH	6.200	9.525	7.120						Continuing	Continuing

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

This project funds basic research on physiological and psychological factors limiting Soldier effectiveness and on the characterization of health hazards generated by military systems and resulting as a consequence of military operations. This includes research on the neurobehavioral aspects of post traumatic stress and suicide, and developing concepts for medical countermeasures to prevent or mitigate the effects of muscle and bone injury and to reduce the effects of sleep loss and other stressors on Warfighter performance. The hazards of exposure to directed energy, repetitive use, fatigue, heat, cold, and altitude are also investigated under this project.

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

- (1) Injury Prevention and Reduction: Conduct research on the body's effects from non-ionizing radiation and directed energy and the physiological mechanisms of musculoskeletal injury.
- (2) Physiological Health: Conduct research on the physiological mechanisms of sleep, fatigue, and nutrition on Soldier performance and well-being.
- (3) Environmental Injury Prevention: Conduct research on the physiological mechanisms of exposure to extreme heat, cold, altitude and other environmental stressors.
- (4) Network Sciences: Conduct research on the fundamental processes of interactions at the molecular and cellular level. In FY10, the funding for Network Science Initiative effort transfers to project T64.
- (5) Computational Biology: Conduct research, using tools that combine biology, computer sciences and mathematics, to solve biological problems that would be difficult or impossible to solve solely through testing in traditional laboratory experiments, animal models or human trials. Research in this area starts in FY11.
- (6) Psychological Health and Resilience: Conduct research into the basic mechanisms of psychological resilience (i.e., mental toughness and the ability to overcome traumatic events) and post-concussion related mental and physical challenges. Studies also include determination of suicide risk and protective factors and treatment for Post-Traumatic Stress Disorder (PTSD).

Promising results identified in this project are further matured under PE 0602787A, project 869.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES			<b>PROJECT NUMBER</b> S15	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Network Sciences: In FY08, characterized newly discovered networks by developing new mathematical and computational methods that address identified gaps. Investigated whether protein-protein network models, developed for a particular pathogen (infectious agent or germ), are portable to a different pathogen sharing a common set of proteins. In FY09, develop mathematical models to predict host-pathogen protein-protein interaction networks, and metabolic models to predict phenotypical (the genetically and environmentally determined physical appearance of an organism) responses induced by external stimuli. In FY10, the funding for this effort transfers to project T64.</p>	.495	.990	.000		
<p>Injury Prevention and Reduction: In FY08, conducted bone marrow stem cell research as a potential therapeutic intervention for induced eye injury. In FY09, investigate the process by which inheritable information from a gene, such as the DNA sequence, is made into a functional gene product or a protein, and how cellular interactions with the environment affect the nature of bone-marrow derived stem cell treatment for laser eye injury; and investigate the effects of hormone levels on cell control of muscle and bone tissue to enhance tissue repair. In FY10, will investigate hormone and cell-level adaptations in skeletal muscle in response to military-relevant training and injury to include mechanisms of skeletal muscle repair, regeneration, and adaptation; will explore how bone components are associated with stress fracture risk.; will identify laser eye injury thresholds in an animal model for single and repetitive pulsed laser exposures for small and large exposures as a risk assessment tool.</p>	1.498	2.296	1.304		
<p>Environmental Injury Prevention: In FY08, explored tissue protein analysis as a predictor of performance degradation from exposure to cold. In FY09, initiate a rodent animal model of classic heat stroke and examine the efficacy of a novel treatment intervention to enhance long-term recovery and return to duty. In FY10, will explore rodent models of heat stroke to evaluate and enhance long-term recovery and return to duty; investigate dose response of medication countermeasures for the efficacy of preventing altitude illness versus probability and severity of adverse side-effects.</p>	3.040	3.305	1.269		
<p>Psychological Health and Resilience: In FY10, will investigate a behavioral screening tool to induce and evaluate PTSD-like symptoms in rodents; will investigate potential correlations between anti-depressant medication use and suicidal behaviors; will investigate</p>	.000	.000	2.180		

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
neuropsychological performance tests/batteries as a diagnostic for concussion in Soldiers; will identify factors that predict or correlate severity of post-concussion symptoms.				
Physiological Health: In FY08, examined individual components of the fatigue performance prediction model within a laboratory environment. In FY09, refine the individual components to establish a more robust fatigue performance prediction model. In FY10, will investigate the extent individual resilience generalizes across various types of sleep loss; will explore the relative effects of countermeasures for reversing deficits caused by fatigue; will investigate and model optimal recovery sleep and recycle rate following missions; and will identify healthy weight management strategies to improve Soldier health and retention.	1.167	2.784	2.367	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.150	.000	
Total	6.200	9.525	7.120	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S19: T-MED/SOLDIER STATUS	.695	.751	.000						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
The purpose of this program is to perform research contributing to superior combat casualty care for troops through faster diagnosis and treatment while allowing on-site health care providers to consult with specialists worldwide. This work will focus on advancing the means to determine soldier physiological status and aiding medical diagnosis and treatment. A significant thrust area will work to ascertain the sensors most relevant to determine change in soldier physiological status.										
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Program							.000	.021	.000	
In FY08, initiated algorithm development for early indication of reduction in central blood volume and imminent cardiovascular collapse, and initiated experiments to test a new sensor that tracks pulse pressure changes associated with hemorrhage and physical activity. In FY09, develop algorithms and complete analysis to analyze real-time beat-to-beat electric signals from the body as it approaches shock in controlled human studies. Compare changes in these signals with other changes to determine if these changes in signal provide an early indicator of progression to circulatory shock and therefore represent a simple algorithm for the triage of battlefield casualties. In FY10, this Project will be consolidated with Project S14.							.695	.730	.000	
Total							.695	.751	.000	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>										
N/A										
<b><u>D. Acquisition Strategy</u></b>										
N/A										
<b><u>E. Performance Metrics</u></b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> T14	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T14: BASIC RESEARCH INITIATIVES - AMC (CA)	26.609	24.319	.000						Continuing	Continuing

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

Congressional Interest Item funding provided for Defense Research Sciences.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Perpetually Assailable and Secure Information System (PASIS)	3.866	3.100	.000	
Functionally Integrated Reactive Surfaces Tech (FIRST) Program	2.319	.000	.000	
Technology Commercialization and Management Network	1.545	1.550	.000	
Cyber Threat Analytics	2.319	2.325	.000	
Document Exploitation for Handwriting Recognition	.966	.000	.000	
Flexible Electronics Research Initiative	.966	1.550	.000	
Integrated Nanosensors for NBC Threat Detection	1.545	.000	.000	
UT-Tyler Organic Semiconductor Modeling and Simulation	.966	1.162	.000	
Imaging Research Center for Research of Disorders Due to Military Training and Performance	.869	.000	.000	
Activated Nanostructures for De-icing	1.159	.000	.000	
John H. Hopps, Jr. Defense Research Scholars Program	1.932	.000	.000	
Global Military Operating Environments	1.545	1.938	.000	
Semiconductor-based Nanotechnology Applications	.774	.000	.000	
Secure Open Systems Institute	2.319	.000	.000	
Silicon Carbide Armor Manufacturing Initiative	2.319	.000	.000	
Nanocrystal Source Display	1.200	1.163	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Fuel Logistics Reduction Through Enhanced Engine Performance			.000	1.163	.000
Direct Methanol Fuel Cell Battery Recharger Program (pending transfer to 622705)			.000	2.325	.000
Nanostructured Materials for Photovoltaic Applications			.000	1.550	.000
Center for Advanced Energy Storage Research and Technology			.000	1.550	.000
Sustainable Alternative Energy for DoD			.000	2.325	.000
Urban Patterns and Signatures to Support Counter-Insurgency Operations			.000	1.163	.000
SBIR/STTR			.000	.680	.000
Toxic Particles			.000	.775	.000
Total			26.609	24.319	.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> T22	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T22: SOIL & ROCK MECH	2.144	2.221	2.311						Continuing	Continuing

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

This basic research project correlates the effects of the micro-scale behavior on the macro-scale performance of geological and structural materials to provide a foundation for the creation of future revolutionary materials and to understand the sensor data within a heterogeneous geological system. This research encompasses geologic and structural material behavior, structural systems, and the interaction with dynamic and static loadings. Research includes: underlying physics and chemistry that controls the mechanics and electromagnetic behavior of geological and structural materials, new techniques that provide measurements at the fundamental scale, and fundamental theories for relating micro-scale phenomena to macro-scale performance. This research provides the basis for applied research in PE 0602784A (Military Engineering Technology), project T40 (Mobility/Weapons Effects Technology), that supports the civil engineering technologies for adaptive protection, scalable weapons effects, near surface computational testbed, and austere entry and maneuver for the future force.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.013	.000	
Military Engineering Basic Research: In FY08, produced limited simulation capability for a full, dynamic micro-scale air-water-solid system. Initiated multiple new studies including notable efforts to determine the feasibility of genetic control of specific bacteria to increase biopolymer production for soil stabilization and to determine the feasibility of using natural gamma shadows to detect near surface anomalies. In FY09, produce a simulation capability for a full, dynamic micro-scale air-water-solid system to examine soil moisture in porous media. Develop an initial modeling and experimental capability for the multi-scale structuring of cementitious materials for enhanced impact and penetration resistance applications. In FY10, will develop a model for ultra high strength fiber reinforced concrete (FRC) subjected to highly dynamic loading conditions (e.g., blast, impact, and penetration events). Will gain an understanding of the rate effects in high	2.144	2.208	2.311	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
performance concrete to determine if meso-scale models under development inherently generate the strain rate effects seen in macroscopic concrete response.				
Total	2.144	2.221	2.311	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T23: BASIC RES MIL CONST	1.612	1.713	1.770						Continuing	Continuing

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

This basic research project supports facilities research initiatives. The project is focused on forming an explicit and mathematically robust set of algorithms for geometrical reasoning; assessing the conceptual feasibility of applying nanoparticle technology to real-time sensors, thermal conductivity, and high strength materials; and developing novel and advanced concepts for mitigating the effect of chemical and biological agents in built structures. These efforts provide basic research leading to improved design in a range of facilities to optimize facility mission performance, enhance facility security, reduce design and construction errors and omissions, reduce resource requirements, and reduce the environmental burdens over the facility's life. This project provides leap-ahead technologies to solve military-unique problems in the planning, programming, design, construction, and sustainment of deployed facilities, and energy and utility infrastructure. This project supports exploratory development efforts in PE 0602784A (Military Engineering Technology), projects T41 (Military Facilities Engineering Technology) and project T45 (Energy Technology Applied to Military Facilities).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.025	.000	
Facilities Research: In FY08, developed a robust model-based support for "Sensing Through Walls" (STW), taking into account critical high-level building design logic and constraints. Developed predictive understanding of blast wave interaction with man-made barriers. In FY09, conduct validations to support the development of next generation nanotechnology for facilities, sensor coatings, and constitutive models for micro-particle dispersion. Investigate the phenomena that govern the synthesis and properties of carbon nanotube coatings. Also investigate light-triggered release of biocides from liposome photosensitive polymers to neutralize biological contaminants. Finalize the complex interactions between a forest edge and an acoustic wave, including the dependence on acoustic ground impedance, microclimate, and biomass structure.	1.612	1.688	1.770	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate mechanisms for on-demand release of biocides and free radicals to determine photolytic degradation phenomena. Will develop a fundamental understanding of the use of electrophoresis in producing new composite materials for present and future military applications.				
Total	1.612	1.713	1.770	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T24: Signature Physics and Terrain State Basic Research	1.412	1.452	1.521						Continuing	Continuing

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

This basic research project increases knowledge in the areas of terrain state and signature physics. It provides the knowledge base for understanding and assessing environmental impacts critical to battlespace awareness. Projects include fundamental material characterization, investigation of physical and chemical processes, and examination of energy/mass transfer applicable to predicting state of the terrain, which control the effects of the environment on targets and target background signatures and mobility in support of the materiel development community. The terrain state area of terrestrial sciences investigates weather-driven terrain material changes and sensing/inferring subsurface properties. The signature physics area of terrestrial sciences focuses on understanding the dynamic changes to electromagnetic, acoustic and seismic signatures, and energy propagation in response to changing terrain state and near surface atmosphere.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.000	.000	
Terrain State and Signature Physics: In FY08, investigated how high frequency radio waves propagate over topographically and electrically complex ground (roughness); specifically, the degree to which roughness controls local and extensive radio frequency (RF) coverage and developed theory to predict coverage given surface roughness and electrical variability. In FY09, investigate the variance in disturbed and undisturbed soil physical, thermal, and optical properties to establish physical parameters that govern the signature response and variance in changing environmental conditions, thus optimizing below surface target detection in prevailing environmental conditions. In FY10, will observe, characterize, and model the variation of forward scattering at near to grazing angles for both vertical and horizontal polarization to determine if significant geometric roughness will deteriorate, rather than not affect, the forward scattering of RF energy; will investigate the controlling influences of radio signal energy loss in deserts	1.412	1.452	1.521	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
and thus poor depth penetration into low clay soils through examination of gypsum and carbonates by determining the complex permittivity spectra and attenuation rates at clay through sand size. Will test hypothesis that urban ambient sound and vibration signals can be characterized as a baseline for actionable warnings for future sensor arrays.				
Total	1.412	1.452	1.521	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T25: Environmental Science Basic Research	5.365	6.116	7.958						Continuing	Continuing

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

This basic research project investigates fundamental scientific principles and phenomena necessary to ensure efficient development of the technologies needed to address Army sustainment issues in the restoration, compliance, conservation, and non-industrial pollution prevention areas. These efforts include: investigating and monitoring contaminated sites, including chemical contamination and unexploded ordnance (UXO) detection/discrimination; better characterization of contaminants through improved risk-based assessment; destruction, containment, or neutralization of organics in water, soil, and sediments resulting from military activities; adhering to applicable federal, state, and local environmental laws and regulations; monitoring and controlling noise generation and transport; protecting and enhancing natural and cultural resources; reducing pollution associated with military activities; and the study of ecosystem genomics and proteomics in support of the Army's new Network Science initiative. The project supports applied research under PE 0602720A (Environmental Quality Technology), project 048 (Industrial Operations Pollution Control Technology), project 835 (Military Medical Environmental Criteria), and project 896 (Base Facilities Environmental Quality).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Environmental and Ecological Fate of Explosives, Energetics, and Other Contaminants: In FY08, applied computational chemistry to identify molecular structure reactivity to predict degradation mechanisms and products and define the molecular mechanisms of neurotoxicity for an invertebrate neurobiology model to assess sublethal neurotoxic effects of CL-20 and other munitions constituents (MCs). Investigated detection of biomolecule binding and cleavage events using biomolecules as switches for ultra-sensitive monitoring of MCs. Identified reactions between the DNA sequence and contaminant for applications toward contaminant-unique biosensors. Integrated toxicogenomics data with biological network analysis as a basis to identify mechanisms and interactive toxicity effects of MC mixtures. Improved estimates of waterborne lead absorption, distribution, and subcellular partitioning in prey invertebrates and reptiles.	3.256	2.838	3.849	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> T25	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, define the equilibrium expressions of major tungsten reactions under relevant geochemical conditions and elucidate tungsten toxicity mechanisms related to intracellular phosphorylation reactions. Combine computational and toxicological approaches to assess basis of environmental risk. In FY10, will complete new computational chemistry equations to predict solubility and other physical characteristics of MCs. Will establish biological models of soil invertebrate neurotransmission networks as affected by less-than-lethal doses of RDX. Will construct computational chemistry models of the physiological reaction of bacteria to explosives contaminants. Will investigate the use of engineered proteins as cell-based toxicology sensors of MCs. Will explore the use of endophytes (microorganisms living inside plants) as biosensors of MC contamination.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.136	.000	
Network Science: In FY09, identify and define mechanisms controlling the genetic networks associated with ovarian hormone production. A model ecological system was used to develop numerical-mechanistic descriptions of how learning and environmental heterogeneity contribute to adaptation in hunter prey relationships. Investigate the theories/algorithms of animal learning and communication on the propagation of information affecting the survival of individuals in a hunter prey network in static versus dynamic heterogeneous hunter/prey environments. In FY10, will identify metabolic network control structures that govern the degradation / transformation of RDX. Will determine the relationship of complex biological network architecture to fragility in hormone production.	.000	.976	1.086	
Remediation of Explosives, Energetics, and UXO: In FY08, defined mechanisms of high explosives movement through the unsaturated soil zone to the groundwater to support range management and remediation approaches. Investigated the application of the unique physical, chemical, and biological interactions with the environment of DoD specific nanomaterials to potentially support advanced environmental technologies. In FY09, define and quantify the effect of disturbance on the sorption and transformation properties of explosives in soils. Quantify surface and vadose zone phenomena such as the role of colloidal transport in migration of explosives. In FY10, will complete investigations of degradation of and by nanomaterials.	1.496	1.561	2.302	
Training Land Natural Resources: In FY08, determined potential use of bioassay guided fractionation (BGF) to assess reptilian developmental and reproductive effects, toxicity, and risk of endocrine active compounds for a large number of contaminants. Continued	.613	.605	.721	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigation, and rehabilitation.</p> <p>In FY09, describe the complex interactions between forest edge and an acoustic wave (such as artillery) incorporating relevant descriptive parameters into appropriate computational techniques allowing noise impact visualization. Complete determination of responses and impacts of multigenerational RDX exposure.</p> <p>In FY10, will define the fundamental properties of pollination networks on Army ranges. Will investigate environmentally benign bioadhesion resistant coatings (modification of surface microstructure) as a means to reduce transport of invasive species.</p>						
Total			5.365	6.116	7.958	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> T61	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T61: Basic Research Initiatives - MRMC (CA)	3.675	4.386	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for Medical Basic Research Initiatives.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>										
	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>						
Fighting Drug Resistant Infections	.000	1.938	.000							
Combat Mental Health Initiative	2.708	2.325	.000							
Innovative, Computational Water-Borne Pathogen Research for Chemical/Biological Detection	.967	.000	.000							
SBIR/STTR	.000	.123	.000							
Total	3.675	4.386	.000							
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> T63	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T63: ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH	.000	1.495	1.230						Continuing	Continuing

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

This project funds basic research in technical areas that will expand the autonomous capabilities, utility, and portability of small robotic systems for military applications, with a focus on enhanced intelligence, biomimetic functionality, and robust mobility, to permit these systems to serve as productive tools for dismounted Soldiers. The ability of the Warfighter to command a suite of small unmanned systems (air, ground, and hybrid vehicles) will reduce exposure of the Soldier to harm and will improve the efficiency by which a dismounted unit achieves tactical objectives such as securing a targeted zone. Example missions requiring enhanced autonomy, manipulation, and man-portability include rapid room clearing and interior structure mapping; detection of human presence, chemical/biological/nuclear/radiological/explosive (CBNRE), and booby-traps; surveillance; and subterranean passage detection and exploration. Because of their relatively small size, light weight, and service in dismounted environments, small unmanned systems have unique challenges in perception, autonomous processing, mobility mechanics, propulsive power, and multi-functional packaging that transcend similar challenges associated with large unmanned systems. The Army Research Lab will conduct research in related disciplines, including machine perception, intelligent control, biomimetic robotics, manipulator mechanics, and propulsive power and drives to foster the development of technologies for lightweight, small-volume, environmentally-harsh robotics applications. Machine perception research includes the exploration of lightweight ultra-compact sensor phenomenology and the maturation of basic machine vision algorithms that enable small unmanned systems to more fully understand their local environment. Intelligent control research includes the maturation of autonomous processing capabilities and the advancement of artificial intelligence techniques that lead to reliable autonomous behavior in a large-displacement, highly-dynamic environment and permit unmonitored task performance. Research in biomimetic robotics and manipulator mechanics includes the advancement of mechatronic and biomimetic appendages to enable agile high-speed locomotion, dexterous task-performance, and environmental-manipulation; and the maturing of nonlinear control algorithms to support robust, stable mobility. Propulsion power and drives research includes investigations of engine cycles and alternative hybrid energy conversion techniques to provide compact, lightweight, quiet, low-emission, high-density power sources that support highly-portable unmanned systems capable of performing long-endurance missions.

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

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES			<b>PROJECT NUMBER</b> T63
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Robotics autonomy and human robotic interface research: Several promising high-risk high-payoff areas of basic research will be conducted in-house with a focus on enabling robust autonomous mobility for small robotic systems, including autonomous operations in Global Positioning System (GPS) denied areas, planning, behaviors, intelligent control, and the interface of perception technologies to accomplish Army missions in the area of unmanned systems.</p> <p>In FY09, develop small staring Laser Detection and Ranging (LADAR) and super-resolution LADAR techniques to provide a small lightweight perception capability; study hybrid-electric propulsion systems with appropriate size, weight, and logistics to provide the necessary power for high energy mobility combined with a silent-drive, silent-watch capability; develop autonomous processing techniques and algorithms for navigation, mapping, object recognition, and intelligent decision making to address increasingly complex dismounted scenarios; conduct validations utilizing advanced mechanical and biomimetic components to advance technologies that support high ground speeds, robust maneuvering, and efficient stair and obstacle climbing capabilities.</p> <p>In FY10, will develop dexterous manipulation systems with high density sensors and intelligent control algorithms to support complex task performance such as opening doors and moving objects or impediments. These manipulation systems will be studied statically and in combination with highly mobile robots.</p>		.000	1.453	1.230	
Small Business Innovative Research/Small Business Technology Transfer Programs		.000	.042	.000	
Total		.000	1.495	1.230	
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> T64	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T64: SCI BS/SYSTEM BIOLOGY AND NETWORK SCIENCE	.000	.000	1.285						Continuing	Continuing

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

This project funds research to conduct studies through a modernized systematic approach that uses iterative computer simulation with mathematical modeling and biological information to analyze and refine biological studies. The information gained provides a better understanding of the overall biological system and its molecular network of interactions, which leads to improved early strategic decision-making in development of preventive and treatment solutions to diseases. This approach establishes a model for application of systems biology processes and knowledge of biological networks to discover medical products that prevent and/or treat diseases or medical conditions. This more complex, yet integrated approach to studying biological systems could potentially reduce both the time and expense of medical product development for the Army.

In FY08 and FY09, this research is funded in project S15 and was realigned to this new project in FY10.

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

Work in this project is performed by the US Army Medical Research and Material Command (MRMC), Fort Detrick, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Network Sciences Initiative: In FY08 and FY09, this research was/is funded in project S15. In FY10, will complete development of mathematical models, which predict host-pathogen (infectious agent or germ) networks. These mathematical models will be used to predict environmentally-produced observable responses induced by external stimuli at the molecular (genomic, proteomic, metabolomic) level; and will also establish and test mathematical and computational models that address identified gaps in network biology.	.000	.000	1.285	
Total	.000	.000	1.285	

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

N/A

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
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<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> 305	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
305: ATR RESEARCH	2.201	2.307	2.378						Continuing	Continuing

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

This project provides automatic target recognition (ATR) research to enhance the effectiveness of Army systems while simultaneously reducing the workload on the Soldier. This project focuses on the fundamental underpinnings of aided and unaided target detection and identification techniques for land warfare scenarios including tagging, tracking, and locating (TTL) of non-traditional targets. This research enables Army systems that can act independently of the human operator to detect and track targets including clandestine tracking of non-cooperative targets. Such capabilities are needed for smart munitions, unattended ground sensors, and as replacements for existing systems, such as land mines. Critical technology issues include low depression angle, relatively short range, and highly competing clutter backgrounds. The resulting research will provide fundamental capability to predict, explain, and characterize target and background signature content, and reduce the workload on the analyst. This research is aimed at evaluating the complexity and variability of target and clutter signatures and ultimately utilizing that knowledge to conceptualize and design advanced ATR paradigms to enhance robustness and effectiveness of land warfare systems. ATR research strategies include emerging sensor modalities such as spectral and multi-sensor imaging. This research supports several technology efforts including multi-domain smart sensors, third generation Forward Looking Infrared (FLIR), and advanced multi-function laser radar (LADAR).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
ATR Algorithms: Investigate new algorithms to improve unaided target detection and identification. In FY08, explored advanced methods for aided tracking via fusion of video modalities and detection likelihoods; investigated statistical algorithms for application in hyperspectral imagery; evaluated methods to classify tracked objects in color and FLIR video; and investigated novel nonlinear fusion methods for anomaly detection using hyperspectral and synthetic aperture radar (SAR). In FY09, research novel behavior characterization algorithms for color and FLIR video; research methods to develop ATR algorithms that exploit the fusion of disparate spatial views of a target for unattended ground sensor (UGS) network applications; and design advanced nonlinear band selection methods and implement new hyperspectral algorithms based on the selected bands.	1.213	1.286	1.368	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 305	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will enhance hyperspectral anomaly detections and validate rapid reconstruction of hyperspectral images by using 3D compressed sensing techniques; and develop novel fusion detection and classification algorithms based on kernel learning theory.				
TTL: Conduct basic research to support advances in state-of-the-art clandestine TTL for non-traditional hostile force and non-cooperative targets. Specific technical objectives, products, and deliverables are in accordance with the Hostile Forces TTL Capabilities Development Document and the TTL Science and Technology Roadmap. This effort will directly support ARL's efforts in applied research and the Communications-Electronics Research, Development, and Engineering Center's advanced research in clandestine TTL. In FY08, identified and initiated research into technologies that have potential to achieve the goals of clandestine TTL including Radio Frequency (RF) tags, Infrared (IR) tags, and hyperspectral imaging. In FY09, begin to prove technologies selected for further exploration. This includes both device and algorithm development. Transition technologies that are of sufficient technology readiness to applied research. In FY10, will develop an advanced RF Integrated Circuit for an RF Tag and a 2nd generation IR Tag.	.988	.986	1.010	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.035	.000	
Total	2.201	2.307	2.378	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
31B: INFRARED OPTICS RSCH	2.415	2.552	2.676						Continuing	Continuing

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

This project supports Army research in materials and devices for active and passive infrared (IR) imaging systems and radio frequency (RF) photonics. This research aims to generate new technologies for unprecedented battlefield situational awareness and to continue the dominance of Army units during night operations. To achieve these objectives, IR focal plane arrays (FPAs), and interband cascade lasers (ICLs) with significantly improved performance, lower cost, and increased operating temperatures are required. This research has direct application to Army ground vehicles, aviation platforms, weapon systems, and the individual Soldier. Research is focused on material growth, detector and laser design, and processing for large area multicolor IR FPAs and interband cascade lasers. The principal efforts are directed towards novel materials for detectors and lasers, and investigating energy band-gap structures in semi-conductor materials to enhance the performance of lasers and IR FPAs. In the Area of RF Photonics near-IR modeling and nanofabrication techniques are applied to the design and fabrication of IR photonic-crystal waveguide structures having customized IR properties. Micro Electro Mechanical System (MEMS) configurations are incorporated into the photonic-crystal waveguide structures to enable reconfigurable IR waveguide properties. Customized IR photonic materials and components in conjunction with fiber optic interconnects are applied to the control of microwaves. The technical goals are to manage and control defects in the raw, unprocessed materials, maintaining quality control in the fabrication of the devices and arrays, limiting introduction of impurities in the material, surface passivation of the devices so that they are resistant to degradation over time and thermal management, particularly as it applies to interband cascade lasers.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Increase situational awareness in open and complex terrain; improve target detection, identification, and discrimination; and enhance IR countermeasure (IRCM) protection against missile threats. In FY08, investigated high-power IR lasers for free space (ground-to-satellite and satellite-to-ground) communications, designed 2-color Midwave Infrared/Longwave Infrared (MWIR/LWIR) detector structures, and researched nano-scale photonic crystal waveguide device that can reconfigure by a MEMS feature. In FY09, research frequency modulated IR lasers for covert communication applications, fabricate high operating temperature LWIR Type detector arrays. Investigate dilute Nitride materials. Design and research chip-scale integrated IR-	2.415	2.544	2.676	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>photonic circuit based on the reconfigurable photonic crystal-MEMS waveguide devices; and assemble innovative fiber optic circuits with a patented new concept in photonic crystals for microwave true-time-delay applications. In FY10, will utilize fiber optic integrated circuits to improve mode control of ultra-low-noise microwave oscillator. Will improve LWIR superlattice detectors comparable to Mercury Cadmium Telluride (HgCdTe) but for higher operation temperature.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.008	.000	
Total			2.415	2.552	2.676	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> 52C	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
52C: MAPPING & REMOTE SENS	2.597	2.698	2.788						Continuing	Continuing

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

This basic research project increases knowledge of the terrain with a focus on improving the generation, management, analysis/reasoning, and modeling of geospatial data, and the exploitation of multi-sensor data. This fundamental knowledge forms the scientific "springboard" for the future development of applications, techniques, and tools to improve the tactical commander's knowledge of the battlefield. Results of this research are used to extract and characterize natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain analysis and reasoning techniques; and to explore the potential of space technology and tactical geospatial sensor technology to provide real-time terrain intelligence, command and control, and targeting support. This research exploits terrain and environmental data to improve situational awareness and enhance information dominance, leading to increased survivability, lethality, and mobility. The research provides the theoretical underpinnings for PE 0602784A (Military Engineering Technology), project 855 (Mapping and Remote Sensing).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.024	.000	
Sensor Phenomenology and Spatial-Temporal Pattern Discovery: In FY08, explored the synthesis of magnetic semiconductor particles for explosives detection in soils, examined the fate and transport of nanosensors in the operational environment, and explored the use of high quantum yield, lanthanide nanomaterials for remote sensing. Also, discovered spatio-temporal co-occurrence pattern models and interest measures. In FY09, creating recoverable semiconductor particles based on paramagnetic properties for distributed robotic sensing, and examining the quantum confined Stark Effect exhibited in nanoscale wires as a new chemical, biological, radiological, nuclear, and explosive (CBRNE) detection scheme. Also, creating a new taxonomy for multi-scale spatial-temporal cascade patterns. In FY10, will examine the synthesis of high quantum yield optical reporters for remote sensing. Also, will create new interest measures for multi-scale spatial-temporal cascade patterns.	2.597	2.674	2.788	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 52C	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Total	2.597	2.698	2.788	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> 53A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
53A: BATTLEFIELD ENV & SIG	2.818	3.002	3.216						Continuing	Continuing

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

This project provides an in-depth understanding of the complex atmospheric boundary layer associated with high-resolution meteorology, the transport, dispersion, optical properties, and characterization of chemical and biological aerosols, and the propagation of full-spectrum electro-magnetic and acoustic energy. The future force will operate in very complex environments (e.g. urban) and disparate terrain requiring new approaches to understanding, characterizing, and depicting micro-scale atmospheric phenomena. The lack of a complete understanding of the meteorological aspects of the complex micro-scale boundary layer in which the Army operates continues to impact our abilities to provide accurate and timely tactical weather intelligence to battlefield commanders. This project focuses on boundary layer meteorology over land and urban terrain. It supports the Army's transformation to the future force through formulation of future capabilities and techniques in such areas as the characterization and identification of bio-warfare agents, enhanced acoustic, and electro-optic propagation modeling techniques for improved target detection and acquisition, and formulation of objective analysis tools that can assimilate on-scene weather observations and fuse this information with forecasts to provide immediate nowcast products. These capabilities will have a direct impact on ensuring Soldier survivability, weapon system lethality, and the mobility required for future combat operations.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Increase survivability and improve situational awareness through research to enhance accuracy of predictive modeling of the boundary layer and improve the ability to function effectively "anyplace and anytime". In FY08 explored fine-scale structure within urban boundary layer for input to models depicting transport of chem/bio and other dispersants as well as predictions of airframe turbulence for unmanned aircraft. Investigated the vertical flux effects of water vapor in the boundary layer to determine effects on sensor propagation models. In FY09 investigate methods to solve problems encountered in computing wind flows for steep terrain and across large elevation differences introducing immersed boundary methods and vertical coordinate stretching; investigate spectral analysis of measured urban meteorological profiles to produce new wake parameterizations to improve the high resolution urban wind model. Investigate water vapor fluctuation spectra influenced by urban boundary layer for propagation effects	1.066	1.106	1.221	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 53A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
on sensor performance and imaging capabilities. Measure and characterize the length scale transitions from 3D isotropic to 2D nonisotropic turbulence in the atmospheric surface layer for their effects on propagation and micro air vehicles. In FY10 will investigate methods for optimizing aircraft routes in adverse weather conditions; will extend physics-based version of the 3DWF microscale wind model to improve fidelity for simulation and prediction of wind fields in urban and complex terrain.				
Research in optical and acoustical propagation in the atmosphere for enhanced Intelligence, Surveillance, and Reconnaissance capabilities for the future force to support situational understanding and rapid targeting. In FY08, measured 2-D Angular Optical Scattering (TAOS) of atmospheric particles using improved instrumentation to improve detection and identification of chem/bio hazards. Implemented an inversion technique to extract the optical constants of the spherical atmospheric aerosol particles to enhance capabilities for discrimination and identification of chem/bio hazards. Investigated effects of single urban structure on sound fields to enhance detection and avoidance capabilities. Implemented model for propagation through atmospheric water vapor fluctuations at TeraHertz frequencies to improve sensor accuracy. In FY09, devise and employ a model for illuminative effects of clouds on night vision devices to improve prediction of range limits, analyze the measurements of heated aerosol particle laser induced fluorescence spectra to enhance identification, investigate techniques for classification of non-spherical aerosol particles for improved chem/bio aerosol identification, and investigate effects of multiple urban structures on sound fields to enhance detection avoidance. Develop building effects parameterizations for acoustic models. In FY10, will design algorithms for atmospheric propagation of acoustic signatures in complex terrain. Will devise methods for determining the effect of the atmosphere on polarimetric imaging. Will measure separated Ultra-Violet Raman spectra of aerosols particles.	1.752	1.896	1.995	
Total	2.818	3.002	3.216	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES	<b>PROJECT NUMBER</b> 53A

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> 74A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
74A: HUMAN ENGINEERING	2.937	5.028	5.703						Continuing	Continuing

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

This project focuses on improving Soldier-system performance in future force environments. Research is on key underlying Soldier performance phenomena such as judgment under uncertainty; echo-location and distance-estimation under degraded conditions; extending and protecting auditory and cognitive performance; human performance in automated, mixed-initiative (human control-machine control) environments; associated neurological dynamics; communications in hearing-degraded conditions; collaborative (team) and independent multi-task, multi-modal, multi-echelon Soldier-system performance, all cast against the influx of emerging Transformation-driven technological solutions and opportunities. Technical barriers include lack of methods for describing, measuring, and managing the interplay of these relatively novel phenomena in the consequent task due to situational complexity and ambiguity that characterize operations in the future force. Technical solutions are being pursued in the areas of data generation and algorithm development in these emerging environments in order to update and improve our understanding of performance boundaries and requirements. These solutions include multi-disciplinary partnerships, metrics, simulation capabilities, and modeling tools for characterizing Soldier-system performance, and provide a shared conceptual and operational framework for militarily relevant research on cognitive and perceptual processes. In the area of neuroergonomics, the study of the brain at work, research is carried out to examine leading edge methodologies and technologies to improve cognitive and behavioral performance, particularly under high stress conditions and to assess how neural pathways implicated in functional processing can be enhanced to improve the training of Soldiers in an operational context.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Department of Defense Basic Research 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), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Research in Cognition and Neuroergonomics: Devise and show fundamental translational principles for neuroscience-based research and theory to complex operations settings in three focus areas: Soldier-system information transfer, commander-level decision making, and individualized analysis and assessment of cognitive performance in operational environments. In FY10, will investigate perceptual-motor interactions, including those between sensory-perceptual channels and motor systems; explore the complex effects of information quality and quantity on physical and cognitive performance; explore the neural representations of command-level decision making through identification of information representation;	.000	.000	1.069	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 74A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
examine factors leading to successful or faulty decisions, including biases, heuristics, implicit versus explicit knowledge, context and stressor; identify key individual differences and stressors and investigate their impact on neural processing and cognitive performance; explore the appropriate neuro-sensing approaches for assessment in operational environments.				
<p>Research in Neuroergonomics:            Enable systems designs that are consistent with human brain function, taking into account its limitations and exploiting its potentials, to maximize Soldier performance.            In FY09, investigate novel approaches to capture brain activity and Soldier behavior in complex, dynamic operationally-relevant environments, examine differences in neural processes between individuals, and explore the neural processes underlying visual scanning.            In FY10, will explore the feasibility of using dry, wireless neurophysiological sensors suitable for high-density arrays in operationally-relevant environments; will identify and model specific neural processes underlying visual scanning and target identification.</p>	.000	1.487	1.078	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.055	.000	
<p>Research to characterize and enhance Soldier auditory performance:            In FY08, determined feasibility and limitations of ultrasonic hearing through a literature search regarding perception of speech signals transmitted in the ultrasonic range. Purchased low power ultrasonic transducers for pilot experiments. Results showed speech not sufficiently intelligible, and transducers became very hot causing discomfort for the user. Increased carrier frequency and greater power (multiple transducers) ruled out due to limited knowledge about stimulation and potential subjects' health issues. Because of these results, other research options will be evaluated. Explored the effect of sound duration on auditory localization accuracy. Stimulus durations of 200-800 ms were used to determine duration effects. Localization accuracy improved with increased duration time for the entire stimuli set. Participants were allowed unrestricted head movement, as in operational environments. The combined effects of constrained head movement and stimulus duration will be investigated in the future.            In FY09, investigate synergy between bone conduction (BC) and tactile communication for military applications. Formulate an algorithm for predicting localization error due to headgear.            In FY10, will investigate and determine optimum ear coverage by infantry helmets. Will devise binaural criterion of speech intelligibility.</p>	1.225	1.438	1.375	
Soldier performance:	1.712	2.048	2.181	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 74A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08 investigated temporal cognition via dynamic Soldier task performance, cognitive modeling, and neurophysiological evidence. Computational cognitive model validated descriptive models of visual perception. The modeling tool ACT-R (Adaptive Control of Thought - Rational) was used to study timing of cognitive processing using visual perception study of neurophysiological Event Related Potentials (ERP). On a millisecond basis very early "N100" signals in brain-wave pattern were paired with the perceptual encoding phase of the study task and later "P300" signals were paired with a context-updating phase in model. High correlation of model findings & empirical data yielded two important advancements: 1) Cognitive model is a means for validating cognitive correlates of the neurophysiological signals N100 and P300, & 2) ACT-R can relate ERP events to cognitive functions & validate cognitive interpretations of ERPs. Conducted study of physiological correlates of cognitive performance in drive-by-wire control display systems. In FY09, use computer modeling/social network analyses to study Soldier decision-making to examine quality of information flow in defined command & control structures; conduct follow-on study to explore valid robot lexicon for human-robot communication; begin research to determine important variables for human-robot teams control; investigate effect of information quality on low-level decision making. In FY10, will conduct investigations of situational understanding & prediction in uncertain environments; identify usability deficiencies & mismatches between battle command processes & technology enhancements; will further investigate the effects of information presentation on the Soldier's ability to perceive information.				
Total	2.937	5.028	5.703	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES					<b>PROJECT NUMBER</b> 74F	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
74F: PERS PERF & TRAINING	3.372	6.237	5.860						Continuing	Continuing

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

This project funds behavioral and social science basic research in areas with high potential to improve personnel selection, training, leader development, human performance, and the human and social dynamics of network operations. Research covers areas such as assessment of practical intelligence as an aptitude that can be measured across job domains; identifying principles and potential methods for training and sustaining complex tasks arising from digital, semi-automated, and robotic systems requirements; identifying potential methods for faster learning, improved skill retention, and adaptable transfer of training to new tasks; identifying likely methods for developing leader adaptability and flexibility and for speeding the maturation process; discovering and testing the basic cognitive principles that underlie effective leader-team performance; understanding the role of emotions in regulating behavior; extending social network theory to assist in training effectiveness for counter insurgency operations; and improving the match between Soldier skills and their jobs to optimize performance. Research is focused on fundamental issues that will improve the Army's capability to: (1) select, classify, train, and/or develop Soldiers and leaders who are adaptable in novel missions and operational environments, can function effectively in digital, information rich, and semi-autonomous environments, can effectively collaborate in quickly formed groups and when distributed in high stress environments, and possess interpersonal and intercultural skills and attributes relevant to Joint-Service and multi-national operations; (2) accelerate the training of leadership, interpersonal, and emotional skills that traditionally develop over long periods of time and through direct experience; and (3) support the Army's new Network Science initiative by focusing on the human cognitive and social domains - understanding individual, unit, and organizational behavior within the context of complex networked environments that will be essential for synergy between technology and human performance.

Research in this project is related to and fully coordinated with efforts funded in PE 0602785A, project 790 (Personnel Performance and Training Technology).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Human Behavior: In FY08, developed methods to identify individuals most susceptible to information biases in complex environments and methods to assess motivation for leadership self-development; identified and developed metrics of individual-difference	2.303	4.131	3.952	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 74F	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>variables that predict organizational citizenship and adaptive performance; and continued examination of unbiased testing and relationships of pattern recognition, creativity, and mental flexibility.</p> <p>In FY09, identify and measure individual attributes and learning principles that foster adaptive performance and promote rapid adaptability skill acquisition and retention; develop a new, culture free measure of self-control that will allow prediction of achievement above and beyond cognitive ability; and mature theoretical framework for addressing the human dimension for training and enhanced performance, Soldier retention, productivity, and organizational citizenship.</p> <p>In FY10, will achieve a better understanding of the interplay between cognition and emotion in training, performance, and socio-cultural interactions; will link training methods and learning principles to performance such that they can be incorporated into models that predict job performance and could be used to improve immersive training environments that are tailorable to the individual needs of learners; will systematically examine how nonverbal behaviors are encoded and decoded in human communications in a variety of settings (in particular, we will be concerned with training, leadership, and negotiation types of settings); and will determine whether and how nonverbal behaviors affect outcomes in these environments.</p>				
Small Business Innovation Research/Small Business Technology Transfer Programs	.000	.151	.000	
<p>Network-Human Science:</p> <p>In FY08, conducted research on human use of networks, communication, and command and control technologies to include automated agents, distributed environments, and improved, integrated assessment; and created new technologies for collaborative scientific inquiries into network science, working with the Army Research Laboratory and Army Research, Development, and Engineering Centers.</p> <p>In FY09, conduct research on modeling and simulation of the human use of networks, communication, and command and control technologies to create semantic networks of common sense knowledge in tactical military settings; create new technologies to integrate the human, biological, mathematical, and engineered domains of network science, to extract higher level principles that illuminate each domain in new ways; and explore the regularities of networked social behavior within massively multi-user online environments as simulations of real behavior.</p> <p>In FY10, will create new computational measures of leadership and organizational expertise in on-line networks and distinguish novices from experts in order to rate the reliability of the contributed information; and will match those needing information to those who are able to share it to investigate the dynamics that foster a thriving online community.</p> <p>In all years, research will be done in collaboration with the Army Research Laboratory and Army Research, Development, and Engineering Centers and with researchers at the Army's University Affiliated Research Centers, i.e., the Institute</p>	1.069	1.955	1.908	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601102A DEFENSE RESEARCH SCIENCES		<b>PROJECT NUMBER</b> 74F	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
for Creative Technologies at the University of Southern California, the Institute for Collaborative Biotechnology at the University of California, Santa Barbara, the Massachusetts Institute of Technology, and Carnegie Mellon University.				
Total	3.372	6.237	5.860	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	79.544	89.632	88.421						Continuing	Continuing
D55: University Research Initiative	62.926	76.725	78.421						Continuing	Continuing
D58: URI ACTIVITIES (CA)	12.174	8.921	.000						Continuing	Continuing
D66: MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)	4.444	3.986	.000						Continuing	Continuing
V72: Minerva	.000	.000	10.000						Continuing	Continuing

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

The objective of this program element (PE) is to support Army efforts in the Multidisciplinary University Research Initiative (MURI) program, the Defense University Research Instrumentation Program (DURIP) and the Presidential Early Career Awards for Scientists and Engineers (PECASE) program by funding basic research in a wide range of scientific and engineering disciplines pertinent to maintaining the U.S. land combat technology superiority. Army MURI program efforts involve teams of researchers investigating high-priority; transformational topics that intersect more than one traditional technical discipline (e.g. Intelligent Luminescence for Communication, Display, and Identification). For many complex problems, this multidisciplinary approach serves to accelerate research progress and expedite transition of results to application. The DURIP provides funds to acquire major research equipment to augment current, or devise new, research capabilities in support of Army transformational research. The PECASE program funds single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers. Project D58 funds for specific congressional special interest items.

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

Work on this project is performed extramurally by the Army Research Laboratory (ARL), Research Triangle Park, NC.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	PE 0601103A University Research Initiatives

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	82.416	76.980	76.364	
Current BES/President's Budget	79.544	89.632	88.421	
Total Adjustments	-2.872	12.652	12.057	
Congressional Program Reductions	.000	-.298		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	12.950		
Total Reprogrammings	-.566	.000		
SBIR/STTR Transfer	-2.306	.000		

**Change Summary Explanation**

FY09 increases are due to congressional adds.

FY10 increase is due to new project for Minerva Initiative.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives					<b>PROJECT NUMBER</b> D55	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D55: University Research Initiative	62.926	76.725	78.421						Continuing	Continuing

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

The objective of this project is to support the Multidisciplinary University Research Initiative (MURI), the Defense University Research Instrumentation Program (DURIP) and the Presidential Early Career Awards for Scientists and Engineers (PECASE) program. The MURI program funds university basic research in a wide range of scientific and engineering disciplines pertinent to maintaining US land combat technology superiority. Army MURI efforts involve teams of researchers investigating high-priority, transformational topics that intersect more than one traditional technical discipline (e.g. Intelligent Luminescence for Communication, Display, and Identification). For many complex problems, this multidisciplinary approach serves to accelerate research progress and expedite transition of results to application. The DURIP provides funds to acquire major research equipment to augment current, or devise new, research capabilities in support of Army transformational research. The PECASE program funds single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers.

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

Work on this project is performed extramurally by the Army Research Laboratory (ARL) located in Research Triangle Park, NC.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Defense University Research Instrumentation Program (DURIP):</b> In FY08, under the Defense University Research Instrumentation Program (DURIP) continued acquisition of instrumentation that enhanced the current research infrastructure and provided new research capabilities at selected universities to enable scientific exploration and discovery in promising areas vital to Army transformational technologies. In FY09, DURIP funds competitive grants for instrumentation. In FY10, will continue to fund competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to Army transformation.	10.594	11.819	13.086	
<b>Multidisciplinary University Research Initiative (MURI):</b> In FY08, supported MURI awards made in prior years and initiated eleven new awards. Awarded were Dynamic Models of the Effect of Culture on Collaboration and Negotiation; Modeling Cultural Factors in Collaboration and Negotiation;	51.374	60.819	59.102	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives		<b>PROJECT NUMBER</b> D55	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>The Analysis and Classification of Brain Signals for Covert Speech Communication; A Brain-Based Communication and Orientation System; A Unified Approach to Abductive Inference; Electrical Control of Magnetic Dynamics in Hybrid Metal-Semiconductor Systems; Room Temperature Spin-Mediated Coupling in Hybrid Magnetic, Organic and Oxide Structures and Devices; Tools for the Analysis and Design of Complex Multi-scale Networks; Stochastic Control of Multi-scale Networks: Modeling, Analysis and Algorithms; Spray and Combustion of Gelled Hypergolic Propellants for Future Rocket and Missile Engines; and Spray and Combustion of Gelled Hypergolic Propellants.</p> <p>In FY09, MURI topics are Disruptive Fibers for Flexible Armor, Network-based Hard/Soft Information Fusion, and Tailored Stress-Wave Mitigation. Integrated Quantum Circuits, Adaptive Structural Materials, Transformational Optics, Emergent Phenomena at Complex Oxide Interfaces, Application of Systems Biology to Regenerative Medicine, Mechanisms of Bacterial Spore Germination, Opportunistic Sensing, and Cyber Situation Awareness.</p> <p>In FY10, will continue to support MURI awards made in prior years and initiate new awards in research critical to the Army's future operating capabilities. Effective transition mechanisms include collaboration among principal investigators, participation by 6.2/6.3 program managers in MURI program reviews, and communication of the MURI research results to the Army Research Laboratory, the Research, Development, and Engineering Centers, and industry.</p>				
<p>Presidential Early Career Awards for Scientists and Engineers (PECASE): Supports PECASE investigators started in prior years. In FY08, selected three new investigators for PECASE awards. In FY09 increase the number of new investigator awards. In FY10 will increase the number of new investigator awards.</p>	.958	1.938	2.952	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	2.149	.000	
<p>The Minerva Research Initiative (MRI) is a university-based social science research program initiated by the Secretary of Defense. It focuses on areas in the social sciences of strategic importance to U.S. national security policy. It seeks to increase the Department's intellectual capital in the social sciences and improve its ability to address future challenges and build bridges between the Department and the social science community. Minerva will bring together universities, research institutions, and individual scholars and support multidisciplinary and cross-institutional projects addressing specific topic areas determined by the Department.</p> <p>Proposals have been solicited that address the following topics: (1) Chinese Military and Technology Research and Archive Programs, (2) Studies of the Strategic Impact of Religious and Cultural Changes within the Islamic World, (3)</p>	.000	.000	3.281	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives			<b>PROJECT NUMBER</b> D55	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Iraqi Perspectives Project, (4) Studies of Terrorist Organization and Ideologies, (5) New Approaches to Understanding Dimensions of National Security, Conflict, and Cooperation. Within the Army four awards will be funded and continued in FY10, FY11 and FY12. Minerva projects have been designed to address a wide range of potential applications leveraging cultural dimensions in support of national and military objectives: qualitative and quantitative input to intelligence, planning, and execution from the national to the tactical level; to cultural modeling and knowledge base initiatives such as the Human, Social, Cultural, and Behavioral Modeling program and the human terrain project; and to training at all levels from senior officer education to small unit tactical exercises.						
Total			62.926	76.725	78.421	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives					<b>PROJECT NUMBER</b> D58	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D58: URI ACTIVITIES (CA)	12.174	8.921	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for University Research Initiatives.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Laboratory for Engineered Human Protection (LEHP)							1.546	.000	.000	
Low Temperature Vehicle Performance Research							.774	1.550	.000	
Massively Broadband Wireless Integrated Circuits							1.159	.000	.000	
University Research Initiatives							7.728	.000	.000	
Hi-tech Eyes for the Battlefield							.967	1.550	.000	
Nanosystems Through Optical Biosensors							.000	1.550	.000	
Electrofluidic Chromatophores for Adaptive Camouflage							.000	1.695	.000	
Columbia College Chicago Construct Program							.000	.776	.000	
Open Source Intelligence for Force Protection and Intelligence							.000	1.550	.000	
SBIR/STTR							.000	.250	.000	
Total							12.174	8.921	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives	<b>PROJECT NUMBER</b> D58

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives					<b>PROJECT NUMBER</b> D66		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
D66: MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)	4.444	3.986	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding provided for Medical University Research Initiatives.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Burn and Shock Trauma Institute								1.546	1.938	.000	
Nanomedical Technologies Research								1.932	.000	.000	
Consortium for Bone and Tissue Repair and Regeneration								.966	.000	.000	
DoD International Diabetes Research Initiative								.000	1.937	.000	
SBIR/STTR								.000	.111	.000	
Total								4.444	3.986	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives					<b>PROJECT NUMBER</b> V72	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
V72: Minerva	.000	.000	10.000						Continuing	Continuing

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

The objective of this project is to support the Minerva Research Initiative (MRI), a university-based social science research program initiated by the Secretary of Defense in FY09. It focuses on areas in the social sciences that are of strategic importance to U.S. national security policy which have not been substantially pursued in the past. Under the Minerva project research will be performed to understand the internal military-political dynamics of repressive regimes, the vulnerabilities of regimes and institutions to various kinds of influence and instability, the nature of crowd dynamics, the potential to influence public opinions and attitudes in diverse cultures, cultural effects on network security and military operations, the influence of technology on military capabilities of potential adversaries and allies, and other intersections of social-cultural issues with military activities. Predictive models and other analysis tools will be developed. Leveraging the expertise in the social sciences within the academic community is needed to provide understanding of the roots of terrorist organizations and the challenges and opportunities for military operations in a culturally diverse environment. Better understanding at a fundamental level and new computational tools will provide a beneficial impact on war fighting capabilities at the national policy, military strategy, operational, and tactical levels, and will enhance the capabilities of intelligence activities at all levels. All research results will be open source. Work in this project will be executed extramurally by the Army Research Office.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Minerva Research Initiative: In FY10, Minerva projects will be solicited addressing topics focusing on social science and cultural issues affecting US military warfighting capabilities. Topics will address the relationship of foreign military and technology capabilities, national and military implications of foreign religious and cultural changes, foreign perspectives of US policy and strategy, terrorist organizations and ideologies, and other issues of national security, conflict and cooperation.	.000	.000	10.000	
Total	.000	.000	10.000	

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

N/A

**D. Acquisition Strategy**

N/A

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601103A University Research Initiatives	<b>PROJECT NUMBER</b> V72

**E. Performance Metrics**

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					PE 0601104A University and Industry Research Centers					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	109.520	130.291	96.144						Continuing	Continuing
F17: NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE	.000	.000	4.980						Continuing	Continuing
H04: HBCU/MI CENTERS - TRADOC BATTLELABS	2.570	2.723	2.746						Continuing	Continuing
H05: INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	6.925	11.033	8.588						Continuing	Continuing
H09: ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2.962	4.365	4.543						Continuing	Continuing
H50: Network Sciences CTA	6.794	7.175	3.187						Continuing	Continuing
H53: Army High Performance Computing Research Center	1.919	3.485	3.444						Continuing	Continuing
H54: Micro-Autonomous Systems Technology (MAST) CTA	5.793	7.635	8.056						Continuing	Continuing
H56: Adv Decision Arch Collab Tech Alliance (CTA)	5.362	5.938	.000						Continuing	Continuing
H59: UNIV CENTERS OF EXCEL	3.879	5.202	5.535						Continuing	Continuing
	5.814	6.134	6.437						Continuing	Continuing

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Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification							DATE: May 2009				
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE						
2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research					PE 0601104A University and Industry Research Centers						
H62: Institute for Advanced Technology (IAT)											
H64: MATERIALS CENTER	2.653	2.813	2.838							Continuing	Continuing
H73: Automotive Research Center (ARC)	2.798	2.940	2.941							Continuing	Continuing
J08: INSTITUTE FOR CREATIVE TECHNOLOGY	7.230	7.673	7.791							Continuing	Continuing
J12: Institute for Soldier Nanotechnology (ISN)	9.562	10.063	10.265							Continuing	Continuing
J13: UNIVERSITY AND INDUSTRY INITIATIVES (CA)	25.339	30.001	.000							Continuing	Continuing
J14: ECYBERMISSION	4.706	5.228	5.273							Continuing	Continuing
J15: NETWORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	6.941	7.889	8.146							Continuing	Continuing
J16: NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	2.876	2.985	.000							Continuing	Continuing
J17: VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE	1.918	2.026	2.044							Continuing	Continuing
J19: Automotive Research Center (ARC) Initiatives (CA)	3.479	.000	.000							Continuing	Continuing

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>						<b>DATE:</b> May 2009				
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research						<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers				
J22: NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER	.000	4.983	9.330						Continuing	Continuing

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

This program element (PE) supports future force capabilities by providing research that supports enabling technologies for future force capabilities. Broadly, the work in this project falls into three categories: Collaborative Technology Alliances (CTAs), University Centers of Excellence (COE), and paradigm-shifting centers - University-Affiliated Research Centers (UARCs). The Army formed CTAs to leverage large investments by the commercial sector in basic research areas that are of great interest to the Army. CTAs involve partnerships between industry, academia, and the Army Research Laboratory (ARL) to incorporate the practicality of industry, the expansion of the boundaries of knowledge from universities, and Army scientist to shape, mature, and transition technology. CTAs have been competitively established in the areas of Advanced Sensors, Advanced Decision Architecture, Communications and Networks, Power and Energy, and Robotics. Work done under the Advanced Sensors CTA and the Power and Energy CTA was redirected into the Micro Autonomous Systems Technology (MAST) CTA in FY08. This PE includes the Army's COE, which focus on expanding the frontiers of knowledge in research areas where the Army has enduring needs, such as rotorcraft, automotive, microelectronics, materials, and information sciences. COEs couple state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in information sciences, materials science, electronics, automotive, and rotary wing technology. Also included is eCYBERMISSION, the Army's national web-based competition to stimulate interest in science, math, and technology among middle and high school students. This PE also includes the four Army UARCs, which have been created to exploit opportunities to advance new capabilities through a sustained long-term multidisciplinary effort. The Institute of Advanced Technology funds basic research in electromagnetic and hypervelocity physics. The Institute for Soldier Nanotechnologies focuses on Soldier protection by emphasizing revolutionary materials research for advanced Soldier protection and survivability. The Institute for Collaborative Biotechnologies, focusing on enabling network centric-technologies, will broaden the Army's use of biotechnology for the development of bio-inspired materials, sensors, and information processing. The Institute for Creative Technologies is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and simulation. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments. Historically Black Colleges and Universities and Minority Institution (HBCU/MI) Centers of Excellence address critical research areas for Army Transformation.

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 PE is managed by: the Army Research Lab (ARL) in Adelphi, MD; the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC) in Warren, MI; the Simulation and Training Technology Center (STTC) in Orlando, FL; and the US Army Research Institute for the Behavioral and Social Sciences (ARI) in Arlington, VA.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	110.100	105.622	101.814	
Current BES/President's Budget	109.520	130.291	96.144	
Total Adjustments	-.580	24.669	-5.670	
Congressional Program Reductions	.000	-5.431		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	30.100		
Total Reprogrammings	2.496	.000		
SBIR/STTR Transfer	-3.076	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> F17	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
F17: NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE	.000	.000	4.980						Continuing	Continuing

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

This project supports the Neuroergonomics Collaborative Technology Alliance (CTA), a competitively selected industry and university consortium, to leverage world-class research in support of future force and Army transformation needs. Escalating levels of complexity and uncertainty on the current and future battlefield present conditions which have never existed before now. Solution strategies and approaches must be developed or tailored. The emerging field of neuroergonomics, which seeks to understand the brain at work and to leverage that understanding to optimize system design, offers tremendous potential for providing the solutions needed to meet the needs of Army forces in the future. This CTA addresses the solution strategies and approaches needed to design systems to fully exploit investments in revolutionary technological advances in areas such as robotics, microelectronics, and computer and network information systems. These technologies present significant opportunities to enhance Army mission capabilities, but impose significant burdens on the human brain, which will ultimately limit Soldier-system effectiveness, sustainability, and survivability. The technical barriers associated with this project include: immature knowledge base to guide the neuroergonomic approach to human-system integration; inadequate capabilities to sense and extract information about brain activity in dynamic, operational environments; lack of valid measures to robustly and uniquely characterize operationally-relevant cognitive performance; lack of techniques for integrating advanced understandings of brain activity into systems designs, including real-time use of measures of cognitive behavior as system inputs and the capability to account for individual differences in maximizing Soldier-system performance. This CTA conducts an intensive and accelerated program to formulate, validate, and transition basic research findings through multi-dimensional approaches (e.g., genetics, computational modeling, neuroimaging, and performance) focused in three areas: maximal effectiveness of information transfer between the system and Soldier; identification of mental states, traits, and experiences that impact commander-level decisions; individualized, real-time measurements and analysis of cognitive processing under operationally-relevant stressors. This Neuroergonomics Collaborative Technology Alliance will begin in FY10.

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

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

Funding was restructured from the Advanced Decision Architecture Collaborative Technology Alliance in PE 0601104A, project H56.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers			<b>PROJECT NUMBER</b> F17
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Maximize effectiveness of information transfer between system and Soldier. In FY10, will investigate perceptual-motor interactions, including those between sensory-perceptual channels and motor systems; will explore the complex effects of information quality and quantity on physical and cognitive performance.		.000	.000	1.429	
Identify mental states, traits, and experiences that impact commander-level decisions. In FY10, will explore the neural representations of command-level decision making through identification of information representation; will examine factors leading to successful or faulty decisions, including biases, heuristics, implicit versus explicit knowledge, context and stressor.		.000	.000	1.446	
Individualize real-time measurement and analysis of cognitive processing under operationally-relevant stressors. In FY10, will identify key individual differences and stressors and investigate their impact on neural processing and cognitive performance; will explore the appropriate neuro-sensing approaches for assessment in operational environments.		.000	.000	2.105	
Total		.000	.000	4.980	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> H04	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H04: HBCU/MI CENTERS - TRADOC BATTLELABS	2.570	2.723	2.746						Continuing	Continuing

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

This project transitions advances resulting from basic research to technology demonstration as rapidly as possible. Centers of Excellence have proven effective in harnessing a critical mass of university research expertise and focusing their intellectual capabilities on Army unique science and technology problems. This project takes that approach one step further by partnering the university researchers at Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) with Army Training and Doctrine Command (TRADOC) Battle Labs to gain first hand perspective of the end-user's needs. Through these centers, the Army user begins the collaboration with university researchers from the outset of the research. These Centers of Excellence will join with Army and industrial partners to accelerate the transition from research phase to actual technology demonstration. In addition, these Centers of Excellence will recruit, educate, and train outstanding students and post doctoral researchers in science and technology areas relevant to Army Transformation. This project was previously funded in PE 0601104A, project H59 (University Centers of Excellence) and is being transferred into a distinct project for visibility and management.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HBCU/MI Centers of Excellence for Battlefield Capability Enhancements: The centers are: Tuskegee University (Flexible Extremities Protection); NCA&T State University (Environmentally-stable Flexible Displays), and (Human-centric Command and Control Decision Making: predictive modeling of group situational awareness); Tennessee State University (Sensor Fusion); and Prairie View A&M University (Beyond-Line-of-Sight Lethality). In FY08, refined fabric designs with new testing strategies; validated sense-making models with test command groups; characterized semiconductor materials on flexible substrates for optical properties; showed use of multi-modal sensor network in urban terrain; refined wireless network protocols using simulation test bed. Additional significant accomplishments for FY08 included: synthesis of shear-thickening fluids; novel low-temperature growth of wide-band-gap GaAlAsN layers; development of Sensemaking Support Software; application of a novel cross-layer mobility support	2.570	2.646	2.746	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
resulting in 58% reduction in packet delay; and application of KV Transform Coding for a multi-path environment. FY09 culminates the Increment I program. In FY09, emphasize transitioning technologies to advanced/applied research. Collaborations with TRADOC Battle Labs will help accelerate technology transitions to the battlefield. Also in FY09, devise enhanced protection capability of final fabric designs; deliver deployable decision support programs for test command groups; design and fabricate hybrid semiconductor devices on flexible substrates and evaluate environmental stability; show full data-fusion for large-scale sensor networks; and show protocols for wireless sensor network. FY09 will also include initiation of the BCE Increment II program via topic selection and execution solicitation. In FY10, the HBCU/MI program is being re-competed. FY10 and FY11 plans will be defined post solicitation.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.077	.000	
Total	2.570	2.723	2.746	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H05: INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	6.925	11.033	8.588						Continuing	Continuing

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

This project supports the Army's Institute for Collaborative Biotechnologies (ICB), a University Affiliated Research Center led by the University of California-Santa Barbara, and two major supporting partners, the California Institute of Technology and the Massachusetts Institute of Technology. The ICB is the Army's primary conduit for leveraging biotechnology for: 1) advanced sensors; 2) new electronic, magnetic, and optical materials; and 3) information processing and bioinspired network analysis. The objective is to perform sustained multidisciplinary basic research supporting technology to provide the Army with biomolecular sensor platforms with unprecedented sensitivity, reliability, and durability; higher-order arrays of functional electronic and optoelectronic components capable of self-assembly and with multi-functions; and new biological means to process, integrate, and network information. These sensor platforms will incorporate proteomics (large scale study of proteins) technology, DNA sequence identification and detection tools, and the capability for recognition of viral pathogens. A second ICB objective is to educate and train outstanding students and post doctoral researchers in revolutionary areas of science to support Army Transformation. The ICB has many industrial partners, such as IBM and SAIC, and has strong collaborations with Argonne, Lawrence Berkley, Lawrence Livermore, Los Alamos, Oak Ridge, and Sandia National Laboratories, the Army's Institute for Soldier Nanotechnologies, the Institute for Creative Technologies, and Army Medical Research and Materiel Command (MRMC) laboratories.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Neuroscience: In FY09, research the emerging area of cognitive neuroscience, examining functional magnetic resonance imaging (fMRI) techniques coupled with electroencephalogram (EEG) results to increase understanding of fast decision making processes, memory retrieval, categorization, aptitudes for specific tasks and other brain functions. Investigate the use of other potential brain imaging techniques such as positron emission tomography (PET) and magnetoencephalography (MEG) to enhance understanding of brain function. Study and characterize individual differences in brain strategy. Research methods within neuroscience to provide optimal control for human/machine interfaces.	.000	3.003	1.230	

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<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will extend brain mapping to evaluate Army personnel with field experience for decision making, executive function and memory performance. Will partner with the Institute for Creative Technologies (ICT) to design, develop and implement standard virtual human-agent interaction contexts and scenarios in order to create standard test-bed scenarios for determining the human interactional efficacy of virtual human agents.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.308	.000	
Institute for Collaborative Biotechnologies: In FY08, established biologically based development path toward flexible high-efficiency batteries and new high-efficiency solar energy materials; provided a means to greatly enhance sensitivity in detection of viral pathogens; enabled electronic detection of DNA. In FY09, define a biocatalytically derived route to low-cost fuel and fuel-cell feedstock using microbes to produce fuels directly from biomass including novel cellulose enzymes to break down biomass; characterize and further develop microfluidic chip-based bioseparation technology; research new bio-inspired nanoparticles to yield optimal signal enhancement in microfluidic channel biomolecular sensors; investigate bio-templated ultra-lightweight batteries for micro-unmanned air vehicles. In FY10, will translate discoveries of the mechanisms by which lightweight biological composites dissipate energy and resist fracture into new approaches for blast-resistant materials and structures; will develop a blood-based assay for specific markers of 9 traumatic brain injuries (TBI); will develop decentralized bio-inspired algorithms for information processing and control by networks of autonomous agents in the presence of unexpected and unfriendly environments.	6.925	7.722	7.358	
<b>Total</b>	<b>6.925</b>	<b>11.033</b>	<b>8.588</b>	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H09: ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2.962	4.365	4.543						Continuing	Continuing

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

This project supports a collaborative effort between the competitively selected industry and university consortium, the Robotics Collaborative Technology Alliance (CTA), and the Army Research Laboratory (ARL) for the purpose of leveraging world-class research in support of the future force and Army transformation needs. This project conducts basic research in areas that will expand the capabilities of intelligent mobile robotic systems for military applications with a focus on enhanced, innate intelligence, ultimately approaching that of a dog or other intelligent animal, to permit unmanned systems to function as productive members of a military team. Research is conducted in machine perception, including the exploration of sensor phenomenology, and the investigation of basic machine vision algorithms enabling future unmanned systems to more fully understand their local environment for enhanced mobility and tactical performance; intelligent control, including the advancement of artificial intelligence techniques for robot behaviors permitting future systems to autonomously adapt, and alter their behavior to dynamic tactical situations; and understanding the interaction of humans with machines focusing upon intuitive control by Soldiers that minimizes cognitive burden. The program will conduct both analytic and validation studies. Research products will be transitioned to the companion applied technology program, PE 0602618A, project H03, for integration and evaluation in test bed platforms and will form the scientific basis for new technology that will migrate into Army and Joint advanced and system development programs to provide highly capable unmanned systems for the future force.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Autonomous systems: Explore opportunities enabling revolutionary, autonomous, highly mobile systems for the future force. Research focuses on unmanned systems operating as a team with human supervisors and displaying a high degree of adaptability to dynamic environmental and tactical situations. In FY08, explored methodologies to permit unmanned systems to perform as co-combatants; examined real-time evaluation of possible adversarial responses, each possessing differing levels of likelihood based upon considerations such as terrain and tactical environment that includes friendly and non-combatant forces; expanded the range of perception algorithms for classification of structures found in the urban environment and explored methods to fuse detection from individual sensor modalities and/or algorithmic approaches.	2.962	4.242	4.543	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, focus on techniques for fusion of the key perception algorithms to enable an unmanned vehicle to maneuver with a high degree of autonomy in urban environments; examine perception based navigation, especially for indoor and GPS denied environments; explore approaches for autonomous activity recognition; evaluate the performance of both perception and behavior algorithms in varied tactical environments. Conduct research to explore human robot interaction, dynamic scene understanding and contextual situational awareness. In FY10, will expand research to include a more complete understanding of control and interaction between humans and robots through non-verbal cues and natural language; autonomous understanding and retention of salient features and activities to promote learning and adaptation to dynamic, unknown environments; and novel structural and control techniques to enable more dexterous manipulation.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.123	.000	
Total	2.962	4.365	4.543	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H50: Network Sciences CTA	6.794	7.175	3.187						Continuing	Continuing

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

This project supports a competitively selected university and industry consortium, the Communication and Networks Collaborative Technology Alliance (CTA) that was formed to leverage commercial research investments to provide solutions for the Army's requirements for robust, survivable, and highly mobile wireless communications networks. The future force has a requirement for state-of-the-art wireless mobile communications networks for command-on-the-move. The objectives include designing communications systems for survivable wireless mobile networks; providing signal processing for communications-on-the-move; secure jam-resistant communications; and tactical information protection. The CTA facilitates the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, as well as the use of state-of-the-art facilities and equipment at the participating organizations. This CTA accelerates the transition of communications and networks technology to PE 0602783A (Computer and Software Technology). The results of this work will significantly affect future force communications and networking formulation efforts. A portion of this program will be shifted to in-house efforts funded from 61102 H48 beginning in FY10. The remainder of the program will be re-focused in FY10 on the Network Sciences CTA to more strongly emphasize Information Assurance and Network Science as defined by the December 2005 National Research Council Board on Army Science and Technology study. Since the International Technology Alliance on Network and Information Sciences (PE 0601104A/project J15) was established in 2006, joint planning of the research programs prevents redundancies and leverages accomplishments from both programs.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Survivable Wireless Mobile Networks: This work performs research in dynamically self-configuring wireless network technologies that enables secure, scaleable, energy-efficient, and reliable communications for command on-the-move. Devise techniques to model, design, analyze, predict, and control the performance of mobile ad hoc networks. In FY08, devised formal models, abstractions, metrics, and validation techniques for understanding the behavior of large scale military mobile ad hoc networks. Designed techniques that combine social networking and network structure control functions in real-time to dramatically increase the level of resource utilization in keeping with the stated intentions (outcomes) of a particular military objective.	2.633	2.717	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, design networking techniques for sensing the networking operating environment, identifying the best networking functional components, and dynamically composing protocols for superior performance.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.200	.000	
Signal Processing for Communication-on-the-Move: This effort performs research in signal processing techniques to enable reliable low-power multimedia communications among highly mobile users under adverse wireless conditions. In FY08, designed and validated multi-input, multi-output, multi-carrier waveforms that exploit non-contiguous spectrum during mobile operations. In FY09, design optimal channel-adaptive distributed multiple access techniques to provide high capacity, interference-robust, multiple access networks for communications-on-the-move.	1.524	1.600	.000	
Secure Jam-Resistant Communication: This effort performs research on secure, jam-resistant, multi-user communications effective in noisy and cluttered and hostile wireless environments enabling low probability of detection/intercept. In FY08, devised low power adaptive medium access control algorithms that are energy-efficient and support duty-cycling to extend the life of sensor networks. In FY09, design signal separation techniques to mitigate packet collisions and improve signal detection for improved network performance.	1.085	1.021	.000	
Tactical Information Protection: This work performs research in scalable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY08, designed and evaluated formal methods-based protocol specification intrusion detection techniques on mobile adhoc networking protocols. In FY09, design resilient clustering algorithms to provide a dynamic detection hierarchy to support detection and localization of attackers under mobile conditions.	1.552	1.637	.000	
Network Sciences Collaborative Technology Alliance (NS CTA): Beginning in FY10, this new CTA will focus on two new research areas: Information Networks and Social/Cognitive Networks; and will build upon successes of the Communications & Networks CTA for Communications Networks and Integration. The vision for the NS CTA is to develop a fundamental understanding of the ways that information, social/cognitive, and communications networks can	.000	.000	3.187	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>be designed, composed, and controlled to dramatically increase mission effectiveness and ultimately enable humans to effectively exploit information for timely decision-making. Information Networks research will develop the fundamental understanding of autonomous network activities and its linkage to the physical &amp; human domains as related to human decision making within the networked command &amp; control (C2) structure. Social/Cognitive Networks research will develop the fundamental understanding of the interplay of the various aspects of the social &amp; cognitive networks with information &amp; communications. Communications Networks research will develop the foundational techniques to model, analyze, predict, and control the behavior of secure tactical communication networks as an enabler for information and C2 networks. Integration will focus on achieving an integrated Information Networks, Social/Cognitive Networks, Communications Networks research program that significantly enhances the fundamental understanding of the underlying science of networks.</p> <p>In FY10, will establish the Network Sciences CTA in support of the Network Science &amp; Technology Research Center. Research will include modeling to understand network centric organizations &amp; will develop mobile ad hoc network simulation &amp; emulation technologies to evaluate networks in organizations.</p>				
Total	6.794	7.175	3.187	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H53: Army High Performance Computing Research Center	1.919	3.485	3.444						Continuing	Continuing

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

This project supports critical research at the Army High Performance Computing Research Center (AHPCRC). Research at the AHPCRC is focused on the Lightweight Combat Systems Survivability, computational nano- and bio-sciences, computational battlefield network and information sciences including evaluating materials suitable for armor/anti-armor and sensor applications, defense from chemical and biological agents, and associated enabling technologies requiring computationally intensive algorithms in the areas of combat systems survivability, battlefield network sciences, chemical and biological defense, nanoscience and nanomechanics, and computational information sciences, scientific visualization enabling technologies that support the future force transition path. This project also supports the Robotics Collaborative Technology Alliance which explores new opportunities to enable revolutionary autonomous mobility of unmanned systems for the Future Force. This research is an integral part of the larger Army Robotics Program and feeds technology into PE 0602618A, project H03 (Robotics Technology). The project will also address research focusing on unmanned systems operating as a team with human supervisors and displaying a high degree of adaptability to dynamic environmental and tactical situations.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.098	.000	
AHPCRC: In FY08, explored new interdisciplinary methods to evaluate lightweight fabric structure systems, developed the Flexible Architecture Research Machine to accelerate architecture and algorithmic research on novel parallel models and facilitated evaluations on heterogeneous systems that combine central processing units (CPU), graphical processing units (GPU), and field programmable gate arrays (FPGA); investigated and planned new computational approaches to analyze very large-scale networks for battlefield applications.	1.919	3.387	3.444	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, implement interdisciplinary methods to evaluate lightweight fabric structure systems; investigate computational approaches to analyze very large-scale networks for mobile network applications; explore advanced simulations to develop new materials for military vehicles and equipment, improve wireless battlefield communication, advance detection of chem/bio attacks and stimulate innovations in supercomputing; design a common infrastructure model for a wide class of interdisciplinary applications; explore new scalable programming models for emerging multi-core computing architectures. In FY10, will enhance lightweight fabric structure systems; enhance innovative scalable algorithms to analyze very large-scale complex mobile network simulation applications; develop new scalable multi-scale computational approaches for micro-systems design, implement computational bio- and nano-science scalable algorithms.				
Total	1.919	3.485	3.444	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H54: Micro-Autonomous Systems Technology (MAST) CTA	5.793	7.635	8.056						Continuing	Continuing

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

This project supports the Micro Autonomous Systems and Technology (MAST) Collaborative Technology Alliance (CTA), a competitively selected industry-university consortium which leverages world-class research necessary to address future force and Army Transformation needs. The CTA links a broad range of government technology agencies, as well as industrial and academic partners with the Army Research Laboratory (ARL). The MAST CTA focuses on innovative research in four main technical areas related to the coherent and collaborative operation of multiple micro autonomous platforms: microsystem mechanics, processing for autonomous operation, microelectronics, and platform integration. Payoff to the warfighter will be advanced technologies to support future force requirements in situational awareness. The CTA facilitates the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, and to make available to the Alliance state-of-the-art facilities and equipment at the participating organizations.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.214	.000	
MAST: In FY08, performers were involved in and supported the Micro Air Vehicles 08 Demonstration in Agra, India. Performers developed plans for collaborative capabilities evaluations to investigate autonomous operation of air and ground microplatforms. In FY09, performers investigate key technologies and techniques for autonomous navigation of microplatforms, low power and low bandwidth communication for collaborative behavior, low power sensing, low power processing, low Reynolds numbers aeromechanics, and ambulation of micro-ground platforms. Perform a capabilities analysis of microsystems and of a system of microsystems as an aid in microsystem design. Develop tools for microsystem design.	5.793	7.421	8.056	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
In FY10, will define information flow architecture for a candidate robotic platform, implement small group collaborative tactical behaviors, investigate tradeoffs in distributed processing and communications for perception and navigation, and incorporate sensing and processing into energy efficient architectures. Will investigate novel concepts and develop initial models and prototypes in microelectronics for navigation, communication, information processing, and energy harvesting and sensing for micro-autonomous systems.					
Total			5.793	7.635	8.056
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H56: Adv Decision Arch Collab Tech Alliance (CTA)	5.362	5.938	.000						Continuing	Continuing

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

This project supports a collaborative effort between the competitively selected industry and university consortium, the Advanced Decision Architecture (ADA) Collaborative Technology Alliance (CTA), and the Army Research Laboratory (ARL). These technologies will provide for real-time situational awareness (SA), distributed commander-staff-subordinate collaboration and planning, and execution monitoring in high-tempo, high-stress battlefield environments at speeds that permit operating inside the enemy's decision cycle. This project will conduct an intensive and accelerated program to formulate, validate, and transition basic research to provide solutions for the many requirements for understanding SA, expert decision making, team collaboration, the ability to display information in a way that facilitates knowledge assimilation on the battlefield, and visualization and decision support architectures. Research is conducted in four areas: cognitive process modeling and measurement, analytical tools for collaborative planning and execution, user adaptable interfaces, and auto-adaptive information presentation. The technical barriers associated with this project are: human-computer interface in an information rich environment; display configuration; real time visualization; information presentation; and control coupling. This CTA accelerates the transition of advanced decision architecture technology to PE 0602716A (Human Factors Engineering Technology) and PE 0602783A (Computer and Software Technology). The ADA CTA ends in FY09 and this program will be re-focused to emphasize individual Soldier, squad, and platoon level tools and information and knowledge fusion. Research partnerships will be established with the Institute for Creative Technology (PE 0601104A, project J08) and the Flexible Display Center (PE 0602705A, project H17).

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

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

Beginning in FY10 funding will be transferred from the Advanced Decision Architecture Collaborative Technology Alliance to PE 0601104A, project F17, for the Neuroergonomics CTA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers): In FY08, extended and improved the system for the automatic generation of Cognitive Models of Situation Awareness (CMSA). In FY09, validate software agent architecture for enhancing the performance of human teams using advanced artificial intelligence techniques including context-sensitive information sharing, automated development of shared situation	1.320	1.357	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
awareness and recognition-primed decision support, a naturalistic decision making (NDM) technique used by experienced decision makers to quickly scan an array of displays or information and "instantly" know the best course of action to pursue.				
Auto-adaptive information presentation: Investigate how to make autonomous machines team players with their human partners or supervisors in warfighting operations. In FY08, tested an agile computing infrastructure integrated with agent-based policy and domain services to enable efficient use of scarce computing and network resources and coordination of human-robot teams in realistic Army future combat system scenarios. In FY09, devise a distributed system for real-time target tracking of multiple entities in an area under surveillance exploiting a reasoning-based approach to include diagrammatic reasoning, domain knowledge, and algorithmic solutions.	1.214	1.271	.000	
User-adaptive interfaces: Explore ideas, frameworks, and technologies that assist the Soldier in understanding, problem solving, planning, and decision-making. In FY08, investigated interface technologies to fuse and visualize sensed information (persistent surveillance) as relevant tactical events to improve Commander's real time situational awareness. In FY09, validate functional model of the capabilities of new sensor/network technologies as they could contribute to perceptual awareness including concepts such as trust.	1.620	1.843	.000	
Analytical tools for collaborative planning and execution: Create tools that effectively support teams in coordinating and collaborating to achieve mission success across the spectrum of operations. In FY08, provided tools and techniques to foster better adaptive learning, expert decision-making, and teamwork. In FY09, devise theoretical foundations and empirical findings on the design of collaborative systems to make Soldiers more effective as sensors in the Brigade and Below Battlefield Awareness Network environment and to enhance Soldier-automation collaboration.	1.208	1.301	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.166	.000	
<b>Total</b>	<b>5.362</b>	<b>5.938</b>	<b>.000</b>	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H59: UNIV CENTERS OF EXCEL	3.879	5.202	5.535						Continuing	Continuing

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

This project funds the International Technology Centers (ITCs), the Foreign Technology (and Science) Assessment Support (FTAS) program, and a Basic Research Center for Network Science located at the United States Military Academy. The nine ITCs located in Australia, the United Kingdom, Canada, France, Germany, Japan, Chile, Argentina, and Singapore support the Army's goals of providing the best technology in the world to our Warfighters by leveraging the Science and Technology (S&T) investments of our international partners. The ITCs perform identification and evaluation of international technology programs to assess their potential impact on the Army's S&T investment strategy. ITC "technology finds" are submitted as technology information papers (TIPs) to various Army S&T customers including the Army Research Laboratory (ARL), the Research Development and Engineering Centers (RDECs) of the Research Development and Engineering Command (RDECOM), RDECOM technology Integrated Process Teams, the Rapid Equipping Force (REF), and others for evaluation and consideration for further research and development. The ITC TIPs also serve as input into the international section of the Army S&T Master Plan. The FTAS program builds upon the TIPs submitted by the ITCs. In some cases the TIP is truly unique and may well meet an Army requirement or potentially support ongoing Army S&T investments. In such cases, the FTAS program can provide initial resources (seed money) to fund basic research in these technology areas identified by the TIPs as having potential relevance to the Army's S&T plan. The research will provide information useful in making an early assessment of the technology's potential contributions to the Army's S&T strategy.

In FY09, this project funds a Basic Research Center in Network Science at the United States Military Academy (USMA) to further the theoretical understanding and develop the engineering design principles leading to the development of a science about networks and how they operate. Work in this project is coordinated with and complementary to the work at the Network Science and Technology Research Center funded under PE 0601104A/project J22.

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

Work in this project is performed extramurally by RDECOM HQ and the Army Research Laboratory (ARL) in Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.124	.000	
International Technology Centers (ITC)/Foreign Technology (and Science) Assessment Support (FTAS): Prior to FY08, the ITC and FTAS efforts were funded in PE 0601102A, project H57.	3.879	4.077	4.547	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, the ITCs will improve upon execution of their international technology search process to focus on critical technology capability gaps based upon direct face-to-face feedback with the RDECOM Commanding General and RDECOM center and lab directors.</p> <p>In FY10, the ITCs will work to make progress in several main areas of foreign technology identification and support to international collaboration including: unmanned systems, Counter-Improvised Explosive Devices, active protection, and power and energy.</p> <p>FTAS Program: During FY08, all seven FY06 FTAS projects were completed and have shown to have successfully advanced technology programs for ARL, CERDEC and MPMC. We will continue to solicit projects and build on the success of the FTAS Program.</p> <p>In FY09, four FY07 FTAS projects will be ongoing for ARL and CERDEC.</p> <p>In FY10, eight FY08 FTAS projects will be completed.</p>				
<p>Basic Research Center in Network Science at the United States Military Academy (USMA):</p> <p>In FY09, to further the theoretical understanding and develop the engineering design principles leading to the development of a science about networks. The Center is prepared to make progress in several main areas of study including: dynamics, spatial location, and information propagation in networks, through better understanding of the relationship between the architecture of a network and its function. Will leverage science to develop the backbone of the Army's future fighting force. Develop fundamental knowledge to support the Army's Basic Research Program in Network Science and enhance the education of the Corps of Cadets in these matters. Perform modeling and analysis of very large networks using tools, abstractions, and approximations that allow reasoning about large-scale networks, as well as techniques for modeling networks characterized by noisy and incomplete data.</p> <p>In FY10, will contribute to and facilitate the Army transformation to network-centric operations (NCO), and promote the professional development of the United States Military Academy (USMA) faculty in the physical, mathematical, engineering, biological, behavioral, and social sciences relevant to network science. The goal will be the creation of tools that allow the design and synthesis of networks to obtain desired properties, and, to increase the level of rigor and mathematical structure in network science.</p>	.000	1.001	.988	
<b>Total</b>	3.879	5.202	5.535	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H62: Institute for Advanced Technology (IAT)	5.814	6.134	6.437						Continuing	Continuing

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

This project funds a University Affiliated Research Center, the Institute for Advanced Technology (IAT) at the University of Texas, to conduct basic research in electromechanics and hypervelocity physics in support of electromagnetic (EM) guns. Of particular interest are EM power, EM launchers, EM integrated launch packages, and hypervelocity terminal ballistics. Advanced computational models are devised and/or applied to solve complex problems in each of these areas. In keeping with the Army EM Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power. The sponsored research provides the scientific underpinning for EM gun pulsed power including switching; addresses technical barriers associated with EM gun launcher life; and researches advanced technologies for hypervelocity target defeat. The sum of these focused efforts serves as a catalyst for technological innovation and provides crucial support to the Army technology base for advanced weapon systems development with applications for anti-armor, artillery, air defense, and the future force.

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 monitored and guided by the Army Research Laboratory (ARL) in Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Pulsed Power:</b> In FY08, modeled and evaluated validated potential alternate pulsed power systems. In FY09, provide technology for large-scale solid state converters. In FY10, will analyze methods to increase energy density of pulsed alternators. Will evaluate the design options for moderate-sized advanced pulsed power system tests of new concepts, especially including battery-inductor arrangements, for Army EM gun applications to define their operating system characteristics.	2.496	2.568	3.050	
<b>Launch:</b> In FY08, examined advanced materials for launcher components. In FY09, examine thermal management of EM launchers.	1.518	1.647	1.673	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate techniques to increase rail life and show higher muzzle energy railgun operation with integrated launch packages that contain realistic flight bodies. Will update theories for elevated temperature railgun operation based on experiments and simulations.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.171	.000	
Electromagnetic Lethality: In FY08, measured material properties under short duration electrodynamic and structural loads; examined the target interaction physics of reactive material during hypervelocity impact. In FY09, complete and validate numerical model of armature physics including gouging and transition; will examine coupled high density/reactive materials during target interaction at hypervelocity. In FY10, will study target effects of novel penetrator concepts for precision fires and other high velocity impact conditions.	1.800	1.748	1.714	
Total	5.814	6.134	6.437	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> H64	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H64: MATERIALS CENTER	2.653	2.813	2.838						Continuing	Continuing

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

This project concentrates scientific resources on materials research for lightweight vehicle protection and is executed through Cooperative Research Agreements (CRAs). The effort funds collaborative research in three Materials Science and Engineering Research Areas (MSERAs): (1) Composite Materials Research; (2) Advanced Metals and Ceramics Research; and (3) Polymer Materials Research. Each MSERA pursues thematic research thrusts that address topics pertinent to lightweight vehicle protection and that are aligned with the Army's strategic materials research vision enabling long-term synergistic collaboration between the Army Research Laboratory (ARL) scientists and university researchers. The Materials Cooperative Research Agreements provide for mutual exchange of personnel and sharing of research facilities with the University of Delaware, Johns Hopkins University, Rutgers University, Drexel University, and Virginia Polytechnic Institute and State University. Lightweight, multi-functional composites, advanced armor ceramics, dynamic response of metals, protective polymer, and hybrid systems are emphasized. This project is closely coordinated with ARL in-house materials research projects (PE 0601102A, project H42) to promote effective and efficient transfer of fundamental scientific research addressing lightweight protective material requirements for the future force. The center accelerates the transition of technology to PE 0602105A (Materials 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 in this project is performed by the Army Research Laboratory (ARL) in Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Materials Research for vehicle protection: In FY08, validated models for multifunctional composite attributes and showed multifunctional capabilities in single composite material; devised schemes for synthesis of protective polymers with enhanced energy absorption; identified key materials parameters for the improved performance of metal matrix nanocomposite materials. In FY09, utilize multifunctional composites to validate potential composite weight reductions; characterize and quantify performance of newly synthesized energy absorbing polymers; and validate effects of armor ceramic processing and materials selection on mechanical properties. In FY10, will examine high rate deformation mechanisms for ceramics and other advanced materials; examine the role of defects; characterize materials using advanced microscopy methods; and develop microstructure-processing relationships for severely plastically deformed materials.	2.653	2.734	2.838	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research	.000	.079	.000	
Total	2.653	2.813	2.838	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H73: Automotive Research Center (ARC)	2.798	2.940	2.941						Continuing	Continuing

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

This project significantly enhances the Army's transformation to the future force by the application of novel, high payoff technologies that can be integrated into Army ground platforms. The Center of Excellence for Automotive Research is part of the basic research component of the National Automotive Center (NAC), a business group within the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial technology for potential application in Army vehicle systems through ongoing and new programs in automotive research, resulting in significant cost savings and performance enhancing technological opportunities. The research performed in this project contributes to formulating and establishing the basic scientific and engineering principles for these technologies.

Efforts are fully coordinated and complementary to those performed by the NAC and TARDEC under PE 0602601A (Combat Vehicle and Automotive Technology). Selected university partners include: University of Michigan, University of Wisconsin, Wayne State University, University of Alaska, University of Tennessee, and Clemson University. Key industry partners include all major US automotive manufacturers and suppliers. The Automotive Research Center (ARC) formulates and evaluates advanced automotive technologies and advances state-of-the-art modeling and simulation for the Army's future ground vehicle platforms.

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

Work in this project is performed by TARDEC, Warren, MI.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Automotive Research Center (ARC): In FY08, performed unique advanced evaluation validation of optimized ground vehicle models to assure proper predictions relative to actual real-world conditions. In FY09, extend the applicability of the advanced automotive models to future Army ground vehicle requirements to address elevated temperatures, increased terrain severity, ultra-reliability and general new global embedded constraints. Perform new extended model validations of these broadened areas of Army ground vehicle automotive models, using advanced instrumentation and efficient state-of-the-art data analysis procedures.	2.798	2.862	2.941	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will explore and develop mobility and propulsion models for unmanned ground vehicles; will develop more detailed vehicle thermal management models for hybrid electric tactical ground vehicles; and will study the feasibility of advanced materials for reducing Army ground vehicle weight while meeting survivability needs with a focus on improved fragmentation protection models.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.078	.000	
Total			2.798	2.940	2.941	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J08: INSTITUTE FOR CREATIVE TECHNOLOGY	7.230	7.673	7.791						Continuing	Continuing

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

This project supports simulation and training technology research at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. The ICT was established to support Army training and readiness through research into simulation and training technology for applications such as mission rehearsal, leadership development, and distance learning. The ICT actively engages industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology and serves as a means for the military to learn about, benefit from, and facilitate the transfer of applicable entertainment technologies into military systems. The ICT also works with creative talent from the entertainment industry to adapt concepts of story and character to increase the degree of participant immersion in synthetic environments and to improve the realism and usefulness of these experiences. Creating a true synthesis of the creativity, technology, and capability of the industry and the research and development community is revolutionizing military training and mission rehearsal by making it more effective in terms of cost, time, range of experiences that can be trained or rehearsed, and the quality of the result. This project accomplishes this by performing basic research in modeling and simulation in accordance with the core competencies for the ICT University Affiliated Research Center (UARC).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Graphics and Sound:                      Research will improve computational techniques in graphics for achieving real-time photo-realistic rendering of physical and synthetic environments for training and simulations. Research into auditory aspects of immersion will provide the sound stimulus for increasing the realism for military training and simulation devices.                      In FY08, implemented hybrid three-dimensional audio system to create perception of auditory depth in mixed reality environments. Developed facial and body animation techniques that can capture a person and then re-light and re-animate him or her in new environments.                      In FY09, explore concepts for facial and body animation controlled by avatars in real time and investigate methods for development of virtual speakers in immersive environments.                      In FY10, will investigate technologies for near-photo real, life-like characters.</p>	1.618	1.668	1.743	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers		<b>PROJECT NUMBER</b> J08	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Immersive Environments:                      Conduct basic research in immersive environments, to include virtual humans, three dimensional (3D) sound and visual media, to achieve more efficient and affordable training, modeling, and simulation solutions. Research includes investigation of techniques and methods to address the rapid development of synthetic environments that can be used for mission rehearsal and training of military operations.                      In FY08, created custom, multi-view, holograph-like display solutions.                      In FY09, investigate use of emerging technologies, such as wide-field head mounted displays and interactive soundscapes to create immersive environments.                      In FY10, will develop semi-automatic environment setup and alignment system that will allow rapid setup and configuration of immersive environments.</p>	2.785	2.874	3.001	
<p>Techniques and Human-virtual Human Interaction:                      In FY08, investigated techniques for appropriate modeling and social schema for avatar-based crowd behaviors.                      In FY09, assess adequacy of virtual human models against models of human behavior and use feedback to guide further research. Develop tools and techniques to speed creation and adaptation of virtual humans.                      In FY10, will investigate technologies allowing virtual humans to sense a person's gestures or facial expressions. Develop new virtual human cognitive architecture.</p>	2.827	2.916	3.047	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.215	.000	
<b>Total</b>	<b>7.230</b>	<b>7.673</b>	<b>7.791</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J12	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J12: Institute for Soldier Nanotechnology (ISN)	9.562	10.063	10.265						Continuing	Continuing

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

This project supports sustained multidisciplinary nanotechnology research for the Soldier at the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology. The ISN emphasizes revolutionary materials research for advanced Soldier protection and survivability. The ISN works in close collaboration with the Army Research Laboratory (ARL), the Army's Natick Soldier Center (NSC), and other Army Research Development and Engineering Command (RDECOM), as well as several major industrial partners including Raytheon and DuPont, in pursuit of its goals. The institute is designated as a University Affiliated Research Center (UARC) to support research to devise nanotechnology-based solutions for the Soldier. This research emphasizes revolutionary materials research toward an advanced uniform concept. The future uniform will integrate a wide range of functionality, including ballistic protection, responsive passive cooling and insulating, screening of chemical and biological agents, biomedical monitoring, performance enhancement, and extremities protection. The objective is to lighten the Soldier's load through system integration and multifunctional devices while increasing survivability. The new technologies will be compatible with other Soldier requirements, including Soldier performance, limited power generation, integrated sensors, communication and display technologies, weapons systems, and expected extremes of temperature, humidity, storage lifetimes, damage, and spoilage.

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

Work in this project is performed extramurally by the Army Research Lab (ARL) in Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Soldier Protection: Conduct research on Soldier Survivability and Protection and Nanosystems Integration. In FY08, investigated nanoengineered electronic devices for sensing. In FY09, explore chemical sensing based upon nanoelectronic building blocks; to improve the function of cell-based biosensors, switchable surfaces will be created to facilitate the patterned adhesion of various cell types allowing control of the spatial location of multiple cell types relative to each other; derivatization of hyperbranched poly-electrolytes designed for virucidal applications and the incorporation of these coatings onto surfaces using layer-by-layer techniques. In FY10, will develop strategy for electrical contacts for optoelectronic fibers; testing of virucidal coatings for activity and toxicity and elucidation of mechanism of virucidal action; demonstrate amplifying fluorescent chemical sensing devices with plasmon-mediated electrical transduction to produce resistivity-based chemical sensing.	2.316	2.485	2.618	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers		<b>PROJECT NUMBER</b> J12	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Nanomaterials:            Conduct research in light-weight, multifunctional nanostructured fibers and materials.            In FY08, devised a theory of a new type of "lasing" based on stimulated emission of hypersound in dual band gap (sound and light) composite polymeric structures; identified optimized structures for photon (light) flow control, and measured sound propagation in select materials.            In FY09, use Monte Carlo simulation methods to optimize 2-D and 3-D structural configurations for simultaneous control of light and sound propagation and reflection; fabricate desired structures by interference lithography and test the resulting materials for the directional dependence of energy flow. Devise mechanically robust initiated chemical vapor deposition coatings fully compatible with electro-spun mats that provide high surface area and a diversity of substrate materials.            In FY10, will prepare nanostructures with unique, controlled sizes and shapes for sensing light; continue development of microfluidic reactor for the synthesis of complex, engineered nanostructured quantum dots; engineering and functionalization of carbon nanotubes (CNTs) to enhance ability of CNTs to generate photocurrents following absorption in the infrared and visible spectra,; continue development of an acoustic fiber having acoustic wave detection and modulation capabilities.</p>	2.378	2.485	2.598	
<p>Blast Effects on Soldier:            Conduct research in Battle Suit Medicine and Blast and Ballistic Protection.            In FY08, conducted low rate mechanical testing of mechanical energy absorption for promising polymers.            In FY09, explore relation of molecular structural features to resultant toughness, including high strain rate testing; development of polymeric nanostructures by synthesis of high molecular weight conducting polymers resulting in superior molecular actuation; determine critical biosensory signatures of inflammatory reaction for integration into multiplexed microfluidic sensing system; develop methodologies to quantitatively assess the mechanical properties of hard nanostructured biocomposites and to measure local property gradients and heterogeneity.            In FY10, will develop models predicting transdermal transport in skin and investigate various transport pathways and mechanisms; design of nanosized micellar structures formed as a block copolymer thin film on surfaces and interfaces for non-invasive drug delivery; tethering of amplified fluorescent polymers for pre-symptomatic biosensing system via polymeric nanocoatings deposited by chemical vapor deposition; portable electro-microfluidic devices for real-time medical monitoring, modeling and simulation of the next-generation of "induced charge electro-osmosis" nanoscale fluid flow regimes; flexible armor based on grapheme chainmail structures.</p>	4.868	4.811	5.049	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.282	.000	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers		<b>PROJECT NUMBER</b> J12	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Total	9.562	10.063	10.265	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J13	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J13: UNIVERSITY AND INDUSTRY INITIATIVES (CA)	25.339	30.001	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for University and Industry Initiatives.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Nanotubes Optimized for Lightweight Exceptional Strength Composite Materials						2.704	2.325	.000		
Electron Microprobe Research						1.449	.000	.000		
Visualization for Training and Simulation in Urban Terrains						1.082	1.162	.000		
Center for Information Assurance						.773	.775	.000		
National Network Security Test Bed						1.545	.000	.000		
Infotonics Research						2.318	.000	.000		
Florida Collaborative Development of Advanced Materials for Strategic Applications						.918	1.162	.000		
Integrated Systems in Sensing, Imaging and Communications						.773	.000	.000		
Nanosensor Stagegate Accelerator						1.600	1.163	.000		
Transparent Nanocomposite Armor						.290	.000	.000		
Center of Excellence In Industrial Metrology & 3D Imaging Research						1.546	.000	.000		
Development of Enabling Chemical Technologies for Power from Green Sources						1.546	1.162	.000		
Manufacturing and Industrial Technology Center						.967	.775	.000		
Nanoscale Biosensor Research						2.416	2.422	.000		
Research Support for Nanoscale Sciences and Technologies						.967	.000	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers		<b>PROJECT NUMBER</b> J13	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Detecting and Eradicating Corrosion in Army Vehicles			1.159	.000	.000
MEMS Antenna for Wireless Comms/UAVs			2.319	2.325	.000
Center for Education in Nanoscience and Nanotechnology			.000	.620	.000
Modeling and Analysis of the Response of Structures			.967	.000	.000
Novel Methods for Detecting and Inhibiting Corrosion			.000	1.318	.000
Center for Nanoscale Bio-Sensors as a Defense Against Biological Threats to America			.000	.775	.000
Academic Support and Research Compliance for Knowledge Gathering			.000	1.938	.000
Large Area Monitoring Network (LAMNET)			.000	5.814	.000
Western Hemisphere Security Analysis Center (WHSAC) (pending transfer to 643779)			.000	1.550	.000
Ink-Based Desktop Electronic Material Technology (pending transfer to 622624)			.000	1.550	.000
Norfolk State University Center for Modeling and Simulation			.000	2.325	.000
SBIR/STTR			.000	.840	.000
Total			25.339	30.001	.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J14	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J14: ECYBERMISSION	4.706	5.228	5.273						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
<p>This project supports eCYBERMISSION, a nation-wide, web-based, science, technology, engineering and mathematics (STEM) competition designed to stimulate interest and encourage continued education in these areas among middle and high school students nationwide. The project supports Army Transformation by providing a pool of technologically literate citizenry that potentially grow to become future Soldiers and civilians for the Army workforce of tomorrow.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan, the Department of Defense Basic Research Plan, and the President's initiative for education.</p> <p>Work in this project is executed by the U. S. Army Research, Development and Engineering Command (RDECOM).</p>										
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
FY08: Completed a full-scale competition to all middle school (grades 6-8) and high school (9th grade) students across the country and Department of Defense Educational Activity (DoDEA) schools. Increased student and teacher participation.						4.706	5.081	5.273		
FY09: Sustain eCYBERMISSION and implement enhancements as necessary based on lessons learned from previous years. Seek to increase team participation.										
FY10: Will continue to seek increased participation from existing levels and to increase geographic diversity and will sustain eCYBERMISSION and implement enhancements based on lessons learned from previous years.										
Small Business Innovative Research/Small Business Technology Transfer Programs						.000	.147	.000		
Total						4.706	5.228	5.273		
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>										
N/A										
<b><u>D. Acquisition Strategy</u></b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
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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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J15: NETWORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	6.941	7.889	8.146						Continuing	Continuing

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

This project supports a competitively selected United States (US)/United Kingdom (UK) government, university, and industry consortium established to perform fundamental network and information science research in the areas of network theory, system-of-systems security, sensor processing and delivery, and distributed coalition planning and decision making. The focus is on enhancing distributed, secure, and flexible decision-making to improve coalition operations, and developing the scientific foundations for complex and dynamic networked systems-of-systems to support the complex human, social, and technical interactions anticipated in future coalition operations. The US Army Research Laboratory (ARL) and the UK Ministry of Defense (MOD) established a jointly funded and managed US and UK consortium, to be known as an International Technology Alliance (ITA) on Network and Information Sciences in FY06. The goal is fundamental science breakthroughs to enable superior coalition operations. Emphasis is on integration of multiple technical disciplines in an international arena. This program supports the future force transition path of the Transformation Campaign Plan (TCP).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Network and information science basic research for US/UK coalition operations. In FY08, investigated mathematical frameworks to model the structure/behavior of wireless networks to establish theoretical limits on capacity, scalability, reliability, and energy-efficiency to understand the performance of command-and-control, sensor, and communication coalition networks. Designed protocols for automated policy negotiations and tools for refining high-level user-specified goals into low-level setting of components in coalition environments. Devised and validated analytical networked fusion architectures based on semantic information. In FY09, investigate models, theory, and algorithms for creating self-organizing wireless networks inspired by highly adaptive biological systems. Investigate cognitive and socio-cultural factors on coalition command processes and coalition networks to enhance situational awareness and decision-making. Establish and validate analytic frameworks, leading to tradeoffs between sensing, computing, communications, and actuation, for classes of wireless sensor networks.	6.941	7.668	8.146	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers		<b>PROJECT NUMBER</b> J15	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will devise efficient robust resource usage algorithms for operations without centralized control, and with inaccurate knowledge of operating conditions for enhanced network capabilities. Investigate trust models to ensure distributed sensor data fusion under uncertainty. Devise agent reasoning models and agent interaction models & algorithms to allow for effective agent support for human ad hoc teams in time stressed environments.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.221	.000	
Total	6.941	7.889	8.146	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J16	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J16: NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	2.876	2.985	.000						Continuing	Continuing

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

This project conducts basic research in nano and micro technologies to improve the performance and effectiveness of portable electronic equipment for the warfighter. This will be accomplished by reducing power and weight while increasing real-time interactivity of vital information content between the warfighters and their environment. The Center for Nanotechnology and Microelectronics (CNAM) is a university research effort focusing on the development and application of nanotechnology that can be integrated with microelectronic systems while not duplicating existing nanoelectronics research programs. The objective is to accelerate the deployment of nanotechnology for military applications by focusing on applications where nanotechnology complements rather than replaces microelectronics. The research program will concentrate on four technology areas focused on resolving key issues associated with military applications of microelectronics and power electronics. Research thrusts include: 1) Thermal Management - the removal of heat from electronics and power electronics is the primary limit on the performance of small devices. Nanotechnology may improve the performance of thermal management systems by enhancing the cooling properties of materials, interfaces, and fluids for microelectronics; 2) Hybrid nano/micro structures and devices - bottom-up self-assembly of nanoscale components onto/into microelectronic platforms can lead to electronic components that integrate nanoscale optical interconnects, produce significantly less waste heat, and integrate on-board sensing; 3) Nanotechnology-enhanced transparent electronic materials - transparent materials can be used for microelectronics, increasing the designers flexibility in integrating microelectronics into other systems; 4) Active Cooling - nanotechnology-based active cooling technology such as high efficiency thermoelectric coolers and nano-enhanced adsorption/desorption cooling can, in theory, cool microelectronics to temperatures below ambient or even to cryogenic temperatures, thus improving performance.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.084	.000	
Research thrusts include thermal management, hybrid nano/microstructures and devices, nanotechnology-enhanced transparent electronic materials, and active cooling for improved portable warfighter electronic equipment. In FY08, researched specialized thermal management techniques to provide improved cooling of Army systems through the	2.876	2.901	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
fabrication of materials with superior thermal conductivity and functionalized thermal interfaces to enhance heat transfer; researched novel nano-technology based sensors and electronics devices, including potentially lower power systems; studied nanotechnology-enhanced transparent electronic materials that may improve portable and flexible display technology; investigated advanced nanotechnology-enhanced cooling techniques including thermoelectric and adsorption/desorption cooling. In FY09, will implement thermal management techniques that provide improved thermal conductivity and will study methods to functionalize the thermal interfaces to improve heat transfer; will fabricate novel nano-electronics for low power sensors and systems; will study nanotechnology-enhanced electronic materials that provide superior electrical capabilities; will research advanced nanotechnology-enhanced cooling techniques including thermoelectric and adsorption/desorption				
Total	2.876	2.985	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J17	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J17: VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE	1.918	2.026	2.044						Continuing	Continuing

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

This project is for Vertical Lift Research Center of Excellence to couple state-of-the-art research programs with broad-based graduate education programs at academic institutions with the goal of increasing the supply of scientists and engineers who can contribute to Army Transformation. Work will provide research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.056	.000	
Vertical Lift Research Center of Excellence: In FY08, investigated interactional aerodynamics for noise prediction of heavy lift rotorcraft configurations, investigated anti-icing and erosion protection systems for rotor blades, investigated high-lift airfoil concepts for delaying dynamic stall onset and reducing adverse pitching moments; and developed data fusion and biomimetic materials for rotorcraft health monitoring systems. In FY09, develop light-weight high-flexibility rotorcraft shafts using flexible matrix composites and active bearing controls; and develop efficient and affordable joining concepts for high-stiffness, light-weight composites. In FY10, will design and fabricate robust wind tunnel testing system for rotating icing environment tests; will build and test active trailing edge flaps rotor configurations for reducing rotor vibrations, power, and noise; will investigate the performance improvements in the tip/casing region of ducted fan systems; and will demonstrate health monitoring capability of hybrid carbon-fiber/carbon-nanotube epoxy composites.	1.918	1.970	2.044	
<b>Total</b>	1.918	2.026	2.044	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers	<b>PROJECT NUMBER</b> J17
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J19		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
J19: Automotive Research Center (ARC) Initiatives (CA)	3.479	.000	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding provided for Automotive Research Center (ARC) initiatives.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
University-based Automotive Research								1.933	.000	.000	
NAC University Automotive Research Coalitions								1.546	.000	.000	
Total								3.479	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers					<b>PROJECT NUMBER</b> J22	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J22: NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER	.000	4.983	9.330						Continuing	Continuing

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

This project funds the establishment of the Network Science and Technology Research Center (NSTRC). The NSTRC will be competitively awarded and managed by the Army Research Laboratory (ARL). ARL researchers, with partners at other sites, will collaborate in a virtual center environment. There will be an effort undertaken to include additional partners such as universities, industry, and other government agencies. Network Science is the study of network representations of physical, biological, and social phenomena leading to predictive models of these phenomena. As such, network science may be seen as the cornerstone for future military operations and the conduct of network-centric warfare. The mission of this center will be to strengthen the theoretical underpinnings of network science; conduct basic research on how and why biological and social (non-physical) networks function and determine their applications to military networks; to manage the activities in network science research, technology development, and network experimentation for the Army; to focus science and technology investments to enable network-centric operations and warfare; to focus applied science and technology to enable social networks important to Army operations; and to enable the development of network science applications and facilitate their transition to Army and Joint operations. Network science, technology, and evaluations encompasses all information and information exchange, visualization, collaboration, manipulation, protection, restoration, transport, services, data storage, and application layers, including the knowledge that human use of networks is a critical component. Establishment of the center will require a phased approach capable of supporting development of fundamental network theory and network technologies, and carry out the assessment of impacts upon human performance; the integration of new technologies and social networks into capabilities; and experimentation as a means to test and confirm fundamental theories and predictive models and/or characterize new technologies and operational concepts while also being capable of promoting training of personnel when applicable. Unlike the Training and Doctrine Commands on-going efforts within their centers, schools, and battle-labs, the focus of the NSTRC will be to develop the framework to perform research important to the Army in the areas of modeling, simulation and testing of very large networks, command and control of joint/combined networked forces, impact of network structure on organizational behavior, security and information assurance of networks, swarming behavior, and managing network complexity. It will also have a significant focus on and investment in the discovery and foundational aspects of the science of networks both human engineered and biologically evolved.

Work on this project is coordinated with and complementary to the work at the United States Military Academy (USMA) Basic Research Network Science Center funded under PE 0601104/project H59.

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 will be performed primarily extramurally with a small intramural effort by the Army Research Laboratory (ARL) in Adelphi, MD.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 1 - Basic Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0601104A University and Industry Research Centers			<b>PROJECT NUMBER</b> J22
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Network Science and Technology Research Center (NSTRC):                      Research in the broad area of network sciences technology is performed at various government agencies, industries and universities across the country. The future Army will have to take advantage of a multitude of new technologies to network the force and create a decisive warfighting advantage. The challenges will be to select, on the basis of their technical merit and applicability, those technologies best able to resolve identified technology shortfalls.                      In FY09, establish the NSTRC capability through a multitude of geographically diverse, interdisciplinary researchers working collaboratively on military network research issues, using shared or existing resources, and exploiting advances in computing, communications, collaboration, and other information technologies to make research and technology development efficient and seamless.                      In FY10, will develop diagnostic models and methods to advance the science of social/cognitive networks. Establish a synergistic framework for physics-based and human-based information fusion. Will develop models of mobile ad hoc networking to define interactions and behavior among information networks.</p>		.000	4.843	9.330	
Small Business Innovative Research/Small Business Technology Transfer Program		.000	.140	.000	
Total		.000	4.983	9.330	
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602105A MATERIALS TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	60.261	80.937	27.206						Continuing	Continuing
H7B: Advanced Materials Initiatives (CA)	41.876	56.035	.000						Continuing	Continuing
H7G: NANOMATERIALS APPLIED RESEARCH	4.763	4.993	5.138						Continuing	Continuing
H84: MATERIALS	13.622	19.909	22.068						Continuing	Continuing

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

The objective of this program element (PE) is to provide materials for lighter weight and more survivable armor and more lethal armaments. This PE supports the design, development, and evaluation of nanostructure materials (project H7G); design, development and evaluation of materials for more survivable and lighter weight armor and armaments (project H84). Project H7B funds congressional special interest items.

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) and applies it to specific Army platforms and the individual Soldier.

The work is related to and fully coordinated with efforts in PE 0602618A (Ballistics Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602782A (Command, Control, Communications Technology), PE 0602786A (Warfighter Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), PE 0603008A (Command, Control, Communications Advanced Technology), and PE 0708045A (Manufacturing 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 performed by the Army Research Laboratory (ARL), Adelphi, MD and Aberdeen Proving Ground, MD.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	64.517	26.985	28.384	
Current BES/President's Budget	60.261	80.937	27.206	
Total Adjustments	-4.256	53.952	-1.178	
Congressional Program Reductions	.000	-2.268		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	56.220		
Total Reprogrammings	-2.854	.000		
SBIR/STTR Transfer	-1.402	.000		

**Change Summary Explanation**

FY 2009 increases are due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY					<b>PROJECT NUMBER</b> H7B	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H7B: Advanced Materials Initiatives (CA)	41.876	56.035	.000						Continuing	Continuing

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

Congressional Interest Item funding provided for Advanced Materials Initiatives.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Future Affordable Multi-Utility Materials for the Army Future Combat Systems	6.183	6.200	.000	
Cold Spray Wear Coating for FCS	.966	.000	.000	
Dual Stage Variable Energy Absorber	.000	2.325	.000	
Affordable Light-Weight Metal Matrix Composite Armor	.000	1.550	.000	
Lightweight Anti-Ballistic Protection for Aircraft	.000	.388	.000	
Control System for Laser Powder Deposition	.386	.484	.000	
Advanced Ceramic Surface Engineering for Helicopter Compressor Blades	2.318	.000	.000	
Improvised Explosive Device Simulation in Different Soils	.386	.484	.000	
Nanomanufacturing of Multifunctional Sensors	1.546	.969	.000	
Advanced Lightweight Transparent Armor for Tactical Wheeled Vehicles and Force Protection	.773	.000	.000	
Advanced Materials Development and Manufacturing of Body Armor	1.932	.000	.000	
3D Woven Ballistic Materials for Future Combat Systems	1.932	.000	.000	
Protection Against Improvised Explosive Devices	3.864	.000	.000	
Lightweight Motors for the Future Combat System	1.546	.000	.000	
Nickel Boron Coating-Technology for Army Weapons	2.319	2.325	.000	
Novel Extremity Body Armor	.465	.581	.000	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY			<b>PROJECT NUMBER</b> H7B	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Polymer Center of Excellence for Blast-Ballistic Protective Armor			1.933	.000	.000	
Project Kryptolite			1.160	1.163	.000	
Ultra Lightweight Metallic Armor			1.546	.000	.000	
Ultra-Endurance Coating			2.319	3.488	.000	
Complex-shaped Armor for Soldier Torso and Extremity Protection			1.933	.000	.000	
Multi-scale Modeling of Impact Resistant Materials for Body Armor			1.450	.000	.000	
Titanium Fabrication for Military/Industrial Equipment			1.306	.000	.000	
One-Step JP-8 Bio Diesel Fuel			4.348	1.550	.000	
Nanotechnologies Initiative			1.265	.000	.000	
Composite Applied Research and Technology for FCS and Tactical Vehicle Survivability			.000	2.906	.000	
Capability Expansion of Spinel Transparent Armor Manufacturing			.000	4.960	.000	
Ultrasonic Consolidation for Armor Applications			.000	1.162	.000	
Ultrasonic Impact Technology			.000	1.162	.000	
Lightweight Transparent Armor for Force Protection			.000	1.938	.000	
Next Generation Protective Seat			.000	2.325	.000	
Unmanned Ground Vehicle Advanced Technology Development			.000	2.422	.000	
Development of Improved Lighter-Weight IED/EFM Armor Solutions			.000	.969	.000	
Modeling and Testing of Next Generation Body Armor			.000	1.938	.000	
Advanced Conductivity Program (ACP)			.000	3.391	.000	
Ballistic Armor Research			.000	3.100	.000	
Lattice Block Structures for AM2 Matting Replacement			.000	2.422	.000	
Moldable Fabric Armor			.000	1.164	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY		<b>PROJECT NUMBER</b> H7B	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Renewable Jet Fuel from Lignocellulosic Feedstocks	.000	3.100	.000	
SBIR/STTR	.000	1.569	.000	
Total	41.876	56.035	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY					<b>PROJECT NUMBER</b> H7G	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H7G: NANOMATERIALS APPLIED RESEARCH	4.763	4.993	5.138						Continuing	Continuing

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

The objective of this project is to support the design, development, and evaluation of nanostructure materials that improve the Soldier's survivability, lethality, and sustainability. 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.

The work is a collaborative effort between the ISN at the Massachusetts Institute of Technology, the Army Laboratories and Research, Development, and Engineering Centers, and the ISN industrial partners.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Nanomaterials Applied Research: Devise and validate improved, physics-based, materials property models, and concepts for multifunctional, lightweight and responsive hierarchical material technologies, and 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 program's protection capabilities. Coordinated research program conducted internally by ARL and externally through a collaborative effort with ISN and ISN industry partners. FY08: researched technologies to enable multifunctional designs utilizing multiple nanomaterial constituents. FY09: validate performance enhancements (survivability, lethality, sustainability) enabled through insertion of nanomaterials constituents in scalable processes. FY10: will examine concepts for the absorption of energy in personnel protection applications.	4.763	4.880	5.138	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.113	.000	
<b>Total</b>	<b>4.763</b>	<b>4.993</b>	<b>5.138</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY					<b>PROJECT NUMBER</b> H84	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H84: MATERIALS	13.622	19.909	22.068						Continuing	Continuing

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

The objective of this project is to support the design, development and evaluation of materials for more survivable and lighter weight armor and armaments. This project provides the technical foundation for materials technology in metals, ceramics, polymers, and composites. This project will address the needs for more survivability and lighter weight armaments through: nanomaterials research across the spectrum of applications to improve performance; improved, physics-based, material, mechanical, and structural models; high strain rate material characterization techniques; non-destructive inspection/evaluation technologies; new high strength/temperature materials and coatings; and advanced fabrication/processing methodologies. Applied research efforts are focused on armor/armament materials, as well as lightweight structural/electronic materials and materials affording protection against chemical, biological, or directed energy threats. Overarching goals of this material research are to provide optimized lightweight armor structures, improved affordable processing methods, and the development of modeling and simulation tools to facilitate future design efforts in support of current and future force systems.

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.

The work is conducted by the Army Research Laboratory (ARL), at its Aberdeen Proving Ground, MD, and Hampton, VA, locations.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Nanomaterials: 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. In FY08, performed parametric processing studies of advanced nanomaterial compositions; applied modeling results to the maturation of reactive materials; assessed and validated performance of nanoengineered composite materials for survivability and lethality applications. In FY09, scale-up the process methodology for fabricating fully-dense, boron carbide plates; perform microstructural and mechanical property characterization. In FY10, will develop relationships between scaled-up processing of nanoscale materials and processing; will characterize reactive materials and will provide feedback to model developers.	1.260	1.346	1.390	
Composites:	4.165	4.198	4.118	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY		<b>PROJECT NUMBER</b> H84	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Design, validate, and optimize advanced materials (ceramic, composite, polymers, lightweight and high-strength metals) and processing techniques for smaller but more lethal penetrators/warheads and affordable, lightweight high performance armaments for revolutionary weapons effectiveness in urban and irregular operations. In FY08, explored micro-mechanics effects of blast and impact shock on prospective warhead and projectile materials; examined methods for controlled fragmentation of projectile body materials; fabricated long metal matrix composite (MMC) sections with advanced liner material and performed full scale validation of MMC tube. In FY09, design material system to provide the desired multi-functional capability to enhance damage on relevant targets and conduct benchmark testing with that material system. In FY10, will develop novel nano-micro-structures in metallic materials; will characterize microstructures and high and low rate properties; and will identify effect of parameters leading to shear in plastically deformed metals.				
Electronic Materials: Design and optimize electro-ceramic materials and processing techniques for integration by the Communications and 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. In FY08, designed and proved a materials reactor to grow thin films for tunable devices; characterized microstructural, interfacial and surface properties of the grown films. In FY09, develop unique growth process science to achieve compositionally graded ferroelectric oxide thin film materials and integrate the material into a specialized device structure. In FY10, will develop methodologies to enable low defect synthesis of ferroelectric oxide thin film materials for high quality factor/low insertion loss devices; will evaluate and develop methodologies to enable materials for Complementary Metal-Oxide Semiconductor (CMOS) compatible low cost integration; and will employ theoretical formalisms to aid the design of materials for tunable device components.	.500	.500	.497	
Structural Armor: Optimize lightweight armor materials/structures, processing methodology, and modeling and simulation tools to enable formulation of lightweight, frontal, and structural armors. In FY08, devised processing capabilities to fabricate multi-layer and hybrid materials; proved ballistic multi-hit capability while maintaining single hit performance; showed capability to fabricate constant-radius, curved, transparent ceramic plates, and applied advanced polishing techniques.	5.047	5.002	5.341	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY		<b>PROJECT NUMBER</b> H84	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, evaluate transparent armors and multi-layer/hybrid materials options against current and emerging threats; provide computational models and simulations of lightweight air supported structures that allow for improved planning, and reduce the number of test coupons needed to develop new lightweight highly mobile medical tent systems. In FY10, will optimize glass-ceramic laminate transparent composite materials at reduced weight; and will examine interlaminar properties of multilaminate materials to optimize performance and reduce weight.				
<b>Soldier Borne Armor:</b> Optimize lightweight armor materials and defeat mechanisms against emerging threats to enable affordable design of multifunctional ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in new lethal mechanisms/protection schemes for the individual warfighter. In FY08, showed simulation capability for multiple density target with complex projectile failures; and incorporated low density surrogate and multi-density range targets into assessment methodology. In FY09, increase fidelity of simulation capability and transition second generation protection/lethality concepts to development community. In FY10, will develop and formulate materials that allow for optimal ballistic performance from low, intermediate, and high velocity impacts and blast waves and refine three dimensional reinforcement concepts for composite materials.	2.650	2.730	2.779	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.140	.000	
<b>Multifunctional Armor:</b> Armor Materials (Material technologies for Soldier personnel protection will be transitioned to PE 0602786/project H98, materials for reactive armor and electromagnetic armor concepts will be used in PE 0602618/project H80, and refined in PE 0602601/project C05): In FY09, investigate composite ceramic materials to increase body armor performance while reducing weight. For ground combat and tactical wheeled vehicles, design and assess materials for reactive armor effectors to reduce fratricide and increase performance. For electromagnetic armors: develop materials capabilities for better coils and field adaptability to reduce weight and increase performance. Design and develop multifunctional materials for hybrid armor systems that provide dual threat protection capability against kinetic energy and chemical energy threats. In FY10, will characterize ceramic materials for high strain rate/shock properties; will examine the tradeoff of stiffness versus damage tolerance in materials systems by quantifying constitutive property behaviors; and will complete investigation/design of material properties for reactive armor effectors and electromagnetic armors coils.	.000	5.993	7.943	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602105A MATERIALS TECHNOLOGY		<b>PROJECT NUMBER</b> H84		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Total	13.622	19.909	22.068		
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602120A Sensors and Electronic Survivability					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	61.180	75.299	50.641						Continuing	Continuing
H15: GROUND COMBAT ID TECH	5.798	13.008	7.839						Continuing	Continuing
H16: S3I TECHNOLOGY	18.611	19.450	19.567						Continuing	Continuing
SA1: Sensors and Electronic Initiatives (CA)	22.463	29.304	.000						Continuing	Continuing
SA2: BIOTECHNOLOGY APPLIED RESEARCH	4.361	5.732	5.799						Continuing	Continuing
SA3: COMBAT IDENTIFICATION COMPONENT TECHNOLOGIES (CA)	2.319	.000	.000						Continuing	Continuing
TS1: TACTICAL SPACE RESEARCH	1.605	1.631	1.661						Continuing	Continuing
TS2: ROBOTICS TECHNOLOGY	.000	.000	15.775						Continuing	Continuing
140: HI-POWER MICROWAVE TEC	6.023	6.174	.000						Continuing	Continuing

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

The objective of this program element (PE) is to provide research and evaluation of sensors and electronic technologies that will enhance survivability, lethality, deployability, and sustainability capabilities. Focus is on research that will provide high-power electronic components and technologies for compact, light-weight power and energy storage, power and energy conversion, and conditioning and radio frequency (RF)/microwave directed energy (DE) weapons (Project 140 - moves to PE 0602705A in FY10 and FY11); research that will provide the ability for joint fires to locate, identify, track, and engage targets as necessary with the overall goal of increasing lethality and survivability through the reduction of fratricide (project H15); research on sensor, signal, and information processing technology for advanced reconnaissance, surveillance, and target acquisition (RSTA) (project H16); 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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability
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Massachusetts Institute of Technology and their industry partners (project SA2); research and evaluation of space-based remote sensing, signal, and information processing technology 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 TS1); research on advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors, human-robot interaction, robotic manipulation, and unique mobility for unmanned vehicles (project TS2). Projects SA1 and SA3 fund congressional special interest items.

Work in this program element (PE) is related to and 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 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0603006A (Command, Control, Communications Advanced Technology), and PE 0603008A (Command Electronic Warfare 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.

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

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	62.910	46.147	40.993	
Current BES/President's Budget	61.180	75.299	50.641	
Total Adjustments	-1.730	29.152	9.648	
Congressional Program Reductions	.000	-.248		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	29.400		
Total Reprogrammings	-.524	.000		
SBIR/STTR Transfer	-1.206	.000		

**Change Summary Explanation**

FY09 increase is due to congressional adds.

FY10 have net increases as funding was transferred from PE 0602618A, project H05 (Robotics Technology), and funding was transferred to PE 0602705, project EM8 (Hi-Power Microwave).

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> H15	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H15: GROUND COMBAT ID TECH	5.798	13.008	7.839						Continuing	Continuing

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

The objective of this project is to research and investigate emergent combat identification (CID) technologies for Joint, allied, and coalition air-to-ground and ground-to-ground mounted, dismounted, forward observer, and forward air controller missions. Efforts include research on enabling technologies to demonstrate a common battlespace picture for joint 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.

Efforts in this project are coordinated with PE 0603270A (EW Technology), PE 0602270A (EW Techniques), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), and other Services, allies and coalition partners as necessary.

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 performed by the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Multi-Intelligence Data Fusion and Targeting:</b> This effort investigates and develops software technologies for intelligence/battle command enterprise collaboration that enable the enterprise to identify, fuse, trace/track specific human targets in an asymmetric environment. In FY10, will develop data extraction tools to incorporate political military economic social information infrastructure and behavior modeling data into a Distributed Common Ground System - Army (DCGS-A) compliant multi-intelligence correlation service and integrate imagery and video data products for additional fidelity; will develop a video-based tracker service for real-time and forensic viewing and analysis; will functionally map battle command mission tasks with the needed intelligence and geospatial data and collection opportunities.	.000	.000	3.694	
<b>Fusion Based Technologies:</b> This effort develops a knowledge generation capability to provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations.	1.165	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> H15	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, developed expanded set of representations for different types of enemy tactics to handle more complex scenarios including the prediction of locations of specific types of asymmetric attacks using real data. Related work is also accomplished under PE 0602270A/project 442, PE 0602270/project 906, and PE 0603772A/project 243.				
<p>Combat Identification (CID) for Light Weight Tactical Vehicles: This effort researches the miniaturization of real time NATO interoperable CID technologies for current force light weight tactical vehicles that will have potential for Soldier CID.</p> <p>In FY09, investigate technologies to reduce the size, weight, cost, and power consumption of the processor, transceiver, and antenna components for the NATO interoperable Battlefield Target Identification Device (BTID) system for implementation on High Mobility Multi-Wheeled Vehicles; investigate large capacity field programmable gate arrays to reduce the processor and transceiver sizes; develop and demonstrate novel millimeter wave (mmW) antenna designs that produce a similar shaped antenna pattern within a smaller, lower profile configuration; and investigate approaches for target ID correlation. Related work is also accomplished under PE 0603270A/project K15.</p>	.000	5.068	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.338	.000	
<p>Combat Identification (CID) Technologies: Focus of this effort is to develop and evaluate potentially cost effective CID approaches that reduce fratricide, increase situational awareness (SA), and increase combat effectiveness of Soldier based and Brigade Combat Team (BCT) CID technologies.</p> <p>In FY08, conducted final technical testing of representative models of Geometric Pairing (GP) and Radio Frequency (RF) tag technologies in a high fidelity lab environment and final technical testing of millimeter wave (mmW) identification (ID) application specific integrated circuits (ASIC) in a high fidelity lab facility; completed regression tests of mmW ID ASICs to validate compliance with NATO Standardization Agreement, (STANAG) 4579; conducted virtual experiments with hardware in the loop for Brigade Combat Team (BCT) ground-to-ground technologies.</p> <p>In FY09, develop an integrated approach for a network enabled architecture to provide CID capability to Soldiers and close air support/strike aircraft; investigate embedding CID waveforms in the Joint Tactical Radio Systems; investigate non cooperative technologies for foe and neutral identification in a battlefield environment; investigate RF tags for air to ground Situational Awareness (SA) applications; develop a consolidated target identification and SA data display.</p> <p>In FY10, will assess technologies for incorporation into a universal/multi-platform CID capability. Candidate technologies include the Soldier Radio Waveform (SRW), Laser/RF Time Difference of Arrival (TDOA), and Geometric Pairing techniques at point of detection/response; will demonstrate CID/SA data display.</p>	1.836	7.602	4.145	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> H15	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Cueing Sensor: This effort develops low cost infrared sensors that detect rocket propelled grenades, anti-tank guided missiles, and kinetic energy, tank fired and high energy anti-tank rounds and then cues active protection system for Army vehicles. In FY08, optimized focal plane arrays design; enhanced sensor, electronics, and algorithms for on-the-move environment. Related work is also accomplished under PE 0603270A/project K16.			2.797	.000	.000
Total			5.798	13.008	7.839
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> H16	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H16: S3I TECHNOLOGY	18.611	19.450	19.567						Continuing	Continuing

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

The objective of this project is to focus on applied research of advanced sensors, signal processing, and information technologies that will enable the future Soldier with decisive new capabilities to locate, identify, and engage battlefield targets in tactical and urban 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, etc.

Significant areas of research include: low cost sensors designed to be employed in large numbers as unattended ground sensors (UGS) for force protection, hostile fire defeat, homeland defense, minefield replacements, counter terrorism operations, and munitions; tagging, tracking, and locating (TTL) of non-traditional targets; fusion of diverse sensors such as acoustic, seismic, magnetic including the micro electro mechanical system (MEMS) magnetic flux concentrator, radar, infrared (IR), forward looking IR (FLIR), laser detection and ranging (LADAR), visible imagers; low cost acoustic, seismic, and magnetic sensors that can passively detect and track battlefield targets such as tanks, helicopters, etc., and locate gun fire; improved signal-to-noise ratio (SNR) and noise mitigation devices and algorithms; sensor technologies for the detection, tracking, and assessment of humans, especially in urban terrain; high performance multi-function radio frequency (RF) systems that allow target acquisition, combat identification (ID), active protection, surveillance, and communications systems consolidated into a single system, reducing system cost, and size; passive and active RF sensors capable of high-resolution imaging to detect targets hidden in foliage, smoke, and fog; ultra wideband radar work enabling buried mine detection and target imaging through dense foliage and greatly enhanced robotic mobility; aided/automatic target recognition (ATR) allowing sensors to autonomously locate and identify targets; Ultra-violet (UV) opto-electronics for battlefield sensors; 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; advanced information processing methods to provide automatic information technologies that utilize widely dispersed sensor and legacy information sources; sensor and eye protection against laser threats, and algorithms for acoustic sensors mounted on a Soldier's helmet to localize source of gunfire.

The work in this project is coordinated with the Communications and Electronics Research, Development, and Engineering Center (CERDEC), other Research and Development Engineering Centers (RDECs), and the Defense Advanced Research Projects Agency (DARPA).

This work is related to and fully coordinated with efforts funded in PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technologies), and PE 0603001A (Warfighter 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.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> H16	
Work in this area is performed by the Army Research Laboratory (ARL), Adelphi, MD.					
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Sensor and Data Fusion:</p> <p>Investigate and devise hyper-modal sensor data fusion for detecting and classifying human infrastructure in urban operations such as machinery, RF emissions, chemicals, and computers in hidden and confined spaces such as tunnels, caves, sewers, and buildings.</p> <p>In FY08, validated an integrated hyper-modal sensor test-bed tailored for urban operations; devised node-based algorithms for detecting human infrastructure and presence in hidden/confined spaces and established a database of co-registered, hyper-modal relevant signatures and features that are detectable with available sensor technologies.</p> <p>In FY09, investigate the application of sensor fusion algorithms and sensor networks to new Army applications, such as force protection and homeland security applications and investigate feasibility of a solar-blind 280-nanometer (nm) avalanche photodiode for Soldier protection.</p> <p>In FY10, will transition research from the US-UK International Technology Alliance, implement diverse modality sensor and information fusion for enhanced situational awareness for hostile fire defeat; advance the state of the art in optical, acoustic, RF, IR, retroreflection and other threat-detection sensors and fusion algorithms on UGS, man-wearable, vehicles, robots, and other airborne systems. Will pursue low-cost implementations of solar blind avalanche detector.</p>		3.500	2.072	4.547	
<p>Unattended Ground Sensors (UGS):</p> <p>Develop technologies for low-cost UGS to enhance persistent sensing capabilities. Research focus is based on opportunities and feedback from UGS used in Operation Iraqi Freedom and other theaters. A key focus is on detecting people. Investigate fusion algorithms using multi-modal sensing phenomenology including acoustic, seismic, magnetic, electric field (E-field), passive IR, and RF to increase probability of target detection and reduce false alarms.</p> <p>In FY08, prepared 1st generation multi-modal algorithms for fielding in Army UGS systems; evaluated use of hyperspectral technology, including band selection techniques for target detection; created image enhancement algorithm toolbox to enable feasibility studies; optimized and transitioned the high sensitivity magnetic sensor and extend advanced infrasonic algorithms to extract a larger class of transient events.</p> <p>In FY09, evaluate the combination of advanced imaging sensor types for ATR such as polarimetric FLIR with LADAR; extend autonomous acoustic sensing and processing algorithms to new platforms; investigate use of magnetic and E-field sensors on vehicles.</p> <p>In FY10, along with the United States Marine Corps and others, advance the Family of UGS concept to develop standard protocols and communications, implement acoustic wind and flow mitigation techniques on moving and airborne systems;</p>		3.790	4.696	4.795	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability			<b>PROJECT NUMBER</b> H16	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
will expand transient classification capabilities; will enhance MEMS magnetic sensor sensitivity and detection algorithms; will evaluate non-erasable magnetic memory; will implement E-field sensor system to conduct target detection and subsurface imaging.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.063	.000	
<p>Tagging Tracking and Locating (TTL):            Conduct applied research to support advances in state-of-the-art clandestine TTL for non-traditional hostile force and non-cooperative targets. Specific technical objectives, products, and deliverables related to this effort are classified. This effort will directly support Communication-Electronics Research, Development, and Engineering Center's (CERDECs) advanced research in clandestine TTL.            In FY09, research extremely wide ranging technologies that are applicable to clandestine TTL.            In FY10, will identify technologies that have potential to achieve the goals of clandestine TTL and conduct research to mature these areas.</p>			.000	1.397	.992	
<p>Improve the lower echelon commander's (i.e. platoon) situational understanding in complex/urban terrain by developing infrastructure and validating algorithms, filters and agent technologies to reduce cognitive load by fusing information.            In FY08, defined robotic asset control technologies and investigated bio-inspired asset behavior algorithm as software components within a stimulation environment.            In FY09, conduct lab experiments in order to establish a baseline for evaluating the effectiveness of bio-inspired asset management for providing persistent surveillance for detecting and monitoring activity within a limited activity dynamic urban scene. From this baseline, devise and develop algorithms to scale to more complex scenes.            In FY10, conduct experiments to assess the effectiveness of collaborative bio-inspired surveillance algorithms using fixed and mobile assets operating in Military relevant environments (e.g., Command, Control, Communications, Computers and Information, Surveillance and Reconnaissance On the Move).</p>			2.165	2.604	2.500	
<p>Sensor Protection:            Research, develop, and validate electro-optical techniques and components to protect sensors and eyes from threat laser sources on the battlefield; target redesign of optical devices and explore new nonlinear optical materials for protection.            In FY08, investigated large-area fast electro-optic shutter devices and evaluated nonlinear optical tandem limiters.            In FY09, develop and evaluate demonstrator protection devices across the visible spectrum.</p>			3.078	2.652	.000	
Ultra Wideband Radar:			3.739	3.680	3.333	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> H16	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Develop technical underpinnings of ultra wideband (UWB) radar for several key Army concealed target detection technology requirements including landmine detection, through-the-wall sensing, and obstacle detection. Validate advanced computational electromagnetic algorithms and estimate performance of proposed radar systems as well as predict target signatures. Characterize target and clutter scattering behavior in support of advanced image formation and detection algorithm development. Transfer predictions and algorithms to landmine detection, through-the-wall sensing, and robotic perception programs.</p> <p>In FY08, collected and transitioned radar data for a collaborative sensor-fusion Improvised Explosive Device (IED)-detection field test.</p> <p>In FY09, devise radar concepts and supporting algorithms to enable Army ground vehicles to survey the forward looking hemisphere for concealed targets including hidden personnel and large arms caches in buildings and various mine deployments.</p> <p>In FY10, will implement effective target/clutter discrimination algorithms using advanced signal processing techniques including change detection. Devise rough-ground models to compute radar backscatter over UHF and L-band and compare to radar forward-looking measurements over road surfaces. Devise realistic CAD models for rooms of high complexity, including plumbing, heating ventilation, air-conditioning (HVAC) systems, wiring, etc.; compute radar images over typical sensing-through-the-wall (STTW) frequency band and compare the exact solution with approximate solver (Xpatch) to quantify approximations.</p>				
<p><b>Multi Function Radio Frequency System (MFRFS):</b> Develop MFRFS 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, target acquisition/track, active protection, and munitions-command guidance. Develop Aluminum-Gallium-Nitride based semiconductor UV optoelectronics for communications and for photoluminescent detection of biological threats.</p> <p>In FY08, evaluated communication functionality with MFRFS demonstration array; investigated methods for increasing communication rates achievable with MFRFS hardware and explored integrated receiver/exciter design and developed methods for increasing frequency flexibility. Investigated UV laser development in the 280 nm to 340 nm range.</p> <p>In FY09, evaluate methods for detecting stationary dismounts using biometric signatures and develop waveforms and algorithms for implementing these techniques in MFRFS and high-power 280-nm light-emitting-diode (LED) sources.</p>	2.339	2.286	3.400	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> H16	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will develop algorithms to extract RF biometric signatures for CERDEC All-terrain Radar for Tactical Exploitation of moving target indicator (MTI) and Imaging Surveillance (ARTEMIS) - Program and explore sub-mmW phenomenology for application to human-borne IED detection. Pursue high-efficiency 280-nm LED sources.				
Total	18.611	19.450	19.567	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> SA1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
SA1: Sensors and Electronic Initiatives (CA)	22.463	29.304	.000						Continuing	Continuing

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

Congressional Interest Item funding provided for Sensors and Electronic Initiatives.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Urban Warfare Knowledge Base	.967	.000	.000	
Nanotechnologies Initiative	1.400	.000	.000	
Advanced Detection of Explosives Program	.966	2.325	.000	
Urban Warfare Analysis Center (UWAC)	1.933	.000	.000	
Center for Advanced Microelectronics Manufacturing (CMM)	1.932	.000	.000	
High Brightness Diode-pumped Fiber Laser (HiBriD-FL)	1.545	.000	.000	
Single Crystal Chemical Vapor Deposition Diamond Thermal Management Elements for High-Energy Lasers	.965	.000	.000	
Wearable Video Capture System	.773	.775	.000	
Advanced Bonded Diamond for Optical Applications	1.932	.000	.000	
Electromagnetic Geolocation	.967	.000	.000	
Integrated Multi-Target Remote-Sensing Technology and Its Applications	1.933	.000	.000	
Land and Sea Special Operations (LASSO)	.966	.000	.000	
Terahertz Spectrometer Technology	1.545	.775	.000	
S31 Technology	.774	.000	.000	
Boston University Photonics Center	3.865	.000	.000	
Nanophotonic Devices (pending transfer to 622782)	.000	1.550	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability			<b>PROJECT NUMBER</b> SA1	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Command, Control, Communications and Computer Module (pending transfer to 622782)			.000	1.163	.000	
Semi-Autonomous or Unattended PsychOp and Recon Tool (SUPORT)			.000	2.326	.000	
Self-Deploying Autonomous Sensor Platforms for Situational Awareness			.000	3.875	.000	
Adaptive Infrastructure for SOF Experimentation			.000	2.326	.000	
Wearable Gyro-Compensated Personnel Tracking During GPS Interference			.000	.775	.000	
Lookout Small Scale Radar Program			.000	1.937	.000	
Intelligent Fault Protected Laser Diodes			.000	.775	.000	
Large Aluminum Nitride Crystals for Effective Deep Ultraviolet Sources			.000	.775	.000	
Advanced Magnetic Nanosensors for Defense Applications			.000	4.650	.000	
Advanced UV Light Diode Sensor Development			.000	1.550	.000	
Hydrogen Batteries for the Warfighter			.000	2.906	.000	
SBIR/STTR			.000	.821	.000	
Total			22.463	29.304	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> SA2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
SA2: BIOTECHNOLOGY APPLIED RESEARCH	4.361	5.732	5.799						Continuing	Continuing

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

The objective of this project is to provide funding for transition biotechnology research from PE 0601104/H05 (Institute for Collaborative Biotechnologies (ICB)). The ICB is led by the University of California, Santa Barbara (Santa Barbara, CA) in partnership with the California Institute of Technology (Pasadena, CA) and the Massachusetts Institute of Technology (Cambridge, MA). Applied research will be conducted that transitions breakthroughs in biotechnology basic research from the ICB to enable capabilities in sensors, electronics, photonics, and network science. 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. Efforts include designing and performing multi-scale dynamic and predictive modeling to understand biologically-inspired "sense and respond" systems (integrated system of sensor, information processing, and response mechanism) and their components. The Army Research Laboratory (ARL) and other Army laboratories, including the Natick Soldier Research, Development, and Engineering Center (NSRDEC) and Edgewood Chemical Biological Center (ECBC), in collaboration with the ICB industry partners will conduct applied research focused on biological sensors, biological, and bio-inspired materials, and biological and bio-inspired power generation and storage. The in-house research program (~20%) will link the ICB research to Army requirements and enhance the transition of this technology into the Army. The remaining funding (~80%) is focused on competitively awarded joint projects led by an ICB Industrial partner in collaboration with an Army laboratory and an ICB faculty member to transition ICB research into the Army and industry. The projects are programmed for three years each and are reviewed annually. Projects are intended to cover the entire breadth of the ICB program.

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 performed by the Army Research Laboratory, Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
ICB: In FY08, designed biologically-based and inspired sensors and materials for "sense and respond" systems components and determined the feasibility of biologically inspired control and network systems for these devices, investigated high-throughput screening of microbe, and fuel candidates for microbial fuel cells, waste reclamation, and bioremediation. Optimized and performed side-by-side comparison evaluation of novel molecular recognition elements (MREs) and standard antibody using baseline methodologies. In FY09, optimize the design of biologically-based and inspired sensors and materials and investigate incorporation of biologically-inspired control systems and networks, investigate bioelectronic properties of biologically-derived conductive	4.361	5.583	5.799	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability			<b>PROJECT NUMBER</b> SA2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>nano-fibers. Establish supporting infrastructure to select MREs using novel micro-fluidic system. Design and fabricate novel materials for uncooled thermal imagers to reduce cost and power consumption. Optimize protein system for conversion of methane to methanol for fuels to reduce logistics burden. Optimize bio-inspired control system for data collection from networks to optimize information flow to users. Fabricate reversible adhesive pads based on gecko-inspired design and design integration with small robots for covert robotic surveillance. Transition MRE selection devices to ECBC and NSRDEC.</p> <p>In FY10, will fabricate and evaluate uncooled thermal detector materials, investigate scale-up of proteins for methane to methanol conversion, evaluate algorithms for optimized collection of data from sensor networks, and characterize reversible adhesive pads based on gecko-inspired design.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.149	.000	
Total			4.361	5.732	5.799	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> SA3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
SA3: COMBAT IDENTIFICATION COMPONENT TECHNOLOGIES (CA)	2.319	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for Combat Identification Component Technologies.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Network Enabled Combat Identification							2.319	.000	.000	
Total							2.319	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> TS1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TS1: TACTICAL SPACE RESEARCH	1.605	1.631	1.661						Continuing	Continuing

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

This project researches and investigates technologies with the potential for space-based and high altitude applications. Applied research efforts include sensors and components, communications, signals and information processing, target acquisition, position/navigation, and threat warning within space and high altitude environments. The applied research and technology evaluation conducted under this effort leverages other DoD space science and technology applications to support space force enhancement cooperative satellite payload development. Successful technologies emerging from this project transition for maturation and demonstration under the Space Applications Technology in program element 0603006A.

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

Work in this project is performed by the US Army Space and Missile Defense Command (SMDC) in Huntsville, AL. This project is designated as a DoD Space Program.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research / Small Business Technology Transfer Programs	.000	.046	.000	
Tactical Space Research: This effort designs, develops, and evaluates space-based technologies and components that lead to smaller, lighter, and more responsive payloads with plug and play standardization. These technologies allow for the rapid integration and development of tactical satellites in support of responsive space and high altitude. In FY08, completed concepts and began design of an Electro Optical/Infrared (EO/IR) imaging space sensor nano-satellite payload; investigated a small on-station digitally reprogrammable radio to provide non-line-of-sight communications from a high-altitude and/or space environment; designed an initial architecture to migrate an existing EO/IR moving target indicator (MTI) sensor to operate in a high altitude environment. In FY09, continue investigation of a small on-station digitally reprogrammable radio for insertion into a tactical radio relay payload for high altitude and/or space environments; begin design of on-board processor and communication links and mature existing software for an EO/IR MTI sensor payload to operate in a high altitude environment; conduct a Joint Space Experiment (JSE) with the US Air Force to measure illumination of the ground. In FY10, will investigate multi-nano-satellite architectures and integration of multiple spectral and hyper-spectral bands for imaging sensors operating in high altitude and space environments; will investigate use of multiple waveforms on	1.605	1.585	1.661	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> TS1	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
single tactical radio relay payloads operating in high altitude and space environments; will continue to conduct the JSE for measurement of ground illumination.				
Total	1.605	1.631	1.661	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> TS2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TS2: ROBOTICS TECHNOLOGY	.000	.000	15.775						Continuing	Continuing

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

The objective of this project is to provide autonomous mobility technology that will enable near autonomous unmanned ground vehicles (UGVs). Technical efforts are focused on advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors; human-robot interaction, robotic manipulation, and unique mobility for unmanned vehicles. The project also provides the basis for the Collaborative Technology Alliance (CTA) in robotics, a tri-Service research consortium joining researchers from the Department of Defense (DoD), other Government agencies, industry and academia in a concerted, collaborative effort to advance key enabling robotic technologies. Research within the CTA is conducted at the Army Research Laboratory, other DoD laboratories and research centers, National Institute of Standards and Technology, National Aeronautics and Space Administration, and Department of Energy research laboratories, as well as industry and academic institutions.

The applied research conducted in this program will be transitioned to technology development, demonstration, and materiel acquisition programs being conducted by the Office of the Secretary of Defense Joint Ground Robotics Enterprise and each of the Services. Research supports collaborative efforts with Defense Advanced Research Projects Agency (DARPA).

Robotics Technology was previously funded in PE 0602618A, project H03 and was transferred to PE 0602120, project TS2 starting in FY10 to more accurately align the research.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Robotics CTA: Execute CTA 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 the environment enabling safe high-speed mobility and intelligent tactical behavior by future unmanned systems; implementing adaptive control strategies that will enable unmanned systems to display intelligent tactical behavior, formulation of control strategies that will facilitate use of unmanned systems in populated	.000	.000	6.880	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability			<b>PROJECT NUMBER</b> TS2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
environments and minimize the cognitive workload on Soldier operators, enable more dexterous manipulation of objects, and explore unique modes of mobility enabled by removing Soldiers from the vehicle. In FY10 will increase focus upon improved understanding of urban scenes and activities to promote enhanced autonomous situational awareness for safe, effective operations and survivability, to enhance techniques for planning and execution of missions in uncertain and dynamic environments, and to examine concepts for dexterous manipulation.						
Perception and Control: Develop perception and intelligent control technologies required to meet 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 Advanced Technology) project 515 for integration into test bed systems. Leverage DARPA sponsored research for control of collaborating agents to enable mixed teams (manned/unmanned) to conduct military missions. In FY10, will investigate perception and control algorithms for safe operations in dynamic urban environments.			.000	.000	5.019	
Autonomous Robotics Integration: Integrate technology on unmanned ground vehicle test beds and conduct extensive field testing and technology characterization to establish improved capability for near autonomous UGVs. Leverage algorithms being conducted under DARPA sponsored research, e.g., Learning Applied to Ground Robotics (LAGR). Conduct regular, periodic testing 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. In FY10, will evaluate ability to safely operate in mixed, dynamic, urban-like environments.			.000	.000	3.876	
Total			.000	.000	15.775	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability	<b>PROJECT NUMBER</b> TS2

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability					<b>PROJECT NUMBER</b> 140	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
140: HI-POWER MICROWAVE TEC	6.023	6.174	.000						Continuing	Continuing

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

The objective of this project is to research and evaluate high-power electronic components and technologies. These technologies have application in compact, light-weight power and energy storage, power and energy conversion, and conditioning, radio frequency (RF)/microwave directed energy (DE) weapons, and traditional and non-traditional RF and laser electronic attack. This includes traditional jammers, RF Directed Energy Weapon (DEW) technology as well as the high power components that will significantly enhance the survivability and lethality of Army platforms and related systems. The DEW effort studies both RF microwave and laser system capabilities and effects against various threats such as off- and on-route mines and electronically guided and fuzed missiles and munitions. Required power system components include power generation and storage, high-temperature/high power devices, power converters, and power conditioning. The ongoing DE effects and power component work is coordinated with and, as appropriate, leveraged by DEW and power and 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 work in this project is coordinated with the Tank and Automotive Research, Development, and Engineering Center (TARDEC); the Armaments Research, Development, and Engineering Center (ARDEC); the Aviation and Missile Research, Development, and Engineering Center (AMRDEC); and the Communications and Electronics Research, Development, and Engineering Center (CERDEC).

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
High Energy Laser: Research novel solid-state laser concepts, architectures, and design components enabling High Energy Laser (HEL) technology for Army specific DEW applications. Exploit breakthroughs in laser technology and photonics basic research. Applied research will be conducted in close collaboration with domestic ceramic (and other) material vendors, university researchers, and major laser diode manufacturers.	2.412	2.434	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> 140		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, evaluated composite ceramic laser materials to increase laser power; evaluated volume Bragg grating based spectral narrowing of diode pumps for high brightness pumping schemes. Completed feasibility study of Tellurium Oxide (TeO2) for high power applications.</p> <p>In FY09, validate a new approach to highly power-scalable, eye-safe, fiber laser based on significant minimization of heat deposition into Erbium (Er) - doped fiber amplifier. This new approach will significantly increase the performance of the laser.</p>						
<p>Research and evaluate technologies related to DEW technology, electronic warfare (EW) survivability/lethality, and supporting high power components to enhance the survivability/lethality of Army platforms.</p> <p>In FY08, measured the RF susceptibility levels of threat sensors/communications of interest to CERDEC. Used data to identify system design requirements for counter electronic system. Built models to help predict the effective range of counter electronic system. Investigated susceptibility profiles of wireless network components.</p> <p>In FY09, design counter electronic system and conduct lab and/or field test to evaluate the capability. Investigate feasibility of using RF DE to electronically attack air threats of interest to Air Defense Artillery Center and AMRDEC for Enhanced Area Air Defense. Identify and acquire critical components of Unmanned Aerial Vehicles and evaluate failure levels. Transition data and system design to AMRDEC for further evaluation. Investigate EW interoperability issues between EW devices and communication systems.</p>			1.329	1.422	.000	
<p><b>High Power Devices:</b></p> <p>Research and evaluate materials and component structures that provide the higher energy density required by next generation Army systems such as electromagnetic armor, hybrid-vehicle propulsion electronics, directed energy sources, pulse power for future force systems, small unattended ground sensors, and Soldier systems.</p> <p>In FY08, advanced development of high-temperature Silicon Carbide (SiC) power modules for operation at power conversion levels &gt;200 kW; determined that additional power is required to meet vehicle requirements. Investigated use of gallium-nitride (GaN) and diamond materials for use as direct energy converter in extended life batteries for unattended sensor and prognostics and diagnostics. Modeled Stirling engine characteristics and optimized parameters for battery charging loads determined by CERDEC. Investigated carbon-monofluorides alloys as anodes and continued work on high energy cathodes for lithium ion air batteries.</p> <p>In FY09, develop SiC power modules for operation at high temperature for power conversion levels &gt;350 kW. Evaluate GaN and diamond materials for use as direct energy converter in extended life batteries for unattended sensor and prognostics and diagnostics.</p>			2.282	2.232	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602120A Sensors and Electronic Survivability		<b>PROJECT NUMBER</b> 140	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.086	.000	
Total	6.023	6.174	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602211A AVIATION TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	42.547	46.898	41.332						Continuing	Continuing
47A: AERON & ACFT WPNS TECH	34.531	37.636	37.053						Continuing	Continuing
47B: VEH PROP & STRUCT TECH	4.149	4.239	4.279						Continuing	Continuing
47C: ROTORCRAFT COMPONENT TECHNOLOGIES (CA)	3.867	5.023	.000						Continuing	Continuing

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

This aviation technology program element (PE) conducts applied research applicable to rotary wing vehicle (RWV) technologies to move towards air vehicle objectives. Emphasis is on developing rotary wing platform technologies to enhance manned and unmanned RWV combat and combat support operations for attack, reconnaissance, air assault, survivability, logistics and command and control missions. The PE supports research and development components and subsystems for air vehicles in the areas of aviation and aircraft weapons technology (project 47A) and vehicle propulsion and structures technology (project 47B). This PE also supports the National Rotorcraft Technology Center (NRTC), a partnership of government, industry, and academia. Project 47C funds congressional special interest items. Efforts under this PE transition to projects supported by PE 0603003A (Aviation-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.

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.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602211A AVIATION TECHNOLOGY

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	43.280	42.013	41.598	
Current BES/President's Budget	42.547	46.898	41.332	
Total Adjustments	-.733	4.885	-.266	
Congressional Program Reductions	.000	-.155		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	5.040		
Total Reprogrammings	-.236	.000		
SBIR/STTR Transfer	-.497	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY					<b>PROJECT NUMBER</b> 47A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
47A: AERON & ACFT WPNS TECH	34.531	37.636	37.053						Continuing	Continuing

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

The objective of this project is to develop Rotary Wing Vehicle (RWV) technologies for manned and unmanned Army/ Department of Defense (DoD) rotorcraft 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 rotorcraft systems.

Work in this project is related to and fully coordinated with PE 0603710A (Night Vision Advanced Technology); PE 0602624A (Weapons and Munitions Technology); and PE 0602303A (Missile 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 in this project is performed by the Aeroflightdynamics 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Aircrew Survivability Technologies: Investigate passive technologies to reduce susceptibility and vulnerability of aircraft to damage from threats or accidents and active technologies to defeat or provide alert to the crew concerning small arms, rocket and missile threats. In FY08, completed development of Cognitive Decision Aiding-Threat Lethality Predictor (CDA-TLP) specific cockpit controls, displays and aural cues as part of the Survivability Planner Associate Re-router (SPAR) software suite. Developed criteria required G-loads that structures such as engines and transmissions must withstand before breaking-away during a crash and threatening the integrity of crew-occupied areas, for "full-envelope crashworthiness" based on rotorcraft size, class and mission type. Developed conventional ballistic threat and advanced crew protection concept preliminary designs. In FY09, develop updated structural design guidelines based on emerging criteria. Develop and test innovative techniques for reducing detection of propeller and rotor driven aircraft by threat	6.918	7.068	7.536	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY			<b>PROJECT NUMBER</b> 47A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
systems. Develop analytical tools (executable software) required to evaluate material behaviors during both ballistic and high energy impact events. In FY10, will complete conventional ballistic protection and advanced crew protection efforts initiated in FY08 and will transition knowledge gained to ballistic protection and advanced crew protection technology maturation in PE0603003A. Will develop remote optical parametric oscillators (OPOs) to tune laser wavelengths to desired threat bands for effective Infrared (IR) jamming of man-portable missiles.						
Network Operations and System Integration and Intelligent and Active Control (Cont.): In FY10, will develop handling qualities criteria for legacy upgrades and future rotorcraft; will develop the Rotorcraft Air Crew Systems Concepts Airborne Laboratory (RASCAL), a JUH-60A Black Hawk helicopter, into a variable-stability in-flight simulator; and will flight demonstrate increased-agility, obstacle field navigation and landing algorithms. Will also investigate geo-location improvements and lightweight sensors incorporating advanced image stabilization techniques to provide hemispherical situational awareness for improved pilotage.			.000	.000	8.683	
Rotor Technology: Evaluate performance enhancements gained from advanced rotor technologies, including on-blade controls. In FY08, evaluated, via wind tunnel tests, on-blade control rotor system to include performance enhancement and noise reduction. In FY09, acquire validation test data for highly instrumented full-scale conventional UH-60 rotor, and validate advanced modeling and simulation methods for active rotor controls using previously acquired test data. In FY10, will evaluate rotor aeromechanics issues for high speed configurations using high fidelity analyses. Will validate methods for UH-60 and active rotor tests. Will prepare Active Elevon Rotor (AER) and test stand.			3.200	3.234	3.390	
Network Operations and System Integration and Intelligent and Active Control: Perform feasibility, operations and concept studies and Analysis of Alternatives to identify promising candidate technologies that can be evaluated as options for improved or new platform capabilities. In FY08, investigated flight control stability margin requirements for upgraded/new airframe configurations and integrated aerodynamics and structural dynamics into control systems optimization. In FY09, expand handling quality requirements and flight control systems for legacy upgrades, multi-role and future rotorcraft. Digital Situational Awareness Testbed: In FY08, developed and evaluated supervisory control interface for multiple heterogeneous Unmanned Aerial Systems (UAS). In FY09, investigate supervisory control techniques for control of multiple UAS. Advanced Rotary Wing Concepts: In FY08, conducted flight test experiments of precision attack capability from test bed UAS operating in support of manned aviation and ground troops in an urban environment. In FY09, conduct flight test experiments using various sensors and weapons systems to gauge precision expected from rotary wing UAS in varying flight modes, i.e., high and low hover, firing on the move, and moving targets.			7.424	7.173	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY		<b>PROJECT NUMBER</b> 47A		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.385	.000	
Rotorcraft Airframe Technology: Develop new rotorcraft structure technologies to improve structural performance while reducing fabrication, operating, and support costs. In FY08, developed structural integrity management by fusing loads monitoring and damage detection capabilities to improve safety and survivability. Investigated ballistic properties and effectiveness of reduced-weight multifunctional structural armor. In FY09, conduct laboratory testing to validate strain-allowable integrity approach, emerging platform concepts and modeling fidelity.			1.230	.984	.000	
Advanced Engines: Design and develop advanced 3000 horsepower turboshaft engine component technology to support goals of reduced fuel consumption, engine size, weight, and cost, and improved reliability, maintainability and survivability. In FY08, completed design of an advanced compressor for improved performance and reduced weight of utility/attack rotorcraft sized engines and completed advanced combustor design, fabrication and evaluation for improved engine performance and structural life for future utility/attack rotorcraft sized engines. In FY09, complete design of an advanced gas generator turbine that improves engine performance and durability for future cargo sized rotorcraft engines. Complete fabrication of an advanced compressor for improved performance and reduced weight for utility/attack rotorcraft sized engines. Conduct an advanced combustor rig-test to validate improved performance and structural life for utility/attack rotorcraft sized engines. In FY10, will complete the design of an advanced compressor, will complete fabrication of a gas generator turbine and will complete the advanced compressor laboratory rig test.			1.931	2.015	2.006	
National Rotorcraft Technology Center (NRTC): 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 preeminence in rotorcraft capabilities. In FY08, performed wind tunnel tests of rotor designs with improved static/dynamic stall characteristics. Tested oscillatory jets on rotor airfoils to assess aerodynamic improvements. Performed qualification test on improved drive system gears. Tested improved crashworthy armored seats. Tested metal matrix composite design for airframe applications to assess structural suitability as a substitute for a titanium structure. Investigated and evaluated a drive train torque measurement system to aid in load assessment. In FY09, perform bird strike and head impact simulations to improve rotorcraft crashworthiness and survivability. Conduct certification testing and probabilistic analysis to evaluate damage tolerance modeling methodologies. Test advanced drive system designs for noise and wear characteristics. Evaluate active crash protection system for application to rotary wing unmanned aerial systems. In FY10, will conduct whirl tower testing of reconfigurable rotor system. Will demonstrate composite production techniques for a 25% reduction in component weight and a 40% reduction in recurring manufacturing costs			8.269	8.456	7.882	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY			<b>PROJECT NUMBER</b> 47A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
compared to a conventional metallic structure. Will correlate nonlinear aeroelasticity analysis results with wind tunnel and flight test data to improve understanding and predictive capability for rotor stall flutter.						
System Concepts Studies: Provide high fidelity methodology for analysis and design of future air vehicles, leading to the ability to develop improved performance and design specifications earlier in the acquisition process. In FY08, initiated design of an analysis environment which integrates higher-fidelity models for aeromechanics and flight controls into the design synthesis of rotorcraft configurations. Focused activities on creating significantly improved interfaces between the design synthesis process and other technical disciplines, such as Computational Fluid Dynamics (CFD), Computational Structural Dynamics (CSD), and Handling Qualities (HQ) assessments. Examined a Variable Speed Tilt Rotor (within the analysis environment) and used results to refine the overall design of the analysis environment. In FY09, expand the design of the models to enable analysis of hover, cruise, transition and maneuver flight conditions. Begin assessment and validation of configuration design process. Initiate the capability to analyze a Slowed Rotor Compound Helicopter. Investigate interfaces to allow inclusion of other new and emerging technical capabilities and rotorcraft configurations. In FY10, will extend the CFD flight conditions for transition and maneuver flight. Continue the validation of modeling capabilities and the ability to pass/generate data within the integrated analysis environment. For example, will automate the methodology for transforming a 3-D Computer Aided Design (CAD) drawing into a grid which can be analyzed with CFD tools.			1.113	2.949	2.390	
Durability and Sustainment Technologies: Develop prognostic and system health assessment technologies to enable transition to a Condition Based Maintenance supportability structure. In FY08, initiated development of new prognostic algorithms for aircraft systems. Developed and evaluated predictive models for engine line replaceable parts and automated trim tab adjustment actuators based on the fusion of data-driven and model-based approaches. Performed rig-testing of ceramic components to characterize failure modes. Embedded sensors in structural components and assessed feedback to form basis of damage detection algorithms. Evaluated sensor and load monitoring feedback methods for structural diagnostics/prognostics and reduction of uncertainty in probabilistic methods for life management. In FY09, perform rig-testing of engine prognostic algorithms, begin bench testing of automatic trim tab actuators, initiate development of prognostic algorithms for structural components and assess structural corrosion and damage detection algorithms. Continue to evaluate sensor and load monitoring feedback methods for structural diagnostics/prognostics and reduction of uncertainty in probabilistic methods for life management. In FY10, will perform bench testing to demonstrate the accuracy and robustness of developed prognostic and diagnostic technologies. Will bench test the physics			4.446	5.372	5.166	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY		<b>PROJECT NUMBER</b> 47A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
of failure models for electronics, as well as, validate prognostic reasoner to predict failures. Will integrate a corrosion monitoring system into the Health and Usage Monitoring System and demonstrate on an airframe structural component.				
Total	34.531	37.636	37.053	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY					<b>PROJECT NUMBER</b> 47B	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
47B: VEH PROP & STRUCT TECH	4.149	4.239	4.279						Continuing	Continuing

**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 is related to and fully coordinated with PE0603003A (Aviation 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.

Work in this project is performed by the Army Research Laboratory (ARL) located at facilities at the NASA Glenn Research Center, Cleveland, OH, and the NASA Langley Research Center, Hampton, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p><b>Rotor and Structure Technology:</b> Devise improved tools and methodologies to more accurately design for acceptable reliability and durability, resulting in platforms that are lighter in weight and less costly to acquire and maintain.</p> <p>In FY08, improved analytical tools of rotor/body and wake flow predictions, investigated aeromechanics design tools to enable the evaluation of new small-scale unmanned air vehicles and micro-scale flapping-wing air vehicles.</p> <p>In FY09, evaluate new multi-functional structural concepts based on biological systems that are key enablers for future microsystems development.</p> <p>In FY10, will conduct wind-tunnel test on a conceptual active rotor system to improve performance.</p>	.771	.842	.886	
<p><b>Propulsion and Drive Train Technology:</b> Investigate high temperature materials, advanced models for flow physics and improved methods for predicting propulsion system mechanical behavior to increase fuel efficiency and reduce propulsion systems weight.</p> <p>In FY08, assessed and quantified the baseline performance of a model-based diagnostic methodology to accurately detect, determine trends isolate engine faults and validated the mechanical properties of advanced gear materials to assess their feasibility for use in rotorcraft transmissions.</p>	3.378	3.397	3.393	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY		<b>PROJECT NUMBER</b> 47B	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, assess the durability of advanced environmental barrier coatings to improve the design of hot section engine components and validate variable speed transmissions sub-scale components to enable improvements in rotorcraft maneuverability and noise reduction. In FY10, will assess the feasibility of fabricating sub-elements of hollow and solid turbine blades from monolithic ceramic/composite hybrid materials to reduce engine weight and will investigate the design of a sand injection facility to enable the development of improved inlet particle separators.				
Total	4.149	4.239	4.279	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602211A AVIATION TECHNOLOGY					<b>PROJECT NUMBER</b> 47C		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
47C: ROTORCRAFT COMPONENT TECHNOLOGIES (CA)	3.867	5.023	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding provided for Rotorcraft Component Technologies.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
SBIR/STTR								.000	.140	.000	
Composite Small Main Rotor Blades								1.546	1.550	.000	
Aircraft Structural Condition Monitoring (ASCM) for Diagnostics and Prognostics								2.321	1.550	.000	
Intensive Quenching for Advanced Weapons Systems								.000	.930	.000	
Helicopter Reliability and Failure Analysis Center								.000	.853	.000	
Total								3.867	5.023	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602270A Electronic Warfare Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	25.564	21.739	16.119						Continuing	Continuing
442: TACTICAL EW TECHNOLOGY	11.655	9.475	.000						Continuing	Continuing
475: ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	6.956	5.182	.000						Continuing	Continuing
906: Tactical Electronic Warfare Applied Research	6.953	7.082	16.119						Continuing	Continuing

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

This program element (PE) designs and develops electronic warfare (EW) component technologies 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 development of sensors used to identify and locate threat forces in an asymmetric environment; and threat warning and electronic countermeasures (ECM) against: munitions sensors and targeting capabilities, missile guidance and targeting systems, and booby traps. This PE protects 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, relationship discovery, and management services through use of automated processing, as well as higher level reasoning techniques that support automated combat assessment. This PE also supports efforts related to research and application of key EW technologies to intercept, locate, and disrupt, current and emerging threat communications and non-communications emitters, to provide vital, quality combat information directly to users in a timely actionable manner. Specifically, its technologies focus on detecting threat sensors and emitters associated with weapon systems, targeting systems and command, control, communications, computers, and intelligence systems and networks. Project 475 funds congressional special interest items.

Since the current PE 0602270A, project 442 efforts are complementary to those funded from PE 0602270A, project 906, all efforts funded and executed from project 442 are being transferred to project 906 in FY10 and beyond, to reduce administrative burden.

Work in this PE is related to and fully coordinated with PE 0603270A (EW Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602783A (Computer and Software Technology), and PE 0602784A (Advanced Concepts and Simulation).

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.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602270A Electronic Warfare Technology

Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	30.013	16.611	16.822	
Current BES/President's Budget	25.564	21.739	16.119	
Total Adjustments	-4.449	5.128	-.703	
Congressional Program Reductions	.000	-.072		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	5.200		
Total Reprogrammings	-3.951	.000		
SBIR/STTR Transfer	-.498	.000		

**Change Summary Explanation**

FY08 funding decrease was due to transfer of Congressional interest items.  
 FY09 funding increase is due to Congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> 442	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
442: TACTICAL EW TECHNOLOGY	11.655	9.475	.000						Continuing	Continuing

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

This objective of this project is to design, develop, and apply electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft, and the dismounted Soldier. The survivability approach provides detection avoidance through signature management and hit avoidance using warning receivers and electronic countermeasures. This project applies recent advances in radio frequency (RF), infrared (IR), and electro-optical (EO) sensor and jamming sources to detect, locate, deceive, and jam threats, 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. The ability to neutralize booby traps is pursued, and this project will investigate Electronic Support (ES) technologies used against non-communications signals for targeting and tactical situational awareness.

Since the current PE 0602270A, project 442 efforts are complementary to those funded from PE 0602270A, project 906, all efforts funded and executed from project 442 are being transferred to project 906 in FY10 and beyond, to reduce administrative burden.

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 performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Low Cost RF Situational Awareness and Countermeasures: This effort provides the electronic countermeasures signal coherency, power, spectral energy efficiency, and jamming capability to protect friendly airborne and surface platforms from wideband threat weapon systems that use advanced radar processing techniques. In FY08, investigated algorithms/waveforms and mitigation techniques to reject/suppress interference from unwanted radar energy from outside the field-of-view of the radar, interference within the field-of view of the radar and interference from residual rotor blade modulations to include electromagnetic modeling of these effects and mitigation techniques.	2.409	1.143	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> 442	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09 develop new hardware and software modules with the capability to neutralize the enemy's ability to locate, classify, and engage our forces with radar-based air defense and targeting radars common to both air and ground platforms. In FY10 and beyond funding for this effort was transferred to PE 0602270A/project 906.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.086	.000	
Multispectral Threat Warning: This effort develops affordable EO/IR countermeasure system concepts with multispectral detectors, multiband laser, and advanced countermeasure architectures. It exploits next generation threats to develop advanced EO/IR countermeasure techniques that effectively defeat laser guided munitions, surface-to-air, air-to-air, and anti-tank threats. In FY09, develop and evaluate new algorithm techniques to exploit signals in background clutter to increase detection, identification, and threat classification capabilities. In FY10 and beyond funding for this effort was transferred to PE 0602270A/project 906.	.000	4.371	.000	
Next Generation Electronic Warfare Technology for Survivability: This effort develops technologies to enable a low cost aircraft self-protection suite that is effective in detecting, disrupting, and defeating small arms, rocket propelled grenades, and man-portable air defense system threats, typical of urban environments. In FY08, integrated/interfaced Navy's Distributed Aperture Infrared Countermeasures (DAIRCM) multiband laser prototype with optical fibers and pointing, switching, and steering technologies and conducted laboratory demonstrations against simulated threats; demonstrated next generation countermeasures techniques against advanced electro-optical (EO)/infrared (IR) threats. Related work is also being accomplished under PE 0603270A/project K16.	3.446	.000	.000	
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats in battlefield and urban environments. In FY08, developed digital wideband receiver capability for the detection and denial across the entire threat band; refined system design and began integration of complementary capabilities such as time difference of arrival geolocation and electronic attack based on geolocation; integrated wideband antennas into an adaptive array; integrated algorithms into government off the shelf hardware. In FY09, integrate capabilities into a net-centric solution that combines detection and jamming, location, and neutralization capabilities; complete fabrication of adaptive processing arrays and algorithm development and validation.	3.509	1.956	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> 442	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Related work is also being accomplished under PE 0602270A/project 906, PE 0603270A/project K15, and PE 0603270A/project K16.				
<p><b>Fusion Based Technologies:</b> This effort develops an advanced knowledge generation capability to answer warfighting commanders' priority intelligence requirements (PIRs). These answers provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations.</p> <p>In FY08, developed expanded set of representations for different types of enemy tactics to handle more complex scenarios including the prediction of locations of specific types of asymmetric attacks using real data; developed and evaluated in a pre-engagement mode, an initial toolset for evaluating and selecting the most capable and relevant collection assets given PIRs and contextual information; developed another increment of modeling and simulation software that provided more realistic threat behaviors to support development and testing of representations of threat tactics, plausible explanations of threat activities, and early recognition of threat goals and intentions. Related work is also being accomplished under PE 0602120A/project H15, PE 0602270A/project 906, and PE 0603772A/project 243.</p>	2.194	.000	.000	
<p><b>Advanced Tactical Electronic Support Measures:</b> This efforts supports development of non-communications Electronic Support (ES) components with multi-functional digital receivers, processors and software tools that reduce the space, weight and power requirements for future electronic support systems.</p> <p>In FY09, develop an integrated suite of optimal detection, de-interleaving (arranging received signal components in the appropriate order) and tracking techniques with a goal of full spectrum coverage for all waveform classes in a dense signal environment. In FY10 and beyond funding for this effort was transferred to PE 0602270A/project 906 under the title Passive and Active Targeting Techniques.</p>	.000	1.820	.000	
<p><b>Cueing Sensor:</b> This effort develops low cost infrared sensors that detect rocket propelled grenades, anti-tank guided missiles, and tank fired kinetic energy and high energy anti-tank rounds and then cue active protection system for Army vehicles.</p> <p>In FY08, optimized focal plane arrays design; enhanced sensor, electronics, and algorithms for on-the-move (OTM) environment.</p> <p>In FY09, complete focal plane array design; evaluate software algorithms for OTM detection capability. Related work effort is also being accomplished under PE 0602120A/project H15, PE 0603270A/project K16, and PE 0603772A/project 243.</p>	.097	.099	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> 442	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Total			11.655	9.475	.000
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> 475	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
475: ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	6.956	5.182	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Electronic Warfare technology applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Silver Fox and Manta Unmanned Aerial Systems							3.092	.000	.000	
Battlefld Connectivity, Multi-Level Secure Network							1.545	1.549	.000	
Dominant Military Operations on Urbanized Terrain Viewer							2.319	.000	.000	
Integrated Information Technology Policy Analysis Research (pending transfer to 62783)							.000	1.550	.000	
Counter-IED Force Protection Program							.000	1.937	.000	
SBIR/STTR							.000	.146	.000	
Total							6.956	5.182	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> 906	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
906: Tactical Electronic Warfare Applied Research	6.953	7.082	16.119						Continuing	Continuing

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

Efforts in this project design, develop, and apply key electronic warfare (EW)/Information Operations technologies to enhance platform survivability (to include ground combat vehicles, aircraft, and the dismounted Soldier) and to intercept and locate current and emerging threat communications and non-communications emitters. This project applies recent advances in radio frequency (RF), infrared (IR), and electro-optical (EO) sensor and jamming sources to detect, locate, deceive, and jam threats, 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, the ability to neutralize booby traps is also pursued. This project develops 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 radio frequency (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, other research areas include fusion (automated assimilation and synthesis) of battlefield intelligence data to enable interpretation of current and future enemy activities and allowing development of courses of action in time to act decisively and in a pre-emptive manner.

Since the current PE 0602270A, project 442 efforts are complementary to those funded from PE 0602270A, project 906, all efforts funded and executed from project 442 are being transferred to project 906 in FY10 and beyond, to reduce administrative burden.

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

Work in this project is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Ft. Monmouth, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats in battlefield and urban environments. In FY08, continued algorithm development for an expanded range of potential targets, as well as software development for data thinning and nodal analysis applications for the purposes of threat identification, classification, and attack technique	6.953	4.091	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> 906	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
selection; expanded algorithm development for larger range of targets; continued deception and effects algorithm development. In FY09, investigate and develop techniques to engage emergent communications technologies for inclusion into Information Operations (IO) techniques database; refine IO techniques database for access and use by other users including Joint Service and other members of intelligence community. Related work is also being accomplished under PE 0602270A/project 442; PE 0603270A/project K15, and PE 0603270A/project K16.				
<b>Fusion Based Technologies:</b> This effort develops an advanced knowledge generation capability to answer warfighting commanders' priority intelligence requirements (PIR) for the future force. These answers provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations. In FY09, develop final set of representations for different types of enemy tactics to handle more complex and asymmetric behaviors such as ambushes, vehicle-borne explosive devices, and sniper attacks; demonstrate capabilities to automatically identify and link human-specified critical entities and activities to PIRs, and reveal emerging actionable intelligence; develop and demonstrate an intelligence, surveillance, and reconnaissance planning/re-planning toolset with capabilities to function in an operations execution mode for evaluating and selecting the most capable and relevant collection assets given PIRs and contextual information. Related work is also being accomplished under PE 0602120A/project H15, PE 0602270A/project 442, and PE 0603772A/project 243.	.000	2.991	.000	
<b>Multi-Intelligence Data Fusion and Targeting:</b> This effort investigates and develops software technologies for advanced Intelligence/Battle Command enterprise collaboration that enable the enterprise to identify, fuse, trace/track specific human targets in an asymmetric environment. In FY10, will develop advanced data ingestion (throughput of high volume and non-traditional data types), data alignment/conversion (normalization), and correlation and data engineering management techniques.	.000	.000	5.452	
<b>Offensive Information Operations Technologies:</b> This effort investigates and develops techniques that capture and identify data traversing enemy networks for the purpose of Information Operations or otherwise countering adversary communications. In FY10, will define distributed communications to allow the technologies to communicate between nodes; will begin development of interception and countermeasure capabilities against network traffic flows of interest; will develop Network Operations techniques against relevant high priority protocols.	.000	.000	3.752	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> 906	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Multispectral Threat Warning: This effort investigates the benefits of augmenting the currently fielded Ultra-Violet (UV)-based Common Missile Warning System (CMWS) threat detection capability with infrared (IR) and acoustic sensors to: improve the probability of detection of Man-Portable Air Defense System (MANPADS)-like threats; reduce atmospheric clutter and, thereby, the false alarm rate, and add detection of ball ammunition to the current CMWS tracer-only capability. In FY10, will investigate integration of acoustic signals into UV-based hostile fire indication (HFI) algorithms; will evaluate acoustic array hardware concepts with regard to algorithm design; will begin correlation of acoustic and UV based HFI data based on hardware integration concepts.	.000	.000	3.715	
Passive and Active Targeting Techniques: This effort investigates passive and active techniques and software algorithm development for three dimensional (3D) detection, identification, and precision geolocation of next-generation wireless communication threats and improved situational awareness (SA) in dense, co-channel, and multipath radio frequency (RF) environments. In FY10, will evaluate and select precision geolocation techniques and analyze performance results under varying environmental conditions; will design software to implement selected techniques on commercial based software defined radio representative hardware; will evaluate techniques for feasibility to implement on representative hardware.	.000	.000	3.200	
<b>Total</b>	<b>6.953</b>	<b>7.082</b>	<b>16.119</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602303A MISSILE TECHNOLOGY					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	67.097	56.747	50.716						Continuing	Continuing
G04: AIR DEFENSE TECHNOLOGIES (CA)	.000	2.552	.000						Continuing	Continuing
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	3.383	1.396	.000						Continuing	Continuing
G06: UNMANNED SYSTEMS TECHNOLOGIES (CA)	1.546	.000	.000						Continuing	Continuing
214: MISSILE TECHNOLOGY	51.734	48.015	50.716						Continuing	Continuing
223: AERO-PROPULSION TECHNOLOGY	10.434	4.784	.000						Continuing	Continuing

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

This program element (PE) designs and develops advanced component technologies for missiles, rockets, and launch systems in order to increase the lethality and effectiveness of tactical missiles and guided interceptors under adverse battlefield conditions, enhance the survivability of launch systems, increase kill probabilities against diverse targets, and provide advanced simulation and virtual prototyping analysis tools.

The work in this PE is related to, and fully coordinated with, with PE 0603313A (Missile and Rocket Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0602618A (Ballistics Technology, Robotics 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.

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	60.935	48.174	48.194	
Current BES/President's Budget	67.097	56.747	50.716	
Total Adjustments	6.162	8.573	2.522	
Congressional Program Reductions	.000	-.187		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	8.760		
Total Reprogrammings	7.375	.000		
SBIR/STTR Transfer	-1.213	.000		

**Change Summary Explanation**

FY08 funding increased due to transfer of congressional interest items for proper execution from PE 0602307A.  
 FY09 funding increase is due to congressional adds.

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY					<b>PROJECT NUMBER</b> G04	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
G04: AIR DEFENSE TECHNOLOGIES (CA)	.000	2.552	.000						Continuing	Continuing

**A. Mission Description and Budget Item Justification**  
Congressional Interest Item funding provided for Air Defense Technologies.

<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
SBIR/STTR	.000	.072	.000	
D-NET: Electrically Charged Mesh (ECM) Defense Net Troop Protection System	.000	2.480	.000	
Total	.000	2.552	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY					<b>PROJECT NUMBER</b> G05	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	3.383	1.396	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for Missile Technologies Initiatives applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Materials Applications Research Center							.967	.775	.000	
Center of Excellence in Integrated Sensor Systems (CEISS)							.000	.581	.000	
SBIR/STTR							.000	.040	.000	
Jam Resistent Technology for INS/GPS Precision							1.449	.000	.000	
Novel Lightweight Armor Material for Insensitive Munitions Protection of Tactical Missiles							.967	.000	.000	
Total							3.383	1.396	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY					<b>PROJECT NUMBER</b> G06	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
G06: UNMANNED SYSTEMS TECHNOLOGIES (CA)	1.546	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for Unmanned Systems Technologies applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Unmanned Systems Initiative at AMRDEC							1.546	.000	.000	
Total							1.546	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
214: MISSILE TECHNOLOGY	51.734	48.015	50.716						Continuing	Continuing

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

This project designs and develops missile and rocket component technologies that support demonstration of lightweight, highly lethal missiles. Major areas of research include missile guidance components and subsystems; air defense target acquisition systems; multi-spectral seekers; high-fidelity simulations; missile aerodynamics and structures; and missile propulsion including research to help solve the insensitive munitions requirements. A theme embedded throughout the efforts in this project is developing smaller, lighter, and cheaper (SLC) missile technology to reduce the cost and logistics burden of precision munitions. 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 Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Smart, Stealthy, Smokeless Missile Propulsion, Smart Structures and Enhanced Lethality: The effort is developing enabling technologies to advance missile propulsion, lethality, structural integrity and reduce launch signatures.	7.021	6.973	5.694	
In FY08, investigated new propellant formulations that operate efficiently over extreme temperature ranges. Demonstrated a fully integrated dynamic Hardened Combined Effects Warhead with enhanced blast and fragmentation characteristics against heavy armor and Military Operations on Urban Terrain (MOUT) targets. Designed, fabricated, and tested distributed thermal ignition concept and grain surface energetic coating schemes in order to improve engagement timeline and accuracy through prompt and repeatable rocket motor ignition with reasonable cost, weight, and volume in support of Active Protection Systems.				
In FY09, develop propellant candidates designed to operate efficiently in extreme temperature ranges in coordination with PE 0602624A. Investigate multi-mode warhead characteristics using multi-point initiation concepts to control the energy deposited on the target; and variable yield warhead technologies to vary the effects on target and minimize collateral				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY		<b>PROJECT NUMBER</b> 214	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>damage. Develop safe and arm logic to integrate with target classification sensor and investigate selectable multi-point firing control.</p> <p>In FY10, will demonstrate and validate missile control thruster analysis tools and design concepts for small diameter applications and will fabricate multi-point initiation warheads and conduct tests to determine the energy deposition effect of the warhead.</p>				
<p>Multi-Role Missile Engine and Missile Component Design: This effort focuses on critical technology and component design to provide a diverse and versatile mix of fires and fused effects capabilities for force protection and overwhelming defeat of conventional and asymmetrical threats in all environments. Successful technologies developed will transition to system development activities in PE 603313A project 263.</p> <p>In FY09, design and develop new ground and air defense missile concepts based on the integration of breakthrough component tests. Demonstrate critical underlying component technologies (e.g. seeker, propulsion, and lethal mechanisms) in laboratory and field environments.</p> <p>In FY10, will investigate, design and develop critical technologies to: enable miniaturization/packaging of sensors, guidance packages and electronics; develop more efficient, advanced propulsion; and explore advanced warhead integration and lethal effects and non-lethal payload options. Will perform high-fidelity modeling and simulation to support trade-studies, requirements definition, and performance evaluations of the specific technologies and components as they apply to various tactical missions.</p>	.000	4.877	7.482	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.795	.000	
<p>Insensitive Munitions (IM) Research: The effort is developing missile propellant formulations and explosive mitigating technologies to enable missiles to meet IM requirements.</p> <p>In FY08, conducted ballistic/aging evaluation on new propellant formulations. Developed integrated passive venting designs and characterized performance of lightweight barrier concepts to impact and thermal threats.</p>	1.065	1.073	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
In FY09, demonstrate improved IM response of a minimum smoke motor with new propellant formulation and integrated venting to bullet impact, fragment impact, fast cook off, and slow cook off environments. Demonstrate improved IM response to thermal threats of high performance motor with new propellant formulation and integrated venting and evaluate endothermic barrier materials.					
<p>Defense against Rockets, Artillery and Mortars (RAM) - Interceptor Development: This effort designs and develops enabling component missile technologies to transition to defense against rockets, artillery, and mortars efforts in PE 0603313A.</p> <p>In FY08, completed testing of sensors and control systems, updated system simulations, developed preliminary integrated interceptor design.</p> <p>In FY09, begin bench level testing of component technologies and begin integration into RAM interceptor design and update error budgets and system level simulations with results. Exercise the simulations to evaluate interceptor performance in expected operational scenarios.</p> <p>In FY10, will complete bench level testing and integration of component technologies and perform Hardware-in-the-Loop testing and develop and integrate flight guidance and control software into RAM interceptor in support of planned live fire testing under PE 0603313A.</p>			9.386	6.828	2.994
<p>Missile Guidance Systems and Seeker Technology: This effort is focused on the design and development of missile seekers and sensors; guidance, navigation, and control technologies and software; and information and signal processing.</p> <p>In FY08, transitioned target algorithm software to Non-Line of Sight Launch System and initiated Human Tracking Technology development for anti-personnel weapon systems. Built and tested Phased Arrays for Tactical Seekers sub-arrays.</p> <p>In FY09, incorporate threat target and environment simulation scenes for infrared (IR) and millimeter wave (MMW) multi-mode seeker algorithm, tracker, and Aided Target Acquisition/Recognition (ATA/R) development, data fusion, and transition ATA/R and Synthetic Aperture Radar (SAR) image resolution to unmanned aviation system and missile</p>			16.028	12.350	11.773

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY		<b>PROJECT NUMBER</b> 214	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>developers. Fabricate an IR seeker with electronically stabilized imager Complete initial design and fabrication of target material classifying sensor based on lab testing.</p> <p>In FY10, will initiate the development of IR and MMW target acquisition and tracking algorithms combining imagery and image feature data. Will complete the SAR design and begin testing; and design and develop a vision based navigation system, the Image Gyro (IG) system. The IG concept will develop an independent navigation solution using camera imagery and terrain databases to provide geo-location data when GPS navigation data is not available.</p>				
<p>High Fidelity System Level Simulations and Aerodynamics: The use of advanced simulation and aerodynamics tools promises to reduce size, lighten the weight, and reduce cost in missile systems. Solar exposure simulation and testing is an enabling technology to evaluate infrared (IR) missile seeker performance due to solar effects in or out of the field of view.</p> <p>In FY08, completed infrared solar spectrum requirements analysis and feasibility studies to fill the gap that exists in missile solar exposure simulation and testing. Installed and tested Hardware-in-the-loop (HWIL) simulation control software in a range of simulation capabilities (including waveform generator and scene generation interface software) and extended aerodynamic prediction techniques for evaluating novel aerodynamic shapes.</p> <p>In FY09, complete initial spectral and optics/platform designs and begin IR radiation component development for solar exposure simulation and test. Extend HWIL simulation control software to improve user capabilities and extend aerodynamic prediction techniques to address fully turbulent, short correlation length, unsteady flows.</p> <p>In FY10, will transition initial solar infrared simulator components to PE 0603313A missile simulation technology program for the system level development. Will continue extension of aerodynamic prediction codes and will initiate an effort to develop improved methods for missile subsonic airfoil design and characterization.</p>	2.917	3.288	1.967	
<p>Smaller, Lighter, Cheaper (SLC) Tactical Missile Technologies: SLC designs and develops innovative smaller, lighter, and cheaper component technologies and 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.</p>	6.773	5.365	7.926	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602303A MISSILE TECHNOLOGY		<b>PROJECT NUMBER</b> 214	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, completed component testing of Multi-Purpose Warhead (MPW) designs. Finalized design, fabricated, and tested miniaturized Guidance Electronic Unit for insertion into precision weapon systems. Identified requirements, conducted trade studies, and completed a rate sensor design package for a form, fit and function upgrade to the TOW missile Gyro.</p> <p>In FY09, leverage latest in nano/advanced technology composite materials for lighter and stronger missile components and electronics packaging to achieve small, light, missile form factors; begin development of advanced image-based stabilization and people tracking; assess light-weight propulsion solutions to safely fire from enclosure (FFE).Will conduct trades, build prototype designs and test SLC components in relevant environments.</p> <p>In FY10, will develop designs for nano/advanced composite missile structures; conduct requirements definition and trade studies for a small height of burst sensor (HOBS) design that provides lethality against soft targets; continue electronics packaging and image stabilization and tracking algorithm development; Initiate scale-up of common MPW for TOW; evaluate common Electronic Safe and Arm Device (ESAD) architecture for application to Close Combat Missile Systems (CCMS); and complete initial designs and testing for FFE insensitive munition compliant motor.</p>				
<p>High-G Microelectromechanical Systems (MEMS) Inertial Measurement Unit (IMU): This effort designs and develops high gravitational force, low cost Micro electromechanical Systems Inertial Measurement Units capable of supporting precision guidance requirements of Department of Defense missile and gun launched precision munitions programs. This effort was performed in 3 Phases, with incremental improvements in size, precision and gun hardening. The Phase 3 design requirements include 2.0 cubic inch volume, 1 degree per hour sensitivity, and gun hardened to 20kG.</p> <p>In FY08, performed laboratory characterization testing and a missile and munition flight test of the Phase 3 IMUs, and current DIGNU design, including anti-jam (A/J) capability, and further miniaturized the A/J module, inertial sensor, deep integration algorithms, Global Positioning System receiver, and their interaction.</p>	3.100	.000	.000	
<p>Embedded Deeply Integrated Guidance &amp; Navigation Unit (eDIGNU) Technology Advancements: This effort builds on previous High-G MEMS IMU and DIGNU research. The Embedded DIGNU incorporates the following: a next generation Selective Availability Anti-Spoofing Module (SAASM); enhanced anti-jam (A/J) capability; full system-on-a-chip (SOC)</p>	5.444	6.466	7.490	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>technology for processor and memory to reduce size; more robust deep integration algorithms; and improved inertial performance. This task is conducted in Phases A and B to provide incremental improvements in inertial performance, electronics, and packaging.</p> <p>In FY08, performed design, fabrication, field tests, and laboratory characterization of Phase A DIGNU design, including A/J capability, and further miniaturized the A/J module. Component development focused on reducing errors due to vibration, improving performance, and minimizing size. The current DIGNU was tested against the following requirements: gyro bias less than 1 deg/hr; volume less than 6 cubic inches; acceleration bias less than 1 milli-G; jamming-to-signal ratio greater than 90 db; and gun-hardened to 20KG.</p> <p>In FY09, fabricate and test gyro and accelerometer sensors, test different platforms, dynamics, and mission envelopes; conduct test flight scenarios with hardware-in-the-loop; conduct government test of 12 Phase A deliverable IMUs and 2 DIGNUs of inertial sensor, deep integration algorithms, A/J capability, Global Positioning System (GPS) receiver, and their interaction.</p> <p>In FY10, will complete test of the final inertial sensor assembly design and the Phase B integrated eDIGNU to verify requirements are met. Twelve IMU deliverables will include new gyro and accelerometer sensors, electronics iteration improvements, and packaging improvements. Eight DIGNU Phase B deliverables will include a full SOC module; increased A/J capability; updated code for the new inertial sensor assembly; and deep integration and Kalman Filter algorithm improvements.</p>				
<p>Target Classification Sensors, Advanced Fuzing Technology (AFT) and Warhead Integration: This effort is designing and developing a low cost sensor capable of identifying the target class on impact and advanced fuzing technology to modify the warhead effect based on target class. The determination of the different target classifications (e.g. heavy armor, light armor, Military Operations on Urban Terrain) will be derived from the collaborative Multi-Mode, Multi-Effect (MMME) warhead effort at ARDEC (PE 0602624).</p> <p>In FY10, will complete the design and fabrication of the second generation target classifying sensor and integrate with miniaturized electronics. Will evaluate the inertial sensors ability to identify three different target classes through lab testing and begin preliminary design and fabrication of the improved sensor which will identify six different target classes. Will develop an integrated fuze design and bench test equipment for sensor test against target materials; conduct</p>	.000	.000	5.390	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
preliminary fuze-level safety tests in preparation for warhead integration tests; perform static tests with warheads to assess fuze performance and perform inert tests with air gun or similar test equipment to demonstrate sensor function.				
Total	51.734	48.015	50.716	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
223: AERO-PROPULSION TECHNOLOGY	10.434	4.784	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding provided for Aero-Propulsion Technology.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Mariah II Hypersonic Wind Tunnel Development Program							3.865	3.101	.000	
LENS XX Hypervelocity Ground Testing							.774	1.550	.000	
Missile Aero-Propulsion Computer System Modernization							5.795	.000	.000	
SBIR/STTR							.000	.133	.000	
Total							10.434	4.784	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602307A ADVANCED WEAPONS TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	24.354	23.187	19.678						Continuing	Continuing
NA5: Advanced Weapons Components (CA)	5.797	3.588	.000						Continuing	Continuing
042: HIGH ENERGY LASER TECHNOLOGY	18.557	19.599	19.678						Continuing	Continuing

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

This program element (PE) investigates enabling technologies for High Energy Laser (HEL) weapons. The major efforts under this PE develop component technologies such as efficient, high energy, solid state laser designs and adaptive optics, and lethality / effectiveness measurements that enable better models and simulations for future HEL weapon designs. Project NA5 funds congressional special interest items.

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, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work is performed by the U.S. Army Space and Missile Defense Command (SMDC), in Huntsville, AL, and the High Energy Laser Systems Test Facility, White Sands Missile Range, NM.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A ADVANCED WEAPONS TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	32.705	19.664	19.499	
Current BES/President's Budget	24.354	23.187	19.678	
Total Adjustments	-8.351	3.523	.179	
Congressional Program Reductions	.000	-.077		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	3.600		
Total Reprogrammings	-7.434	.000		
SBIR/STTR Transfer	-.917	.000		

**Change Summary Explanation**

FY 2008 funding was decreased due to

- transfers of congressional interest items of \$7340 for proper execution
- below threshold reprogrammings (BTR) of \$94

All FY 2009 increases are due to congressional adds.

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
NA5: Advanced Weapons Components (CA)	5.797	3.588	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding provided for Advanced Weapons Components applied research.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Remote Video Weapon Sight, USSOCOM Phase III								.967	1.937	.000	
Army Missile and Space Technology Initiative								4.830	1.550	.000	
SBIR/STTR								.000	.101	.000	
Total								5.797	3.588	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A ADVANCED WEAPONS TECHNOLOGY					<b>PROJECT NUMBER</b> 042	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
042: HIGH ENERGY LASER TECHNOLOGY	18.557	19.599	19.678						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 testing 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.

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, the Army Modernization Strategy and the Army Science and Technology Master Plan.

Work is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL, and the High Energy Laser Systems Test Facility (HELSTF), White Sands Missile Range, NM.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Beam Control Component Development: 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. In FY09, research and demonstrate beam control components that would be suitable for integration into an existing beam control system. This includes development and field testing of adaptive optics (AO) consisting of deformable mirrors (DMs) with high stroke and bandwidth to overcome ground level atmospheric degradation. In FY10, will design advanced architectures for beam control systems that incorporate AO and will develop component technologies that improve compactness, pointing accuracy, and agility of beam directors for improved compatibility with	.000	4.844	5.317	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A ADVANCED WEAPONS TECHNOLOGY		<b>PROJECT NUMBER</b> 042	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
future all-electric tactical platforms. This includes high power eye-safe illuminators to acquire threats at longer ranges and low-absorbing HEL windows, shared aperture optics, and mirror coatings to minimize system losses.				
Solid State Laser Effects: This effort provides the underlying data required to support system engineering designs for laser weapon systems. In FY08, performed lethality testing of advanced fuses of candidate Rockets, Artillery, and Mortar (RAM) targets in order to explore various kill mechanisms. In FY09, continue lethality testing of RAM warheads and fuses and begin expanding the program to emphasize targets other than RAM, such as Unmanned Aerial System (UAS) components, Man Portable Air Defense Systems (MANPADS), Anti-Tank Guided Missiles, and Rocket Propelled Grenades (RPGs). Use results to improve and validate the vulnerability models for use in Army engagement codes such as Extended Air Defense Simulation (EADSIM), Interactive Distributed Early Entry Analysis Simulation (IDEEAS), and other distributed interactive simulation tools. In FY10, will conduct expanded full scale static lethality testing against RAM targets, UASs, and other high priority threats to determine the laser energy required to defeat them.	1.401	1.453	2.152	
High Efficiency Laser Development: This effort develops component technologies that lead to increased laser wall-plug efficiencies. In FY09, initiate design of components, such as diode arrays, high throughput optical elements, and fiber optic/ceramic slab gain media, for developing high efficiency (greater than 30% wall-plug efficiency) SSLs. In FY10, in cooperation with the HEL Joint Technology Office (JTO) and other Services, will continue to design and develop reliable electric laser component technologies that improve SSL efficiencies, such as improved gain media, pump power sources, optical elements, and diode arrays; and will begin to explore thermal management technologies.	.000	.969	6.892	
HEL Research and Development Laboratory: This effort focuses on developing in-house expertise through SSL assessments. In FY10, in cooperation with the Army Aviation and Missile Research Development Engineering Center (AMRDEC), will conduct low-to-medium power studies on a 600-meter test range to investigate SSL atmospheric propagation and target interaction phenomenology. Data analysis and model development will be initiated to support atmospheric correction algorithm development and to provide validated inputs to wargaming modeling and simulation efforts.	.000	.000	.492	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.549	.000	
	17.156	11.784	4.825	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602307A ADVANCED WEAPONS TECHNOLOGY		<b>PROJECT NUMBER</b> 042	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>Solid State Laser (SSL) Development, Phase 3 - 100 kW: 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 that are favorable for tactical weapon applications.</p> <p>In FY08, continued laboratory performance testing and increased power output in order to evaluate laser characteristics and achieve medium power (25 to 50 kW) laser output.</p> <p>In FY09, leveraging joint and other Service funding, as well as technology progress, complete integration and performance testing of two 100 kW SSL devices; select the most promising laser and component technologies for use in High Energy Laser Technology Demonstrator (HEL TD) risk reduction activities; support systems engineering of the selected SSL Phase 3 technology for use on the mobile HEL TD platform; and begin integration of one of the devices with an existing beam control subsystem (BCS) at HELSTF to evaluate high power SSL performance at tactical ranges of interest.</p> <p>In FY10, will complete integration of the laser device with the existing BCS and will begin evaluation of high power SSL performance against a variety of target types at tactical ranges of interest as a risk reduction activity for the HEL TD.</p>					
Total			18.557	19.599	19.678
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	18.489	21.778	17.473						Continuing	Continuing
C90: Advanced Distributed Simulation	10.561	11.085	11.465						Continuing	Continuing
D01: PHOTONICS RESEARCH	.000	3.189	.000						Continuing	Continuing
D02: MODELING & SIMULATION FOR TRAINING AND DESIGN	5.609	5.908	6.008						Continuing	Continuing
D14: Advanced Modeling and Simulation Initiatives (CA)	2.319	1.596	.000						Continuing	Continuing

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

This program element (PE) designs and develops enabling technologies to create effective training capabilities for the Warfighter. The PE 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). The Advanced Distributed Simulation (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. The Modeling and Simulation for Training and Design (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.

Photonics Research, and Advanced Modeling and Simulation Initiatives (projects D01 and D14) fund congressional special interest items.

Work in this PE is related to and fully coordinated with efforts in PE 0603015A (Next Generation Training & Simulation Systems), PE 0601104A (University and Industry Research Centers), and PE 0603007A (Manpower, Personnel and Training Advance 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 in this PE is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602308A Advanced Concepts and Simulation

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	22.903	17.048	17.603	
Current BES/President's Budget	18.489	21.778	17.473	
Total Adjustments	-4.414	4.730	-.130	
Congressional Program Reductions	.000	-.070		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	4.800		
Total Reprogrammings	-3.853	.000		
SBIR/STTR Transfer	-.561	.000		

**Change Summary Explanation**

FY08 funding decrease was due to the transfer of congressional interest items for proper execution.  
 FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation					<b>PROJECT NUMBER</b> C90	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
C90: Advanced Distributed Simulation	10.561	11.085	11.465						Continuing	Continuing

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

This project develops enabling technologies for advancing distributed interactive simulation in synthetic environments such as networking of models, complex data interchange, and collaborative training. The project provides the ability to create a virtual representation of a lethal combined arms environment with the Warfighter-in-the-loop that constructive (event driven) simulation cannot provide. This project leverages and coordinates efforts with work at the Army Research Institute, the Army Research Laboratory, and the Medical Research Materiel Command.

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

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Live, Virtual, Constructive (LVC) Simulations: This effort investigates the combination of Live, Virtual and Constructive (LVC) training technologies into a seamless event. Live training refers to personnel and systems performing an exercise mission; virtual training refers to personnel using simulators; and constructive training refers to computer-aided simulations that introduce a wider control of virtual forces. Developed methods and technologies are transitioned for maturation and demonstration to PE 0603015A/project S29.</p> <p>In FY08, investigated feasibility of using the Defense Threat Reduction Agency's model of an improvised explosive device (IED) detonation that provides calculations and visualization in a physics-based real time dynamic situation for LVC resulting to realistic virtual training environments (lethality, causality assessment, mobility, etc.) for mounted and dismounted soldier embedded software to improve terrain representation, user interfaces, and adding after-action review capability. Completed component technology development and conducted laboratory experiments with small, accurate, low cost, low power tactical engagement simulation sensors (i.e. Weapons Orientation Sensor which enables technique of geometric pairing (geo-pairing) to couple a countermeasure with potential target); completed tests in live training environments to support embedded training on small footprint computers used on current force combat vehicles. Demonstrated LVC embedded training functionality capability for future transition into next generation live training programs and for embedded dismounted Soldier systems.</p>	3.608	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation			<b>PROJECT NUMBER</b> C90	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Collaborative and Immersive Environment Technologies: This effort investigates adaptive learning environments with social simulations to conduct non-kinetic asymmetric warfare training.</p> <p>In FY08, extended Joint, Interagency, Intergovernmental Multi-National (JIIM) simulation environment for mission planning/rehearsal; investigated component enhancements for adaptive learning environments that provide geo-specific surroundings, virtual human agents, and representative cultural behaviors/effects; conducted experiments using multi-sensory environments, virtual humans, and cultural effects for the development of enhanced leader and critical thinking social simulations.</p> <p>In FY09, conduct experiments utilizing game based technologies to evaluate training methods and mission planning/rehearsal tools in a JIIM simulation environment; expand multi-sensory capabilities in adaptive learning environments to enable virtual human and intelligent decision components to incorporate awareness of trainee actions; expand training development tools to rapidly portray additional representative cultures; and expand non-kinetic simulation capability to squad/team level for training.</p> <p>In FY10, will continue development of JIIM environment for squad team level training using distributed simulations and after action reviews; will develop immersive environments to support infantry training and mission rehearsal; will investigate the algorithms and methodologies to enhance the realism of simulation environments for battle command training and decision making.</p>		3.628	2.153	4.409		
Small Business Innovative Research/Small Business Technology Transfer Programs		.000	.218	.000		
<p>Modeling and Simulation Training Technologies: This effort investigates and evaluates combat medic training technologies and their effectiveness. The effort also conducts applied research to develop training technologies and techniques for Soldiers with unmanned systems.</p> <p>In FY08, completed design and construction of patient trauma simulators utilizing advances in material sciences (realistic skin, flesh, blood, bone, fluids and organs), sensory technologies, and simulated fluid loss technologies. Conducted experiments using autonomous systems to enhance the human intelligent agent team training; designed and conducted experiments with man-worn immersive systems (man-wearable training system integrates a binocular helmet mounted display with a head/body/weapon motion tracker system, and a training weapon onto a load-bearing vest) and reconfigurable mobile immersive systems to conduct training with unmanned systems using augmented reality approach.</p> <p>In FY09, conduct experiments with patient trauma demonstrators to assess Army medical training effectiveness; design and develop a mobile immersive training environment that includes the appropriate combination of man-worn systems,</p>		3.325	4.003	3.908		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation			<b>PROJECT NUMBER</b> C90	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
locomotion systems, intelligent tutors, human computer interfaces, and the ability to control autonomous systems for team training. In FY10, will investigate methods and technologies to increase medical simulation capabilities for surgical training to include initial designs for a surgical simulator. Will develop simulations to support the safe operations of unmanned systems in complex environments.						
In FY09, develop physics-based real time dynamic situations for LVC training to provide realistic environments (lethality, causality assessment, mobility, etc.) by integrating live sensor components to enable live training and a virtual/constructive mission rehearsal capability onto both Soldier and combat vehicle embedded training devices; conduct laboratory experiments in an operational environment with an embedded training device to develop display technology for combat vehicles embedded training. In FY10, will investigate use of predictive technologies and artificial intelligence in constructive training to provide behaviors and reasoning for computer generated forces in asymmetric warfare simulations. Continue technology improvements of sensor components for physics-based real time dynamic environments for LVC training.			.000	4.711	3.148	
Total			10.561	11.085	11.465	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation					<b>PROJECT NUMBER</b> D01	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D01: PHOTONICS RESEARCH	.000	3.189	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for applied research in Photonics.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Boston University Photonics Center							.000	3.099	.000	
SBIR/STTR							.000	.090	.000	
Total							.000	3.189	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation					<b>PROJECT NUMBER</b> D02	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D02: MODELING & SIMULATION FOR TRAINING AND DESIGN	5.609	5.908	6.008						Continuing	Continuing

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

This project develops training applications that enable the Army's 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 and then assess techniques and methods 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 (R&D) community through the synthesis of creativity and technology including work at the Army Research Institute and the Army Research Laboratory.

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

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Immersive Technology Techniques: This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments, creating enhanced realism. In FY08, developed intelligent tutoring, computer coaching, and rapid simulation development tools; incorporated virtual humans with large-scale social simulations; created a simulation environment in which social and anthropology data/knowledge was used to affect virtual human behavior in order to tailor/enhance the educational experience for a trainee to achieve the defined learning objectives established for a program of instruction. In FY09, explore techniques for developing distributed asymmetric warfare tutoring and coaching methods to support team training, performance assessment, and team after action reviews; and investigate/develop methods and technologies to expand single student tutoring capabilities to distributed multi-student team assessments and after action reviews. In FY10, will develop software tools for rapidly creating automated tutoring systems that can be tailored to multiple training applications/needs and support team training, performance assessment, and team after action reviews.	2.946	3.042	3.124	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.164	.000	
	2.663	2.702	2.884	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation			<b>PROJECT NUMBER</b> D02	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Immersive Technology Environments: This effort develops technologies that enable responsive and reconfigurable simulations that immerse human senses such as sight, sound, and touch in mixed reality environments (consist of physical elements you can touch and feel (such as walls and obstacles) combined with virtual imagery). Developed technologies and techniques are transitioned for maturation and demonstration to PE 0603015A/project S28.</p> <p>In FY08, developed and evaluated methods for portraying dynamic effects in mixed reality environments and assessed the use of new and emerging display technologies. Investigated methods to capture trainee physical and emotional responses in mixed reality environment.</p> <p>In FY09, create a mixed-reality immersive environment that uses sensors to provide near real-time perspective of the surrounding real world allowing a user and the world model to share a high fidelity and more realistic common view of the training environment; design and develop new, flexible display technologies to advance future training environments.</p> <p>In FY10, will investigate and develop multiple display, tracking, and audio system technologies for rapidly inserting virtual content into large-scale, real-world training environments that can be rapidly reconfigured.</p>						
Total			5.609	5.908	6.008	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602308A Advanced Concepts and Simulation					<b>PROJECT NUMBER</b> D14	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D14: Advanced Modeling and Simulation Initiatives (CA)	2.319	1.596	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for applied research in Advanced Modeling and Simulation.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Live, Virtual and Constructive (LWC) Training Systems							.000	1.551	.000	
SBIR/STTR							.000	.045	.000	
Development and Simulation for Advanced Troop Protection Concepts in Urban Warfare							.774	.000	.000	
Mobile Medic Training Program							1.545	.000	.000	
Total							2.319	1.596	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602601A Combat Vehicle and Automotive Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	87.144	89.036	55.937						Continuing	Continuing
C05: ARMOR APPLIED RESEARCH	9.169	15.437	19.801						Continuing	Continuing
H77: National Automotive Center	13.717	14.178	14.541						Continuing	Continuing
H91: Ground Vehicle Technology	29.483	25.434	21.595						Continuing	Continuing
T26: Ground Vehicle Technologies (CA)	20.284	24.219	.000						Continuing	Continuing
T31: NAT'L AUTO CENTER APP RES INIT (CA)	14.491	9.768	.000						Continuing	Continuing

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

This program element (PE) researchs and develops automotive technologies that enable Army transformation. The PE supports the research and development of components and subsystems for ground combat/tactical vehicles in the areas of survivability (project C05), advanced automotive technology (project H77), and tank and automotive technology (project H91). Projects T26 and T31 fund congressional special interest items.

Work in this PE is related to, and fully coordinated with, PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0602618A (Ballistics Technology, Robotics Technology, 0602105A (Materials Technology), and PE 0602705A (Electronics and Electronic Devices). 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	93.622	55.234	59.496	
Current BES/President's Budget	87.144	89.036	55.937	
Total Adjustments	-6.478	33.802	-3.559	
Congressional Program Reductions	.000	-.298		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	34.100		
Total Reprogrammings	-4.682	.000		
SBIR/STTR Transfer	-1.796	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology					<b>PROJECT NUMBER</b> C05	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
C05: ARMOR APPLIED RESEARCH	9.169	15.437	19.801						Continuing	Continuing

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

This project investigates, designs, and evaluates advanced armor concepts, ballistic defeat mechanisms, and armor packaging concepts to achieve lightweight, ballistically-superior armors/structures for combat and tactical vehicles. Armors 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 down select of technologies entering maturation and development in PE 0603005A/project 221.

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

Work in this project is performed 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.388	.000	
Armor for Tactical Vehicle Survivability: The objective of this effort is to evaluate structural and add-on armors for tactical vehicles and investigate and characterize effects of mine blasts on lightweight vehicles using modeling and simulation. In FY08, assessed new armor solutions for implementation into tactical wheeled vehicle (TWV) survivability (0603005A). Assessed optimized armor/non-armor survivability technologies as a layered survivability suite for FY09 testing and potential demonstration platform(s). In FY09, conduct final armor assessments of potential candidates for maturation and transition using demonstration vehicles; and fabricate test bed(s) to assess the integrated survivability suite(s). Conduct electrical bench tests to study electrical integration impacts such as electromagnetic (EM) compatibility and interference caused by integration of survivability suite(s) onto vehicles.	.647	.630	.000	
Advanced Armor Development:	.000	5.503	4.601	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology		<b>PROJECT NUMBER</b> C05	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
The objective of this effort is to investigate advanced armors (primarily reactive and electromagnetic solutions) for combat and tactical vehicle applications to defeat single and multiple chemical and kinetic energy (CE and KE) emerging threats. In FY09, assess reactive armor and electromagnetic armor concepts developed under PE 0602618/Project H80 for defeat of emerging CE and KE threats. Investigate tools and techniques for non destructive evaluation (NDE)/non destructive inspection (NDI) of dissimilar material joints. Assess and validates modeling and simulation (M&S) tools for vehicle level analysis of combat vehicles in collisions and blast threats. In FY10, will continue to investigate and test candidate reactive and passive armor concepts for single emerging threat (KE) and downselect solutions for maturation with respect to capability, weight, and ease of integration.				
Vehicle Armor Protection for Lightweight Combat Systems: This effort designs, fabricates, and evaluates add-on lightweight armor packages to protect combat systems against projectiles, warheads, penetrators and blast fragments. In FY08, demonstrated optimized second generation add-on armor (upgraded performance B-Kit armor package for objective projectile, fragment, and mine threats at reduced weights) and structure configurations for future combat vehicles; conducted ballistic tests to verify final armor designs and integrated into second generation full sized concept vehicle structure (spaceframe demonstrator). In FY09, develop enhancements to ground vehicle armor and third generation mine kits to reduce weight and meet objective and emerging threats; conduct and report armor space and weight trade studies to support design of next generation add-on armor solutions; assess blast modeling and simulation tool(s) capability for full level simulation, including impact on crew; and perform material and hull design attachment analysis and develop non-destructive evaluation and inspection techniques. In FY10, will perform initial testing of third generation armor systems to meet emerging threats; will analyze and evaluate material/recipes performance for various armor/mine protection areas; and will provide initial characterization of next generation armor materials to identify risks for maturation; and will build improved ballistic performance armor with embedded health monitoring. This work is done in conjunction with program elements 0602105A, 0602618A, and 0603005A.	8.522	8.916	10.313	
Blast Mitigation: This effort matures modeling and simulation (M&S) tools to predict ground vehicle structural performance against blast threats. Tests are also conducted to validate the M&S tools.	.000	.000	4.887	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology		<b>PROJECT NUMBER</b> C05	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will develop advanced crew protection technologies for land mine/explosive events; will investigate potential techniques for 3-dimensional vehicle design and crew protection methods for land mine/explosive events; will validate survivability enhancements of integral fuel tanks against objective threats; will begin development of external fire suppression methods to address fuel, track, and stowage fire vulnerabilities for combat vehicles; and will improve blast tolerance of automatic fire extinguishing systems.				
Total	9.169	15.437	19.801	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology					<b>PROJECT NUMBER</b> H77	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H77: National Automotive Center	13.717	14.178	14.541						Continuing	Continuing

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

This project researches and develops automotive component technologies to meet ground combat and tactical vehicle objectives. The project funds the National Automotive Center (NAC), which conducts shared government and industry technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Alternative Energy: This effort leverages opportunities from industry to develop alternative energy technologies for Army applications. In FY08, developed thermoelectric power modules using waste exhaust heat to power low current sensing devices; conducted qualification experiments for alternative fuels program for ground vehicle systems; and developed mobile micro-grid Electronic Power Conditioning Control (EPCC) module. In FY09, evaluate thermoelectric power modules on Tactical Wheeled Vehicle (TWV) platforms; continue to conduct qualification experiments for alternative fuels program for ground vehicle systems; expand mobile micro-grid technology development program with large scale technology demonstration; evaluate dual-use advanced automotive technologies on ultra-light, light, medium, and heavy tactical vehicles. Leverage developments in 3D terrain topology modeling and verification of vehicle designs tools in support of a distributed simulation capability. In FY10, will investigate waste to energy technologies for application in power generation devices; will pursue dual-use power and energy component development; will evaluate vehicle platform with high output power capabilities tied to power grid with new vehicle based output controller strategy; will expand development and commercialization of dual-use simulation-based tools that incorporate 3D terrain topology modeling for validation and verification of vehicle designs; and will design and build an energy storage system on hybrid electric vehicles for forward operations applications utilizing renewable energy sources and/or generator set.	8.232	7.908	8.724	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology		<b>PROJECT NUMBER</b> H77	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.177	.000	
<p>Conditioned Based Maintenance (CBM) and Intelligent Systems:                      This effort advances condition based maintenance and intelligent systems technologies for dual use applications, including the evaluation of commercial hybrid electric non-tactical vehicles on military bases to gather performance, reliability and maintainability data.                      In FY08, developed and evaluated inline oil sensing technology to provide condition data including viscosity, oxidation, and lubricant contaminants.                      In FY09, continue crash modeling and safety design for TWV's; develop and evaluate dual-use condition-based maintenance/intelligent systems M&amp;S tools. Evaluate new data collection and analysis methods for ground vehicles as systems of systems with an emphasis on robustness and focusing on creation of comprehensive vehicle CBM M&amp;S tools.                      In FY10, will continue to develop and evaluate dual-use CBM tools by conducting lithium-ion and lead acid battery characterization experiments and thermo electric power unit studies.</p>	2.055	2.103	2.181	
<p>Power, Energy and Mobility:                      This effort investigates dual use power, energy, and mobility technologies.                      In FY08, expanded hybrid-hydraulic hybrid technology light tactical vehicle and fuel cell alternative power unit on-vehicle investigations; and pursued dual-use power and energy component development.                      In FY09, conduct detailed technology evaluation of fuel cell APU; conduct military specification comparison of micro-grid hardware and software; expand energy capacity range of mobile micro-grid power control module; pursue dual-use power and energy component development including motor and generator concepts; and develop vehicle platform with high output power capabilities tied to power grid with new vehicle based output controller strategy. Expand development and commercialization of high-density diesel engine and vehicle thermal management M&amp;S tools and investigate new energy conversion options and propulsion system architectures.                      In FY10, will evaluate performance capabilities of commercially available technologies applied to military ground vehicle platforms in suspension, torque vectoring differentials, batteries, brakes, electrical subsystems, and alternative chassis structures; will develop hybrid electric vehicle requirements and software integration to facilitate the design and build of a communication system between vehicle and the power control using intelligent software. Continue M&amp;S efforts by modeling advanced diesel and hybrid powertrains by developing predictive M&amp;S tools and optimization methodologies.</p>	3.430	3.990	3.636	
<b>Total</b>	13.717	14.178	14.541	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology					<b>PROJECT NUMBER</b> H91	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H91: Ground Vehicle Technology	29.483	25.434	21.595						Continuing	Continuing

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

This project designs, develops, and evaluates a variety of innovative and enabling technologies in the areas of vehicle concepts, virtual prototyping, 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.

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

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

Efforts in this project are closely coordinated 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Non-primary Power System (NPS):</b> This effort investigates component technologies for energy storage and generation. In FY09, investigate optimal strategy combining energy storage and power generation components into a non-primary power system. In FY10, will develop system controls for advanced power and energy system demonstrator; will investigate strategies to reduce non-primary power generation system exhaust noise; and will develop techniques to mitigate safety challenges for advanced energy storage devices on vehicles. This effort is done in coordination with efforts in 0603005A.	.000	4.384	2.619	
<b>Propulsion-Prime Power:</b> The goal of this effort is to design engines and generators and their components with significantly improved performance characteristics, efficiencies, and power densities. In FY08, completed fabrication of the Opposed Piston/Opposed Cylinder (OPOC) engine and performed fuel economy optimization: initiated OPOC engine performance and durability test demonstration. Initiated concept analysis for design	7.594	2.032	2.029	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>of a tactical wheeled vehicle (TWV) engine for lower heat rejection and higher system power density. Initiated concept analysis for design of a fuel injection system for heavy fuel operation.</p> <p>In FY09, perform hybrid electric power component test and evaluation (T&amp;E) for TWV; optimize control strategy for higher system power density engine design.</p> <p>In FY10, will evaluate the performance of modified commercial diesel engines with control strategy to enable JP-8 fuel operation; and will assess compact, high power dense hybrid electric components performance environment.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs.			.000	.052	.000	
<p>JP-8 Reformation for Military Fuel Cells:</p> <p>This effort investigates JP-8 reformer and desulphurization technologies so that JP-8 can be utilized as a fuel source for fuel cells used in future military vehicle power applications.</p> <p>In FY08, optimized a logistics fuel reformer sized to transportable system for processing JP-8 for fuel cell use.</p> <p>In FY09, complete integration of fuel reformer system for JP-8; conduct endurance and environmental testing on JP-8 reformer connected to fuel cell to produce power suitable for auxiliary and light robotic platform propulsion requirements.</p> <p>In FY10, will begin tracking sulfur handling capacity and operational temperatures of JP-8 reformer, desulfurization devices and fuel cell system; will begin development on all major reformer fuel cell system components to ensure functionality within the claim space limitations; and will finalize test plan for JP-8 reforming fuel cell system. This effort is done in coordination with efforts in 0603005A.</p>			5.806	3.900	2.076	
<p>Hybrid Electric Vehicle Components:</p> <p>The objective of this effort is to design, fabricate, and evaluate components for energy storage, power distribution and power management.</p> <p>In FY08, designed and fabricated high power density DC-DC converter using silicon carbide (SiC); demonstrated innovative thermal management techniques achieving superior heat rejection rates and high inlet coolant temperatures compatible with SiC technologies; and conducted computational fluid dynamics analysis on cooling systems to optimize their integration in vehicle platforms.</p>			4.701	.000	.000	
<p>Pulse Power:</p> <p>This effort focuses on providing technology for compact, high frequency/high energy/high power density components and devices, which are enablers for several advanced electric-based weapon systems.</p>			2.177	3.276	6.583	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, increased pulse width of Si and SiC switches by 10X, increased power density of converters by 3X, and increased power density for batteries and capacitors by 2X to provide compact power conditioning and energy/power storage for applications such as EM gun, laser, and other directed energy weapons.</p> <p>In FY09, evaluate pulse switches, power converters, and power, and energy storage. Evaluate Si-based Super Gate Turn-Off (SGTO) versus SiC-based thyristors for capability to meet power density and switching speeds required for High Energy Laser application.</p> <p>In FY10, will develop improved gate and bus structure design for high power applications; will develop SGTO switch technology using SiC for high power applications.</p>						
<p><b>Diagnostics/Prognostics for Condition Based Maintenance:</b> 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 the occur.</p> <p>In FY08, developed diagnostic/prognostic algorithms for ground vehicle condition based maintenance.</p> <p>In FY09, develop diagnostic and prognostics systems capabilities to monitor and anticipate component and system failures and faults; identify root-cause of failures for critical power train components of Abrams and Bradley engine and transmission; and evaluate and identify commercial monitoring sensor capabilities. Investigate capability to integrate sensors to provide more accurate diagnostics/prognostics as well as architecture to integrate into wireless networks to enable remote monitoring capability.</p> <p>In FY10, will develop and evaluate engine and transmission algorithms to determine component and system state of health; and will develop and assess engine and transmission algorithms to predict failures and report remaining useful life.</p>			1.300	4.433	1.242	
<p><b>Power &amp; Thermal Management:</b> 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. In FY09, develop, verify, and validate power and thermal management models and simulation; design and develop intelligent power and thermal components; and generate test and evaluation plan for intelligent power and thermal management.</p> <p>In F10, will develop combined power and thermal management system level architecture from modeling and simulation toolset; will design and develop integrated electronic power and thermal management device/component level technology; and will investigate advanced intelligent (learning and adaptive) power management control algorithms using artificial intelligence techniques. This effort is done in coordination with efforts in 0603005A.</p>			.000	3.507	3.110	
Force Projection:			5.212	2.855	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>This effort focuses on reducing the logistics footprint by developing water generation, recovery, and purification technologies.</p> <p>In FY08, developed and tested alternative disinfection technology for water purification; analyzed rate and transformation of water contaminants for reduced health risks and improved water quality.</p> <p>In FY09, investigate a water from air prototype system on a mobile platform; assess in-line and hand-held water monitoring technology to determine the capability to monitor biological and chemical contaminants; formulate and prepare single lubricant product and conduct laboratory assessment of key properties; and create Fire Resistant Fuel formulation for JP-8 with antimist agent and develop laboratory methods to assess key Fire Resistant Fuel properties.</p>						
<p>Intelligent Systems Technology Research:</p> <p>This effort assesses improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems.</p> <p>In FY10, will analyze the sensor data required to allow for safe unmanned system operations in an urban environment; and will use modeling and simulation to develop embedded real-time dynamic mobility models to predict manned and unmanned vehicle responses to prevent unsafe mobility situations while under robotic control.</p>			.000	.000	2.906	
<p>Mobility:</p> <p>This effort focuses on improving drive component performance and reliability, fuels and lubricants, minefield clearance, counter obstacle bridging, and gap crossing technologies to reduce the logistics burden associated with the sustainment of manned and unmanned tactical and combat vehicles.</p> <p>In FY08, completed technical and economic feasibility report for single lubricant technology, developed additives, and identified synthetic base stocks for making a single lubricant; completed Abrams track bushings failure analysis and track elastomer laboratory.</p> <p>In FY09 reformulate, model, redesign, and fabricate high performance track bushings; install the improved bushings onto standard Abrams track; and initiate laboratory testing of high performance track bushings.</p> <p>In FY10, will test new high performance bushings on a standard Abrams track to validate track system durability improvements.</p>			2.693	.995	1.030	
Total			29.483	25.434	21.595	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology	<b>PROJECT NUMBER</b> H91
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology					<b>PROJECT NUMBER</b> T26	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T26: Ground Vehicle Technologies (CA)	20.284	24.219	.000						Continuing	Continuing

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

Congressional Interest Item funding for Ground Vehicle Technology applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Nano-Engineered Multi-Functional Transparent Armor	.773	.000	.000	
Light Weight Composite Brake for Armored Wheeled Vehicles	.772	.000	.000	
Center for Advanced Vehicle Design and Simulation	1.545	.000	.000	
Digital Engine/Hydraulic Valve Actuation Technology	.773	.000	.000	
Secure Mobile MANET System	1.159	.000	.000	
Institute for Advanced Materials and Manufacturing Strategies (IAMMS)	2.319	1.163	.000	
SkyPure-Water from Air	1.545	.000	.000	
Automotive Research Equipment Purchase	1.545	.000	.000	
DoD Hydrogen PEM Fuel Cell Medium/Heavy Duty Vehicle Demonstration Program	3.091	1.550	.000	
Extreme-Condition Vehicle Tribology for Military Vehicle Technology at Northwestern University	.966	.000	.000	
Quick Reaction Advanced Tactical Vehicle Technology	2.705	.000	.000	
Rapid Up-Armor Synthesis and Crashworthiness Design for Improved Soldier Survivability	1.546	1.163	.000	
Center for Tribology and Coatings	1.545	.000	.000	
Nanofluids for Advanced Military Mobility	.000	.775	.000	
Ground Vehicle Reliability Modeling for Condition Based Maintenance	.000	.775	.000	
Fire Resistant Fuels (pending transfer to 0603005A)	.000	3.100	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology			<b>PROJECT NUMBER</b> T26	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HEV Battery System for Future Combat System			.000	1.550	.000	
Condition Based Maintenance and Mission Assuredness for Ground Vehicles			.000	2.325	.000	
Improved EFP & IED Prot, Testing, Modeling & Proving Using Lithia Alumina Silica (LAS) Glass Ceramics			.000	2.325	.000	
Ultra Light Weight Transmission for FCS			.000	1.549	.000	
Remote Unmanned Vehicle Checkpoint System			.000	.969	.000	
Turbo Fuel Cell Engine			.000	2.422	.000	
Integrated Vehicle Health Monitoring System			.000	1.550	.000	
SBIR/STTR			.000	.678	.000	
Superlattice Semiconductors for Mobile SS Lighting and Solar Power Applications (pending transfer to 0603005A)			.000	2.325	.000	
Total			20.284	24.219	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology					<b>PROJECT NUMBER</b> T31	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T31: NAT'L AUTO CENTER APP RES INIT (CA)	14.491	9.768	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for National Automotive Center applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Tactical Metal Fabrication System (TacFab)						2.319	1.937	.000		
Extended Lifecycle Management Environment						.000	.969	.000		
Illinois Center for Defense Manufacturing						.000	1.938	.000		
Advanced Manufacture of Lightweight Materials and Components						1.545	2.325	.000		
Globally Accessible Manufacturing and Maintenance Activity (GAMMA)						2.319	.000	.000		
Military Fuels Research						1.545	1.550	.000		
Hydraulic Hybrids, Advanced Materials, and Multi-fuel Engine Research (HAMMER) Program						3.864	.000	.000		
Light Utility Vehicle						.966	.000	.000		
Advanced Digital Hydraulic Hybrid Drive System						1.933	.000	.000		
Center for Advanced Vehicle Technology and Fuel Development						.000	.775	.000		
SBIR/STTR						.000	.274	.000		
Total						14.491	9.768	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602601A Combat Vehicle and Automotive Technology	<b>PROJECT NUMBER</b> T31
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602618A BALLISTICS TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	89.526	87.960	61.843						Continuing	Continuing
HB1: SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)	16.520	16.645	.000						Continuing	Continuing
H03: ROBOTICS TECHNOLOGY	14.697	16.348	.000						Continuing	Continuing
H75: ELECTRIC GUN TECHNOLOGY	3.867	4.038	4.086						Continuing	Continuing
H80: Survivability and Lethality Technology	54.442	50.929	57.757						Continuing	Continuing

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

This program element (PE) provides ballistic technologies required for armaments and armor that will enable enhanced lethality and survivability for the Soldier. The PE supports applied research on autonomous mobility technology for future land combat systems (project H03); applied research on technologies for electric armaments and penetrators that offer the potential to achieve leap-ahead lethality capability by providing hypervelocity and hyper-energy launch well above the ability of the conventional cannon (project H75); and applied research on lightweight armors and structures for the Soldier and vehicles, kinetic energy active protection, crew and component protection from ballistic shock and mine-blast, insensitive propellants/munitions, novel multi-function warhead concepts, affordable precision munitions technologies, and physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies (project H80). Project HB1 funds congressional special interest items.

Work in this PE is related to and 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 0602782A (Command, Control, Communications Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle 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.

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	68.899	71.550	75.526	
Current BES/President's Budget	89.526	87.960	61.843	
Total Adjustments	20.627	16.410	-13.683	
Congressional Program Reductions	.000	-.290		
Congressional Rescissions	.000	.000		
Total Congressional Increases	20.000	16.700		
Total Reprogrammings	1.744	.000		
SBIR/STTR Transfer	-1.117	.000		

**Change Summary Explanation**

FY08 funding increase was due to transfer of congressional interest items.

FY09 funding increase is due to congressional adds.

Beginning in FY10, funds transferred to PE 0602120A, project TS2 (Robotics Technology), and adjustments made to Electromagnetic Armor and Individual Warfighter Technologies to support higher priority efforts.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY					<b>PROJECT NUMBER</b> HB1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
HB1: SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)	16.520	16.645	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
These are Congressional Interest Items										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Tungsten Penetrators and Ballistic Materials							1.545	.000	.000	
Laser Based Explosives and Chem/Bio Standoff and Point Detector							3.091	3.875	.000	
Advanced Composite Materials Research for Air and Ground Vehicles							1.545	.000	.000	
Beneficial Infrastructure for Rotorcraft Risk Reduction Demonstrations (BIRRRD)							.774	.775	.000	
Multi Mission Armored Watercraft (MMAW) Project							1.159	.000	.000	
Small Unmanned Aerial Vehicles (UAVs) and Sensors							.484	.484	.000	
Super High Accuracy Range Kit - 105mm Artillery Technology							3.091	3.487	.000	
Advanced Composite Armor For Force Protection							2.898	1.550	.000	
Next Generation Lightweight Electric Drive Systems for Army Weapons							1.933	1.550	.000	
Globally Accessible Manufacturing and Maintenance Activity (pending transfer to 62601)							.000	1.550	.000	
Eye-Safe Standoff Fusion Detection of CBE Threats							.000	1.938	.000	
5.56mm Aluminum Cartridge Case, Lake City Army Ammunition Plant							.000	.969	.000	
SBIR/STTR							.000	.467	.000	
Total							16.520	16.645	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY	<b>PROJECT NUMBER</b> HB1
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY					<b>PROJECT NUMBER</b> H03	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H03: ROBOTICS TECHNOLOGY	14.697	16.348	.000						Continuing	Continuing

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

This project funds applied research on autonomous mobility. The research focuses on investigation of advanced perception for autonomous ground mobility, intelligent vehicle control and behaviors; and human supervision of unmanned ground systems. Research results will enable both semi-autonomous and near autonomous unmanned ground vehicles (UGVs) with products transitioning to advanced development efforts. The work within this project provides the basis for the Collaborative Technology Alliance (CTA) in robotics. The applied research conducted in this program will be transitioned to technology development, demonstration, and materiel acquisition programs being conducted by the Office of the Secretary of Defense Joint Robotics Program and each of the Services.

Work in this PE is related to and fully coordinated with efforts in PE 0603005A (Combat Vehicle 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.

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
UGV Integration: Integrate technology on unmanned ground vehicle (UGV) test beds and conduct extensive field testing and technology characterization to establish improved capability for near autonomous UGVs. Leverage algorithms being conducted under DARPA sponsored research, e.g., learning applied to ground robotics (LAGR). Conduct regular, periodic testing at Ft. Indiantown Gap, PA, and other military facilities that will test the technology in complex environments. The results of the tests will be used 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. In FY08, evaluated technologies to enable collaborative operation of near-autonomous unmanned systems, including networked air and ground unmanned vehicles, managed by a single Soldier. In FY09, evaluate the ability of unmanned ground vehicles to autonomously adapt to dynamic tactical environments.	3.758	3.987	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY		<b>PROJECT NUMBER</b> H03	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>CTA: Execute CTA for advanced perception, control/behavior, and man-machine interface technology required for high-speed mobility (including robotic-follower operations) and basic tactical behaviors common to multiple military missions. Research focuses on new sensor and sensor processing algorithms for rapid detection and classification of objects in the environment enabling safe high-speed mobility and intelligent tactical behavior by future unmanned systems; implementing adaptive control strategies that will enable unmanned systems to display intelligent tactical behavior, and development of human-robot interaction (HRI) scalable, intuitive, multi-modal control interfaces that will minimize the additional cognitive workload for Soldiers controlling unmanned assets. In FY08, researched improved object recognition and feature detection to enable tactical behavior and initiated creation and integration of mechanisms to adapt to intelligent adversaries. In FY09, develop technology for scene understanding and autonomous tactical behavior in the context of reconnaissance mission scenarios.</p>	7.000	7.220	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.420	.000	
<p>Perception and Intelligent Control: Develop perception and intelligent control technologies required to meet objective capabilities for the armed robotic vehicles and to transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle Advanced Technology) project 515 for integration into test bed systems. Leverage Defense Advanced Research Projects Agency (DARPA) sponsored research for control of collaborating agents to enable mixed teams (manned/unmanned) to conduct military missions. In FY08, developed perception and control technology to permit initial implementation of behaviors to enhance the operational effectiveness of robotic vehicles, including safe operations in populated environments. In FY09, develop robotics technology that will permit unmanned vehicles to adapt to dynamic situations found in tactical environments.</p>	3.939	4.721	.000	
<b>Total</b>	<b>14.697</b>	<b>16.348</b>	<b>.000</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY	<b>PROJECT NUMBER</b> H03
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY					<b>PROJECT NUMBER</b> H75	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H75: ELECTRIC GUN TECHNOLOGY	3.867	4.038	4.086						Continuing	Continuing

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

This project conducts applied research for Electromagnetic (EM) Guns. This project evaluates the potential of EM guns to provide such leap-ahead armaments capabilities that are fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force. Focus is placed on addressing advanced materials for pulsed power; robust, compact, and lightweight launchers; full-scale, hypervelocity utility of novel kinetic energy penetrators (NKEPs) against a range of present and future threats; and efficient high energy launch packages. The results are transitioned to the Armament Research, Development, and Engineering Center (ARDEC) where they are being incorporated into an EM gun demonstration system.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.076	.000	
Analysis: In FY08, analyzed utility of EM guns on the battlefield. In FY09, define the guidance and control parameters needed to increase hypervelocity hit probability. In FY10, will provide system analysis for precision fire application and document the EM armament system technical barriers.	.370	.350	.509	
Pulsed Power: Evolve the high strength composite materials critical for compact pulsed alternators. In FY08, proved high-strength, low-density, high-conductivity conductor technology and investigated high current switch materials. In FY09, study advanced materials (bandings, conductors, and switches) to reduce pulsed alternator size and mass. In FY10, will evaluate technology for rotor design, components, and assembly, which are required for next generation pulsed alternator. Provide assessment on improvements to pulsed alternator design that uses advanced materials.	1.397	1.512	1.961	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY			<b>PROJECT NUMBER</b> H75	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Launcher/Projectile:                      Research technologies needed to incorporate high strength, low density materials necessary for a long life, field-worthy EM cannon and develop lethal mechanisms that take advantage of the hypervelocity capability of EM guns and provide the armature and sabot technologies needed for accurate, low parasitic mass launch packages.                      In FY08, established technologies to eliminate arcing at the projectile/launcher interface.                      In FY09, demonstrate large-caliber (&gt;5 MJ) kinetic energy and multipurpose projectiles launched from an EM gun.                      In FY10, will provide an analysis of thermal management techniques that are needed to cool rails for repetitive launch. Provide a projectile concept that is capable of meeting the precision fire mission as specified by the ARDEC Electromagnetic Gun advanced technology development effort.</p>	1.300	1.300	1.616		
<p>Full-Scale Hypervelocity Lethality:                      In FY08, validated reactive material (RM) multipurpose round at 2 MJ muzzle energy.                      In FY09, demonstrate full scale (&gt;5MJ muzzle energy) RM warhead and transition to ARDEC.</p>	.800	.800	.000		
<b>Total</b>	3.867	4.038	4.086		
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY					<b>PROJECT NUMBER</b> H80	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H80: Survivability and Lethality Technology	54.442	50.929	57.757						Continuing	Continuing

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

This project provides materials and armor/anti-armor terminal ballistic mechanisms that will provide better armor and armorments. Specific technology thrusts include: lightweight armors (Soldier/vehicle) and structures; active protection systems (APS); crew and component protection from ballistic shock, 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 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.

Work in this PE builds on the materials research transitioned from PE 0601102A (Defense Research Sciences), project H42 (Materials and Mechanics), and PE 0602105A (Materials Technology) and applies it to specific Army platforms and the individual Soldier. The work is related to and fully coordinated with efforts in 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), and PE 0708045A (Manufacturing 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 in this project is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Mine blast Protection: Develop mine blast, ballistic shock mitigation, and crew protection technologies to enable survivability of current and future platforms, ground tactical vehicles, and the individual Soldier. In FY08, designed lightweight, easily installed blast-penetrator protection (to include better seat designs) for occupants of current and future vehicles. In FY09, devise models for mine protection using advanced-electromagnetic armor (A-EMA) and support validation of A-EMA mine kits; prove full-scale explosive loading with test apparatus to simulate vehicle borne or roadside blast fragment loading; transition second generation flexible protection equipment for individual Soldier development community.</p>	3.500	3.550	4.012	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY			<b>PROJECT NUMBER</b> H80	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will analyze the ballistic shock effects of objective threat defeat on future vehicles. Will computationally address the interaction of blast waves from objective blast threat with magnetic plate materials investigated in PE 0602105A/project H84.						
<p><b>Armor Formulations:</b> In FY09, research and investigate composite ceramic materials (from PE 0602105A/project H84) to increase body armor performance while reducing weight. For ground combat vehicles, design and develop reactive armor and electromagnetic armor solutions for defeat of emerging kinetic energy (KE) and chemical energy (CE) threats. Assess new explosive materials for reactive armors (RA) with modeling, simulation, and tests to characterize performance as well as sensitivity. Conduct modeling and simulation and experiments of lightweight brass board electromagnetic (EM) armor solutions using advanced materials to include hybrid armor designs that provide dual threat protection capability.</p> <p>In FY10, will continue composite ceramic materials investigations for personnel protection applications; will conduct tests with candidate single and dual-threat (CE &amp; KE) defeat armor components (RA and EM) to design vehicle armor concepts; will conduct first proof of principle test with hybrid armor components (combines RA and EM technologies) for dual threat defeat; will develop new test methodologies, diagnostics, and modeling and simulation tools to better support active and hybrid armor development.</p>			.000	15.976	20.789	
<p><b>Structural Armor:</b> Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies for transition to current and future tactical and combat vehicle designers.</p> <p>In FY08, developed passive armor designs with lower densities that defeat tactical vehicle threats; validated optimized second generation armor and structure configurations for future threats; explored novel electrical protection system (EPS) mechanisms for full spectrum defeat.</p> <p>In FY09, prove passive armor designs that defeat future tactical vehicle threats with further density reductions; validate objective threat defeat at goal vehicle weights; couple modeling and simulation with ballistic characterization to validate third generation armor concepts for future threats.</p> <p>In FY10, will confirm multi-hit capability of third generation armor concepts designed from emerging materials in PE 0602105/project H84 at goal weights against objective threats for vehicles. Will validate EPS performance for tactical vehicles, both computationally and with tests in relevant environment.</p>			9.434	11.808	12.328	
<b>Energetics:</b>			4.650	4.450	4.606	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY		<b>PROJECT NUMBER</b> H80	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Develop propulsion and energetics technologies. Evaluate, select, and validate novel/nanostructural insensitive energetic materials concepts that exploit managed energy release and are required for improving the effectiveness and reducing the vulnerability of future gun/missile systems and warheads.</p> <p>In FY08, utilized reactive materials, novel energetics, and nano-structured materials to enhance propellant, igniter, explosive performance, reduced sensitivity, and provided increased multipurpose applications; formulated, evaluated, and characterized propulsion and detonation performance of common low-cost novel insensitive formulations; employed testing, modeling, and simulation to reduce munitions vulnerability and enhanced performance and effectiveness.</p> <p>In FY09, apply ballistic modeling and simulation to evaluate low-vulnerability propulsion charge configurations at reduced caliber for MOUT and gun launched rockets; apply reactive materials and nano-structured materials to enhance energy output with less propellant and explosive material; derive and apply chemical and physical mechanisms to reduce erosion via dynamic nitriding; determine the effects of physical modification and compartment packing design of munitions on the vulnerability of propellants and explosives to fast and slow cook-off, bullet and fragment impact, shaped charge jet impact; evaluate performance of advanced enhanced blast explosive formulations and munitions.</p> <p>In FY10, will provide technology assessment of reactive material as structural components for Army munition systems. Will incorporate reactive materials into structural components for Army munition systems and will test their performance of the system. Will transition hypergolic rocket motor and understanding to RDECs.</p>				
<p><b>Precision Munitions:</b> Develop advanced technologies to enable a broad spectrum of affordable precision munitions. Develop a multi-disciplinary approach to munitions system design by coupling physics-based models of interior ballistics, launch dynamics, flight mechanics, and high-G guidance, navigation, and control (GN&amp;C) technologies to enable smaller, cheaper, and lighter low-collateral-damage precision munitions for future asymmetric operations in military operations on urban terrain (MOUT).</p> <p>In FY08, performed an integrated flight demonstration of a supersonic medium-caliber interceptor; validated smaller, lighter, cheaper munitions components and transition to development community.</p> <p>In FY09, address technology that enables precision fires for small unit MOUT operations.</p> <p>In FY10, will validate reduced state GN&amp;C methods that will significantly reduce cost of precision munitions. Will validate low cost robust actuator technology for indirect fire application.</p>	4.350	4.200	4.557	
<p><b>Active Protection:</b></p>	1.600	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY			<b>PROJECT NUMBER</b> H80	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Develop active protection counter-munitions and sensor technologies to effectively defeat all anti-armor munitions including kinetic energy (KE) projectiles, which is critical to enable survivability of future platforms. In FY08, developed enhanced explosive warhead technology and validated the warhead technology versus KE and shaped charge threats.						
<p><b>Advanced Munitions:</b> Develop advanced ammunition and lethality technologies. Identify and model preferred options to reduce energy/mass required to defeat emerging armor threats and to provide multi-purpose capabilities for revolutionary future lethality. In addition, investigate technology options for scaling warhead lethality to enhance MOUT war fighting including control of collateral damage. In FY08, performed end-to-end validation of multi-threat objective projectile (M-TOP) warhead; transitioned M-TOP technologies (including analytic and numerical models for weapons effects) to ARDEC and AMRDEC; developed scalable warhead component technologies and prepared for possible technology transitions. In FY09, prove integrated scalable warhead technology for blast, fragmentation, and penetration effects in urban environments. In FY10, will research advanced scalability concepts for medium and large caliber projectiles and missiles.</p>			4.175	3.575	3.863	
<p><b>Survivability/Lethality Analyses:</b> Devise state-of-the-art survivability/lethality/vulnerability (SLV) methodologies to dynamically model the interaction of conventional ballistic threats versus future systems. In FY08, developed methodologies to analyze emerging technologies and survivability in a networked, system of systems context and validated for production. In FY09, develop novel blast and combined-effects methodologies for non-traditional, emerging synergistic threats; demonstrate an early Modular UNIX-based Vulnerability Estimation Suite (MUVES) 3 analysis capability, and deliver advanced crew-casualty metrics for assessing body armor. In FY10, will investigate alignment of methodology development to the coupling of emerging and predicted threats with advancing armor materials/recipes and medical community inputs.</p>			6.733	6.810	7.602	
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.560	.000	
GWOT Request:			20.000	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602618A BALLISTICS TECHNOLOGY		<b>PROJECT NUMBER</b> H80	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, explored proven, expedient armor solutions at reduced weights against emerging threats using a combination of standard ballistic instrumented test protocols and high performance computing. Overall goal is to achieve weight neutral or enhanced performance armor solutions relative to current armor being pursued. Demonstrated and matured high performing reduced weight/alternate materials for armor designs. Performed integration and automotive assessments of additional weight impact on Mine Resistant Ambush Protected (MRAP) platforms due to the improved armor designs. Continued threat characterization along with vulnerability analysis to support design decisions as well as address evolving threats. Evaluated current and enhanced seating technologies to provide enhanced crew survivability from blast. Augmented armor with emerging protection technologies to include detection and neutralization systems. Selected armor/non-armor solutions have undergone testing at ATEC on MRAP platforms for the purpose of fulfilling Urgent Material Release (UMR) requirements/safety certification/Capabilities and Limitations Report.				
Total	54.442	50.929	57.757	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602622A Chemical, Smoke and Equipment Defeating Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	10.248	8.906	5.293						Continuing	Continuing
BA1: Protection Technologies (CA)	8.061	6.618	.000						Continuing	Continuing
552: SMOKE/NOVEL EFFECT MUN	2.187	2.288	5.293						Continuing	Continuing

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

The objective of this program element (PE) is to investigate and evaluate 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. This PE pursues research in materials science and dissemination methodologies and mechanisms and technologies and techniques to enable forensic analysis of explosive signatures (project 552).

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

The cited work is consistent with the 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 Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602622A Chemical, Smoke and Equipment Defeating Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	8.976	2.295	2.324	
Current BES/President's Budget	10.248	8.906	5.293	
Total Adjustments	1.272	6.611	2.969	
Congressional Program Reductions	.000	-.029		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	6.640		
Total Reprogrammings	1.495	.000		
SBIR/STTR Transfer	-.223	.000		

**Change Summary Explanation**

FY08 funding increased due to transfer from Navy 1490 for Sensor Arrays for Multiple Applications (SAMA).

FY09 funding increases are due to congressional adds.

FY10 funding increased to support Forensic Analysis of Explosive Signatures.

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602622A Chemical, Smoke and Equipment Defeating Technology					<b>PROJECT NUMBER</b> BA1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
BA1: Protection Technologies (CA)	8.061	6.618	.000						Continuing	Continuing

**A. Mission Description and Budget Item Justification**  
Congressional Interest Item funding for Protection Technologies applied research.

<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Systems Biology Biomarker Molecular Toxicology Initiative	1.546	2.557	.000	
Rapid and Accurate Pathogen Identificatlon/Detection (RAPID) Program	1.159	1.550	.000	
Paint Shield for Protecting People from Microbial Threats	1.546	.000	.000	
Enhanced Vapor Aeration Capabilities (EVAC)	2.319	2.325	.000	
Sensor Arrays for Multiple Applications (SAMA)	1.491	.000	.000	
SBIR/STTR	.000	.186	.000	
<b>Total</b>	<b>8.061</b>	<b>6.618</b>	<b>.000</b>	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602622A Chemical, Smoke and Equipment Defeating Technology					<b>PROJECT NUMBER</b> 552	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
552: SMOKE/NOVEL EFFECT MUN	2.187	2.288	5.293						Continuing	Continuing

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

The 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 investigates 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.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Obscurant Enabling Technology: This effort investigates distribution technologies for various obscurants.  In FY08, conducted studies to examine performance improvements in low toxicity visual obscurant and new bi-spectral obscurants.  In FY09, conduct studies of dissemination techniques for low toxicity bi-spectral obscurants and new bi-spectral obscurants.  In FY10, will conduct modeling and chamber evaluation studies to examine performance improvements possible for microwave obscurants.	.925	.875	.885	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.032	.000	
Advanced Obscurants: This effort investigates technologies which enable safe, effective screening of personnel and equipment.	1.262	1.381	1.426	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602622A Chemical, Smoke and Equipment Defeating Technology		<b>PROJECT NUMBER</b> 552	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, performed modeling and simulation to determine the survivability increase achieved over current smoke systems; and conducted a technology evaluation of selected prototype grenade.</p> <p>In FY09, expand existing theory for advanced obscurants across the entire spectrum of interest (visual, IR and microwave regions); examine alternate theoretical approaches; determine particle characteristics based upon theory; and initiate investigation of new high performing, low toxicity visual obscurants. Conduct studies of bi-spectral (visual thru Far IR) obscurant concepts.</p> <p>In FY10, will investigate, through chamber and field evaluation, bi-spectral packaging and dissemination concepts to improve overall obscuration performance.</p>				
<p>Forensic Analysis of Explosive Signatures: This effort investigates the detection and analysis of chemical and biological explosive material signatures.</p> <p>In FY10, will conduct surface/vapor characterization of existing high explosives (HEs); and common materials used in homemade explosives (HMEs); will conduct environmental persistence studies (how long a compound is available) relevant to counter HE and HME sensing operations; will also conduct fate and transport studies for post blast event surface chemical residues, and will identify chemical compounds present in decomposition pathways (those that are the result of thermal or photochemical degradation).</p>	.000	.000	2.982	
<b>Total</b>	2.187	2.288	5.293	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0602623A JOINT SERVICE SMALL ARMS PROGRAM					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	6.798	9.102	7.674						Continuing	Continuing
H21: JT SVC SA PROG (JSSAP)	6.798	7.506	7.674						Continuing	Continuing
S50: SMALL ARMS APPLIED RESEARCH (CA)	.000	1.596	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>The objective of this program element is to design and develop individual and crew-served weapon technologies that enhance the fighting capabilities and survivability of dismounted battlefield personnel in support of all the Services. All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP) and the Joint Capabilities Integration Development System's Small Arms Analyses.</p> <p>Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology) and PE 0603607A (Joint Service Small Arms Program).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>This program is managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.</p>										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>	
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602623A JOINT SERVICE SMALL ARMS PROGRAM	

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	6.962	7.531	7.747	
Current BES/President's Budget	6.798	9.102	7.674	
Total Adjustments	-.164	1.571	-.073	
Congressional Program Reductions	.000	-.029		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	1.600		
Total Reprogrammings	.004	.000		
SBIR/STTR Transfer	-.168	.000		

**Change Summary Explanation**

All FY 2009 increases are due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602623A JOINT SERVICE SMALL ARMS PROGRAM					<b>PROJECT NUMBER</b> H21	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H21: JT SVC SA PROG (JSSAP)	6.798	7.506	7.674						Continuing	Continuing

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

This project designs and develops individual and crew-served weapon technologies that enable increased lethality for survivability of dismounted battlefield personnel 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.

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

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 program is managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Fire Control Technology for Small Arms: This effort addresses advanced fire control technologies to reduce miss distance of small arms weapon systems. In FY08, determined and developed the best technical approaches for improvements in warfighter rapid range finding against stationary targets; evaluated short time exposure range-finding improvements and their relationship to Soldier capabilities through modeling and simulation tools. In FY09, evaluate improved ranging accuracy technologies mounted on individual weapons and used against moving targets; develop concepts to consolidate energy supply to multiple devices, such as sights and rangefinders, mounted on the rail systems; assess the improvements in automated target location correction for very short time target exposures; and assess increase in effectiveness with modeling and simulation tools. In FY10, will develop modeling and simulation tools to evaluate the soldier-small arms interface to determine factors influencing loss of accuracy in aiming; will design and fabricate advanced modular rail components; will evaluate weapon aiming concepts using target testbed components; will demonstrate critical gun barrel reference sensor components.	3.504	3.511	3.818	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.180	.000	
Advanced Lethal Armament Technology for Small Arms:	3.294	3.815	3.856	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602623A JOINT SERVICE SMALL ARMS PROGRAM		<b>PROJECT NUMBER</b> H21	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>This effort addresses terminal effects and launch aspects of small arms weapon systems.</p> <p>In FY08, developed and evaluated advanced small arms lethality designs for warheads, projectiles and microelectromechanical systems (MEMS) setback generators; evaluated technology design concepts; modeled recoil components and gas dynamics/heat flow in weapons; assessed low-weight recoil reduction designs; evaluated and assessed technological improvements through modeling and simulation tools.</p> <p>In FY09, design improvements and assess trajectory correction and drag compensation sensors for 40 mm and 25 mm ammo; analyze and confirm projectile terminal effectiveness in laboratory environment; confirm proof of principle recoil reduction concepts with recoil kinematic modeling.</p> <p>In FY10, will fabricate and evaluate 2 advanced small caliber payload/warheads in laboratory; will assess MEMs setback generator critical component in lab environment; will design ammo breadboard to demonstrate launch survivability, will assess recoil reduction to multiple variation in loads and confirm with model.</p>				
Total	6.798	7.506	7.674	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602623A JOINT SERVICE SMALL ARMS PROGRAM					<b>PROJECT NUMBER</b> S50	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S50: SMALL ARMS APPLIED RESEARCH (CA)	.000	1.596	.000						Continuing	Continuing

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

Congressional Interest Item funding for Small Arms Applied Research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
SBIR/STTR	.000	.045	.000	
Extreme Light Sources, University of Florida	.000	1.551	.000	
<b>Total</b>	<b>.000</b>	<b>1.596</b>	<b>.000</b>	

**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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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602624A Weapons and Munitions Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	100.973	102.339	41.085						Continuing	Continuing
H1A: WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	64.461	71.862	.000						Continuing	Continuing
H18: ARTY & CBT SPT TECH	14.263	12.123	17.281						Continuing	Continuing
H19: CLOSE COMBAT WEAPONRY	5.309	7.253	12.260						Continuing	Continuing
H28: MUNITIONS TECHNOLOGY	16.940	11.101	11.544						Continuing	Continuing

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

The objective of this program element (PE) is to design and develop enabling technology for improved lethal and nonlethal weapons and munitions with increased performance and the potential for lower weight, reduced size, and improved affordability. This PE supports weapons and munitions development (project H18); technologies to maintain the lethality of US weapons and directed energy (DE) technologies and subsystems to support the weaponization of high power microwave (HPM), and short pulse lasers (project H19), and development of munition components such as fuzes and power, warheads with tailorable effects, and insensitive munition compliant energetic materials (project H28). Project H1A funds congressional special interest items.

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 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.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602624A Weapons and Munitions Technology

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	102.681	30.576	30.384	
Current BES/President's Budget	100.973	102.339	41.085	
Total Adjustments	-1.708	71.763	10.701	
Congressional Program Reductions	.000	-.337		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	72.100		
Total Reprogrammings	.828	.000		
SBIR/STTR Transfer	-2.536	.000		

**Change Summary Explanation**

FY09 funding increases are due to congressional adds.

FY10 increases funding to investigate technology options which will reduce or eliminate unexploded ordnance (UXO) threats from current submunitions.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology					<b>PROJECT NUMBER</b> H1A		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
H1A: WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	64.461	71.862	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Weapons and Munitions Technology applied research.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Green Armaments/RangeSafe								2.318	2.325	.000	
Advanced Materials & Process for Armament Structures (AMPAS)								5.409	2.325	.000	
Armament System Engineering and Integration Initiative (ASEI2)								2.319	3.100	.000	
Electroconversion of Energetic Materials								5.602	3.488	.000	
Army Center of Excellence in Acoustics								3.168	4.263	.000	
Developmental Mission Integration								3.865	3.875	.000	
Engineered Surfaces for Weapons Life Extension								2.898	.000	.000	
Fatigue Odometer for Vehicle Components and Gun Barrels Project Cannon Systems								2.551	.000	.000	
Remotely Operated Weapons and Sensor Technology								3.092	4.844	.000	
SLEUTH Tungsten Heavy Alloy Penetrator and Warhead Development								1.546	.000	.000	
Electrolytic Super-Capacitor								2.319	.775	.000	
Energetic Formulation and Fabrication								3.864	.000	.000	
Ripsaw Unmanned Ground Vehicle Weaponization								1.546	1.162	.000	
Advanced Rarefaction Weapon Engineered System								1.546	2.325	.000	
Hospital Emergency Planning and Integration (HEPI) Letterkenny Army Depot and Chambersburg Hospital								1.546	.775	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology			<b>PROJECT NUMBER</b> H1A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
CZT-Based Liquid Explosives Detections Systems			1.314	.000	.000	
Effects Based Operations Decision Support Services (EBODSS)			.774	7.750	.000	
Long Range Initiator			1.353	.000	.000	
Mitigation of Energetics Single Point Failures			2.319	2.325	.000	
Center for Borane Technology			1.933	1.938	.000	
Development and Demonstration of Multi-use/Urban Operations Joint Training System at Fort Dix			2.319	.000	.000	
Exploding Foils Initiators with Nanomaterial-based Circuits			2.319	1.550	.000	
Research for Army Cannon Systems			1.778	2.422	.000	
Remote Sensor Station (RSS) for Special Weapons Observation Reconnaissance Detection System (SWORDS)			.772	.000	.000	
Strategic Tech Dev & Integration for the Jt Munitions & Lethality Life Cycle Management Command			.966	.000	.000	
Wyoming Valley Integrated Command Operations Program (ICOP)			.000	1.550	.000	
MATRIC- Project National Shield Integration Center			.000	1.938	.000	
Specialized Compact Automated Mechanical Clearance Platform			.000	1.550	.000	
Regional Integrated Command Center (RICC)			.000	.775	.000	
Advanced Technologies Energy and Manufacturing Science			.000	4.844	.000	
Rapid Prototyping for Special Programs (pending transfer to 63004)			.000	3.100	.000	
Threat Detection and Neutralization Project			.000	3.100	.000	
Northern Ohio Integrated Command Operations Program			.000	1.550	.000	
Heavy Metals Total Life-Cycle Initiative			.000	.775	.000	
Munitions Evaluation for Composite Electric Armor			.000	1.162	.000	
SBIR/STTR			.000	2.013	.000	
Rapid Response Force Protection System (Remote Weapons Platform)			3.092	2.325	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H1A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Renewable Energy Testing Center	1.933	.000	.000	
Kinetic Energy Enhanced Lethality and Protection Materials	.000	1.938	.000	
Total	64.461	71.862	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology					<b>PROJECT NUMBER</b> H18	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H18: ARTY & CBT SPT TECH	14.263	12.123	17.281						Continuing	Continuing

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

This project designs and develops component technologies to enable affordable smart munitions that can be launched from multiple platforms and provide increased lethality with reduced logistics and advanced direct/indirect fire capabilities.

Work in project H18 is related to, and fully coordinated with, efforts in projects H19 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.

The work in this project is performed by the US Army 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Affordable Precision Technology:</b> This effort develops and incorporates technologies to provide affordable precision to the full spectrum of gun calibers. In FY10, will identify technologies which can potentially increase delivery accuracy and lethal performance of weapons.	.000	.000	.885	
<b>Advanced Weapons Technology:</b> This effort investigates innovative weapon technologies for future medium caliber direct fire systems that provide similar or greater lethality than current systems. In FY10, will assess detailed designs of distributive technologies for new weapon delivery effects; will conduct detailed analysis to select novel weapon schemes for use in recoilless medium caliber weapons such as rarefactory wave gun and novel light gas guns; develop critical design factors for launch survivability, component reliability and recoil energy management.	.000	.000	3.285	
<b>Common Smart Submunition (CSS):</b> This effort designs and evaluates component technologies for a next generation precision kill and target-discriminating sub-munition that can be used in a variety of delivery systems.	3.068	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H18	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, quantified and baselined post-test operational performance metrics. Specific metrics were the sensor transmit/receive performance, algorithm/Autonomous Target Recognition (ATR) discrimination capability, Orientation and Stabilization (O&S) samara blade performance for both slow and high speed deployments, and High-G survivability of components/sub-systems (sensor module, electronics, Safe and Arm (S&A) module, battery, and O&S module.) Developed interface for submunition electronics, sensors, and warhead; conducted structural integrity testing and captive flight test (Phase 1) to facilitate development of form-factored components; evaluated tactical hardware and dynamic environment through modeling and simulation (M&S) and verification testing. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H19 and PE 0603004A/project 232.				
<p>Insensitive Munitions (IM) Technologies Initiatives: This effort focuses on identifying, maturing, and applying technologies that will reduce unplanned, accidental, and/or sympathetic detonation of munitions in order to meet IM requirements.</p> <p>In FY08, demonstrated the ability to maintain the lethality of a warhead after insertion of venting and reactive liner technologies designed to increase IM performance; and conducted sympathetic detonation (SD) modeling and laboratory characterization of a munitions reaction after IM techniques have been applied to the munition. In FY09, complete sympathetic detonation (SD)/bullet impact (BI) modeling of Precision Attack Missile (PAM) warhead after IM techniques have been added to the rounds. Beginning in FY10 the funding for this effort is in PE 0602624/project H28 in FY10.</p>	1.027	.249	.000	
<p>Fuze and Power for Advanced Munitions: This effort researches and evaluates technologies that reduce munition size and add tailorable effects for advanced munitions.</p> <p>In FY08, evaluated performance and safety of electronic safe and arm devices (ESAD) and micro electro-mechanical system (MEMS) sub-assemblies. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/project 232.</p>	2.911	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.160	.000	
<p>Novel Propulsion Technology for the Future: In FY08, designed and developed advanced propulsion and ignition technologies for gun launched munitions; evaluated existing modeling and simulation (M&amp;S) tools for advanced propellants, igniters and thrusters; developed and characterized novel propellants for igniter based upon M&amp;S results.</p>	1.512	2.019	1.857	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology			<b>PROJECT NUMBER</b> H18	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>In FY09, fabricate novel igniters and demonstrate them against current baseline igniters; optimize propulsion technologies at the component level for integration into scalable and adaptive response munitions; and develop M&amp;S tools for scalable and adaptive propulsion prediction capabilities across the full range of munition applications.</p> <p>In FY10, will fabricate optimized propulsion components and integrate them into gun launched munitions; will employ and verify advanced M&amp;S tools to predict munition component performance; will conduct static and subscale tests to verify models and design performance.</p> <p>Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624/H28 and 0603004/232.</p>						
<p><b>High Powered Microwave (HPM) - Anti-Material Munitions:</b> This effort designs and develops HPM technology for use in non-lethal (NL) munitions.</p> <p>In FY08, modeled component behavior and fabricated individual components of the system; conducted component demonstrations for antenna, prime power, pulsed power, and microwave source. In collaboration with Department of Energy, modeled effects of HPM on infrastructure targets such as communications networks; integrated the effects of HPM on infrastructure targets into battlefield effectiveness models to determine potential operational effectiveness in order to inform the requirements generation process. Evaluated G-Hardened design of NL munition to address structural integrity in a gun launch environment; and determined optimal delivery method through use of various design codes.</p> <p>In FY09, commence integration of individual components; perform analysis of the systems ability to generate power while in flight and operate in a gun launch environment; and commence laboratory effects testing of an integrated laboratory demonstrator against relevant simulated targets.</p> <p>In FY10, will develop non-fragment producing materials for carriers to achieve NL effects; will develop, test and integrate demonstrator capacitor technology to obtain high energy density, high voltage, with nano-second discharge times, and solid state switches for nano-second discharge rates; will identify components which provide the greatest ability to tune the system in flight to get the desired effects; will test components integrated into a system to characterize defeat mechanisms for target sets.</p>		5.745	6.730	3.902		
<p><b>Pulsed Laser technologies:</b> This effort develops and miniaturizes key directed energy (DE) technologies for use in munitions and subsystems. The laser induced plasma channel(LIPC) effort explores the ability to use a short pulse laser to generate a cavity in the air in which electricity from high powered microwaves is channeled to produce tailored effects on targets.</p> <p>In FY09, perform laser induced plasma channel (LIPC) modeling and simulation to define the optimum filament geometries for effective energy transmission; investigate the interaction of RF fields in custom waveguides; conduct</p>		.000	2.965	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H18	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
verification tests for LIPC that provide insight to expected increases in performance. Efforts described here will be consolidated starting in FY10 in PE 0602624A/project H19 and are coordinated and complimentary to related efforts in PE 0603004A/project 232. This effort moves to PE 0602624A/project H19 in FY10.				
Advanced Munition Components: This effort designs and develops individual components in the firing chain for gun launched munitions. In FY10, will focus on designing and developing scalable adaptable munition components; will evaluate various munition components and determine options to modify components to support scalable munition development; and will evaluate performance through modeling and simulation tools and select a munition to caliber to design initial scalable munition around and initiate design. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H28 and PE 0603004A/project 232.	.000	.000	2.581	
Advanced Munition Payloads: This effort designs and develops new and novel payloads and related components for integration into gun-fired munitions and missiles. In FY10, will assess advanced fuze technologies capable of either detonating or deflagrating submunitions such as Dual-Purpose Improved Conventional Munitions (DPICM) in selected environments; will conduct study concepts of extremely insensitive energetics and sensor fuzed munitions to determine optimal design configurations that will reduce and eliminate unexploded ordnance (UXO) on the battlefield while retaining area denial capability.	.000	.000	4.771	
Total	14.263	12.123	17.281	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology					<b>PROJECT NUMBER</b> H19	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H19: CLOSE COMBAT WEAPONRY	5.309	7.253	12.260						Continuing	Continuing

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

This project designs and develops technologies to support asymmetric countermeasures such as RF 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 US Army 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Counter Countermeasure (CCM) Technologies for weapons and munitions: This effort develops technology to enable continued effectiveness of US weapon systems against enemy countermeasures including Active Protection Systems (APS), GPS jamming, and active seeker jamming. Technology areas investigated include reducing radar cross section of gun fired rounds and increasing performance of warheads. In FY10, will conduct systems effectiveness analysis to determine which weapons/rounds are most susceptible to countermeasures; investigate potential counter-countermeasure techniques/technologies and identify the most promising that reduce the effectiveness of threat countermeasure technologies.	.000	.000	4.420	
Ground Based Munitions Technologies: This effort optimizes smart ground based munitions for the urban and complex fight. In FY09, evaluate urban technologies for ground based munitions for use with the intelligent munitions system (IMS) (PE 0654808A/D016); optimize a set of sensor suites for the urban environment and evaluate merging sensor modalities; evaluate target engagement approaches from a ground based munition that can engage both personnel and light vehicles while minimizing collateral damage. Efforts described here are coordinated and complimentary to related efforts in PE 0654808A/project D016, PE 0603004A/project 232, and PE 0603606A/project 683.	.000	3.044	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H19	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Near Autonomous Unmanned Systems (NAUS): This effort designs and evaluates a remote weapon station optimized for high-reliability on an unmanned vehicle and addresses the safe operation of weapons on robotic vehicles. In FY08, fabricated demonstrator robotic weapon and ammo handling subsystems; conducted laboratory evaluations to assess interface and functionality of subsystems; and simulated functionality of complete system design via hardware-in-the-loop emulation. In FY09, fabricate and integrate critical sub-systems; and conduct baseline system level tests. Efforts described here are coordinated and complimentary to related efforts in PE 0602601A/project H91; PE 0602618A/project H03; PE 0602120A, and PE 0603005A/project 515.</p>	1.911	1.985	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.161	.000	
<p>Novel Battlefield Effectors: This effort develops unique weapon and munitions technologies to achieve "tunable" effects on targets and capable of including providing a full range of effects from non-lethal to highly lethal via a single weapon or munition. In FY10, will select the most promising munitions/weapons to achieve the projection of tunable effects for line-of-sight (LOS), beyond-line-of sight (BLOS) and non-line-of-sight (NLOS) missions; will develop the technologies into bread board system and begin target effectiveness studies; will conduct trade studies to determine the proper power, size, and weight to achieve required lethal effects on</p>	.000	.000	3.929	
<p>Pulsed Laser Component Technologies: This effort matures short pulse laser components for use in laser induced plasma channel (LIPC) systems. In FY08, performed target vulnerability analysis based on target modeling and follow on live-fire validation testing against simulated targets to demonstrate effectiveness; developed compact and frequency agile HPM sources that reduced overall system footprint and volume by at least 10-20% as well as increase effectiveness and tactical suitability. In FY09, characterize and optimize high voltage and radio frequency waveforms to produce multiple target effects on buried or surface threats. In FY10, will mature model of LIPC target engagement to optimize interaction between next generation LIPC and high voltage waveform; will optimize advanced short pulsed LIPC laser system parameters to enhance transmission of the high voltage waveform required for target effects; will initiate design of advanced high quality critical subcomponents for an optimal LIPC laser system. Efforts are coordinated and complimentary to related efforts in PE 0602624A/project H18 and PE 0603004A/project 232.</p>	3.398	2.063	3.911	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H19	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Total			5.309	7.253	12.260
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology					<b>PROJECT NUMBER</b> H28	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H28: MUNITIONS TECHNOLOGY	16.940	11.101	11.544						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project designs and develops 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. Work in project H28 is related to, and fully coordinated with, efforts in projects H18 and H19 in this PE, PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0603004A (Weapons and Munitions Advanced Technology).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>This work is performed by the U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD. The active protection system (APS) countermunition efforts are developed in collaboration with the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, PE 0603005A and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL, PE 0603313A.</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Extended Area Protection and Survivability (EAPS): This effort demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery, and mortar rounds. In FY08, evaluated the effectiveness of a lethality round (the standard projectile envelope configured for an enhanced warhead technology kill mechanism), and a course correction round (the standard projectile envelope containing course correction technology for increased accuracy), as the basis for the final decision on the integration of the EAPS projectile. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/project 232 and PE 0603313A/project 704.</p>						2.918	.000	.000		
<p>G-Hardened Sensors Technology for Munitions: This effort develops ground sensors hardened to resist the forces of gun-launch and ground impact. In FY08, conducted tests and demonstrated survivability of individual and integrated component technologies in &gt; 20kG environments against established metrics; developed architecture for networking sensors from different G-hardened nodes for target localization; conducted fabrication of hardware and demonstrated ruggedness of sensors through testing</p>						1.787	1.899	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H28		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>conducted with air gun testing; performed initial demonstration of miniaturized highly-integrated components embedded in munitions to include 40mm grenades.</p> <p>In FY09, refine integrated design approach and G-hardened packaging; investigate survivability of individual and integrated component technologies in &gt; 30kG environment and investigate (through live fire of munitions) the remote deployment of fully integrated sensor packaged into mortars and 40mm grenades; implement architecture for distributed, power efficient decentralized network fusion of data from multiple G-hardened sensor nodes to enable target localization.</p>						
<p><b>Scalable Warhead Technology:</b> 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.</p> <p>In FY09, conduct modeling and simulation studies of warhead concepts for baseline performance against multiple target set configurations. In FY10, will design and develop enhanced fragmentation, reactive materials technologies, multipurpose explosives, and initiation trains for warheads and scalable and adaptive munitions; will compare performance of designs against predictive models, simulations and baselines; will fabricate, test and evaluate component technologies in static munition tests.</p> <p>Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H18 and PE 0603004A/project 232.</p>			.000	2.749	7.670	
<p><b>Insensitive Munitions Multi-Scale Reactive Modeling (IM-MSRM):</b> The IM-MSRM effort designs and develops new modeling and simulation tools for the design and development of insensitive munitions.</p> <p>In FY10, will evaluate the structure and density predictions for insensitive energetic materials resulting from the modeling and simulation analysis.</p>			.000	.000	.594	
<p><b>Future Force Gun and Munition Technology (Nanotechnologies for Future Force Armaments &amp; Munitions):</b> This effort is investigating nanoscale and nanostructured multifunctional materials for armament applications.</p> <p>In FY08, optimized process parameters to process nanoscale iron; began fabrication of oxide nano-ceramic powder; developed process parameters to fabricate nano-structured tungsten powder and tungsten-based composite powders (dry high energy technique); and conducted metallurgical characterization of high energy milled nano-structured tungsten powder.</p> <p>In FY09, optimize process parameters to fabricate large quantities of nanostructured and nano-scale tungsten powders; develop wet milling technology to fabricate nano-scale/nanostructured tungsten powders &amp; compare results to those</p>			1.266	2.543	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H28	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
powders obtained using dry milling technology; develop powder consolidation technology to fabricate nanostructured bulk materials; conduct metallurgical characterization/mechanical property evaluations of bulk nanostructured materials.				
Hardened Combined Effects Penetrator Warhead Technology: This effort designs and develops enhanced warhead liners to more efficiently defeat existing and projected targets. In FY08, tested and evaluated optimized blast fragmentation, optimized warhead penetration, and blast/fragmentation penetrator warheads against a broad target set including armor, personnel, material, and fortified structures. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/project 232.	4.170	.000	.000	
Kinetic Energy Active Protection System (KEAPS) Warhead: This effort investigates and validates a warhead designed by the Army Research Laboratory (ARL) for use in an active protection system (APS) designed to defeat tank-fired rounds. In FY08, refined design of warhead, fuze and safe and arm (S&A) device integrated with countermeasure technologies; evaluated critical warhead parameters in near tactical environments; evaluated performance of integrated warhead and fuze S&A interface in a lab environment; evaluated integrated fuze S&A and the correspondent countermeasure performance in near tactical environments. In FY09, finalize design of warhead/fuze S&A demonstrator integrated with the KEAPS interceptor; evaluate warhead and fuze S&A demonstrator against primary threat class and use M&S to evaluate performance against remaining classes of threats. Efforts described here are coordinated and complimentary to related efforts in PE 0603004A/project 232 and are developed and collaborated with efforts in PE 0603005A/project 221 and PE 0603313A/project 550.	6.799	3.757	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.153	.000	
Energetic Materials and Warheads: This effort designs energetic materials with controlled energy release for precision munition and counter-munition applications. In FY10, will investigate the use of exotic ingredient materials including nano-scale oxidizers and fuels in high fidelity models for the design of extremely high energy, low sensitivity initiation, propulsion, explosive and pyrotechnic formulations; will down-select promising ingredient materials for fabrication and characterization studies; will fabricate ingredient materials. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H18 and PE 0603004A/project 232 and PE 0602618A/project H80.	.000	.000	3.280	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602624A Weapons and Munitions Technology		<b>PROJECT NUMBER</b> H28	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Total	16.940	11.101	11.544	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	124.115	99.687	61.404						Continuing	Continuing
EM4: Electric Component Technologies (CA)	22.357	22.626	.000						Continuing	Continuing
EM6: HEATING AND COOLING TECHNOLOGIES (CA)	3.286	6.378	.000						Continuing	Continuing
EM7: POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	55.792	25.556	.000						Continuing	Continuing
EM8: High Power and Energy Component Technology	.000	.000	13.951						Continuing	Continuing
H11: Tactical and Component Power Technology	13.276	13.121	12.837						Continuing	Continuing
H17: FLEXIBLE DISPLAY CENTER	5.863	6.540	7.007						Continuing	Continuing
H94: ELEC & ELECTRONIC DEV	23.541	25.466	27.609						Continuing	Continuing

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

The objective of this program element (PE) is applied research on technologies in areas such as electronic components, power components, frequency control and timing devices, high power microwave devices, and display technologies. The applied research on these technologies will enable the ability to perform precision deep fires against critical mobile and fixed targets; provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft; and provide 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 (ATR), foliage-penetrating radar, and combat identification. This PE sustains applied research on high-power, microwave, electronic components and technologies (project EM8), advanced portable power technologies (batteries, fuel cells, hybrids, engines, chargers, and power management) (project H11), applied research on flexible

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b>		<b>R-1 ITEM NOMENCLATURE</b>		
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES		
<p>displays in conjunction with the Flexible Display Center (project H17), and applied research on electronic component technologies such as photonics, micro electromechanical systems, imaging laser radar (LADAR), magnetic materials, ferroelectrics, microwave and millimeter-wave components, and electromechanical systems (project H94). Projects EM4, EM6, and EM7 fund congressional special interest items.</p> <p>Work in this PE is related to and fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602709A (Night Vision Technology), PE 0602783A (Computer and Software Technology), PE 0603008A (Command, Control, Communications Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work is performed by the Army Research Laboratory (ARL), Adelphi, MD, and the Army Communications and Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth NJ.</p>				
<b><u>B. Program Change Summary (\$ in Millions)</u></b>				
	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>
Previous President's Budget	105.492	45.278	46.940	
Current BES/President's Budget	124.115	99.687	61.404	
Total Adjustments	18.623	54.409	14.464	
Congressional Program Reductions	.000	-.331		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	54.740		
Total Reprogrammings	20.967	.000		
SBIR/STTR Transfer	-2.344	.000		
<b><u>Change Summary Explanation</u></b>				
FY08 increase is due to transfer of congressional interest items of \$20802 for proper execution and BTR of \$165.				
FY09 increase is due to congressional adds.				
FY10 funding increase was due to the restructure of 0602120A, project 140 (Hi-Power Microwave), and funding provided to support power and energy initiatives and Electromagnetic Armor Power.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES					<b>PROJECT NUMBER</b> EM4	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EM4: Electric Component Technologies (CA)	22.357	22.626	.000						Continuing	Continuing

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

Congressional Interest Item funding for Electronic Component applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
PEM Fuel Cell Tactical Generators	4.829	.000	.000	
Direct Methanol Fuel Cell-Battery Recharger Program	1.545	.000	.000	
Manufacturing Technology Development of Advanced Components for High Power Solid-State Lasers	1.546	2.325	.000	
Defense Modernization and Sustainment Initiative, Rochester Institute of Technology	1.933	.000	.000	
Micromachined Switches in Support of Transformational Communications Architecture	1.545	2.325	.000	
Renewable Energy for Military Applications	1.450	1.550	.000	
High-Frequency, High-Power Electronic and Optoelectronic Devices on Aluminum Nitride (AlN)	2.319	3.100	.000	
Roll-to-Roll Microelectronics Manufacturing in Support of the Flexible Display Initiative	1.546	.000	.000	
Silicon Carbide MOSFETs for Electric Power Systems	1.546	.000	.000	
Self-Powered, Lightweight, Flexible Display Unit on a Plastic Substrate	1.546	1.550	.000	
Flexible Solar Cell for Man-Portable Power Generator	1.778	.000	.000	
Large Format Li-Ion Battery	.774	.775	.000	
Compact Eyesafe Tactical Laser	.000	1.162	.000	
Extremely High Frequency (EHF) Transmitter for Win-T Satellite Communications	.000	1.938	.000	
Integrated Lightweight Tracker System (pending transfer to 62782)	.000	1.550	.000	
SOCOM Lightweight Unmanned Ground Robot (pending transfer to 62624)	.000	1.550	.000	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES		<b>PROJECT NUMBER</b> EM4	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Fuel Cell Power System	.000	.775	.000	
Maryland Proof of Concept Alliance for Defense Technologies	.000	3.392	.000	
SBIR/STTR	.000	.634	.000	
Total	22.357	22.626	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES					<b>PROJECT NUMBER</b> EM6	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EM6: HEATING AND COOLING TECHNOLOGIES (CA)	3.286	6.378	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Heating and Cooling applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Tactical 2KW External Combustion Power Sources for Cogeneration Applications							.000	2.325	.000	
Miniature Cooling Unit for Electronic Devices							.967	.775	.000	
Cogeneration for Enhanced Cooling and Heating of Advanced Tactical Vehicles							2.319	2.325	.000	
Co-Generation of Power and Air Conditioning							.000	.774	.000	
SBIR/STTR							.000	.179	.000	
Total							3.286	6.378	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EM7: POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	55.792	25.556	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding Power and Energy Component applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Lithium Air Metal Battery							3.865	.000	.000	
Soldier Fuel Cell System							.774	2.325	.000	
Novel Zinc Air Power Sources for Military Applications							1.933	1.550	.000	
ONAMI Miniature Tactical Energy Systems Development							2.415	2.325	.000	
Soldier Portable Solid Fuel Hydrogen Generator Cartridge							3.865	.000	.000	
Thin Lithium-Iron Disulfide Primary Batteries							2.319	.000	.000	
Advanced Portable Power Institute (APPI)							1.546	1.550	.000	
Non-Flammable, High Energy Density, Low Temperature Warrior Battery							.774	.000	.000	
Advanced Lithium-Carbon Monoflouride Combat Portable Batteries							3.786	.000	.000	
Advanced Wearable Microcell Power System Process Development							1.933	.000	.000	
Bio-Battery							1.160	.775	.000	
Ceramic Membrane - 10(X) More Energy for Battery Systems							.966	1.163	.000	
Low Signature Portable Fuel Cell Power Systems							2.705	.000	.000	
Mega-Capacity Hybrid Chemistry Lithium Primary Portable Batteries							1.546	.000	.000	
Revolutionary Self-Seating Plastic Enclosure for Military Batteries							1.546	.000	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Advanced, Integrated Portable Power Generation and Charging System		2.397	.000	.000		
Enzyme Biofuel Cell (SEBC)		.966	.775	.000		
Improved Energy Density Battery		.774	.000	.000		
Portable Hydrogen Generator and Hybrid Power Source		1.546	.000	.000		
Alternative Energy Research		15.454	.000	.000		
Direct Methanol Fuel Cell Development		1.932	.000	.000		
Acid Alkaline Direct Methanol Fuel Cell Technology		1.590	.000	.000		
Military Jet-Fueled Fuel Cell Generator		.000	.775	.000		
Soldier Portable Power Pack (SP3) for the 21st Century Warrior		.000	1.647	.000		
Advanced Solder Portable Power Systems Technologies		.000	1.550	.000		
Highly Reliable, Maintenance Free Remote Solar Power System		.000	.620	.000		
Advanced Energy Storage Development for Renewable Energy Generation		.000	1.163	.000		
Program Increase		.000	5.425	.000		
Solid Oxide Fuel Cell Powered Tactical Smart Charger		.000	1.550	.000		
Tactical Asset Visibility Enhancement		.000	.484	.000		
Thermoelectric Power Generation Materials and Devices		.000	1.163	.000		
SBIR/STTR		.000	.716	.000		
Total		55.792	25.556	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
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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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES					<b>PROJECT NUMBER</b> EM8	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EM8: High Power and Energy Component Technology	.000	.000	13.951						Continuing	Continuing

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

The objective of this project is to fund research and evaluation of high-power electronic components and technologies. These technologies have application in compact, light-weight power and energy storage, power and energy conversion, and conditioning, radio frequency (RF)/microwave directed energy weapons (DEW), and traditional and non-traditional RF and laser electronic attack. The ongoing directed energy effects and power component work is 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 work in this project is coordinated with the Tank and Automotive Research, Development, and Engineering Center (TARDEC); the Armaments Research, Development, and Engineering Center (ARDEC); the Aviation and Missile Research, Development, and Engineering Center (AMRDEC); and the Communications and Electronics Research, Development, and Engineering Center (CERDEC). These efforts were previously funded in PE 0602120A (Sensors and Electronic Survivability).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
High Power Components: Research and evaluate materials and component structures that provide the higher energy density required by next generation Army systems such as electromagnetic armor, hybrid-vehicle propulsion electronics, directed energy sources, pulse power, small unattended ground sensors, and Soldier systems. In FY10, will design power sources and antennas for higher frequency and power output. Will implement silicon carbide (SiC) high-power density modules for pulse switching levels > 10 MW.	.000	.000	2.213	
High Energy Laser: Research novel solid-state laser concepts, architectures, and design components enabling high energy laser (HEL) technology for Army specific DEW applications. Exploit breakthroughs in laser technology and photonics basic research	.000	.000	2.437	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
to meet the stringent weight/volume requirements for platforms. Applied research will be conducted in close collaboration with domestic ceramic (and other) material vendors, university researchers, and major laser diode manufacturers. In FY10, will implement cryogenically-cooled, gain medium to highly scalable, eye-safe, Er-doped lasers based on advanced laser ceramics.				
<b>Directed Energy (DE):</b> Investigate, research, and evaluate technologies related to DEW technology, electronic warfare (EW) survivability/ lethality, and supporting high power components to enhance the survivability/lethality of Army platforms. In FY10, will design, develop and implement components to reduce the size and weight of counter improvised explosive device IED and mines systems, and continue to conduct lab and field assessments to understand susceptibility level of targets. Will investigate RF directed energy (DE) interoperability issues between an RF DE device and Army radios.	.000	.000	1.566	
<b>Platform Power Components:</b> Investigate, research, and evaluate compact, high efficiency, high-temperature, high power component technologies (switches, magnetics, capacitors, etc.) for hybrid platform propulsion, power generation, and power distribution. In FY10, will evaluate power components for high-temperature (100 C coolant) 250 kW traction drive inverter and 150 kW battery-to-bus converter.	.000	.000	3.966	
<b>Power Switching for Protective Systems:</b> Investigate, research, and evaluate technologies relating to compact, high-power, high-efficiency pulse power for electronic survivability applications such as electromagnetic (EM) Armor, advance EM Armor, and Electronic Protection Systems. Such technologies include storage capacitors, direct current (DC-DC) converters, and high rate-of-current-rise pulse switches. In FY10, will evaluate fast rise storage capacitors at 1.5 joules/cubic centimeter (J/cc) and SiC pulse switch die at 3 kiloampere (kA) with fast rate-of-current-rise.	.000	.000	1.785	
<b>Platform Power Integration and Control:</b> Investigate, research, and evaluate power stage and control circuit technologies for implementation of high-power density, high efficiency power converters for hybrid platform propulsion, power generation and power distribution. In FY10, will validate power switch temperature sensing and gate control circuitry for high-temperature (100 C coolant) operation.	.000	.000	1.984	
<b>Total</b>	.000	.000	13.951	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H11: Tactical and Component Power Technology	13.276	13.121	12.837						Continuing	Continuing

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

The objective of this project is on applied research to identify, advance, and enhance emerging power generation, energy storage, and power management technologies. This project funds research in electrochemistry, energy conversion, and signature suppression technologies, including those 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 operating system dynamic power management software.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p><b>Soldier Hybrid Power and Smart Chargers:</b>                      This effort develops and evaluates hybrid power sources, rapid battery chargers, and power management technologies in order to decrease Soldier load, increase power capabilities, and decrease battery costs.                      In FY08, evaluated methanol fueled Soldier hybrid fuel cell power source for 72 hour mission at 700 watt-hours per kilogram; investigated rugged JP-8 burners for solid oxide fuel cell and Stirling engine power sources.                      In FY09, demonstrate JP-8 fueled Soldier hybrid solid oxide fuel cell; demonstrate man-portable 160 watt JP-8 linear free piston Stirling engine power source weighing less than 10 kilograms; evaluate 250 watt reformed JP-8 fuel cell for battery charging.                      In FY10, will develop advanced fabrication processes to reproduce lithium air cell lab results in larger scale batches suitable for production, and demonstrate in a laboratory environment with packaged cells; will develop a 25W hybrid power source, 1.5 lbs, 1300 Wh/kg; will demonstrate micro-electro mechanical system-based burner for a 150-250W portable power source functioning in a laboratory environment.</p>	7.790	6.550	9.136	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.259	.000	
<p><b>Lithium Air Battery:</b>                      This effort develops and investigates materials, material processes, and electrochemical components that will produce a high energy density (&gt;1,000 Watt-hours/kilogram) lithium air power source for Soldiers.                      In FY08, investigated lithium organic and inorganic materials and processes to produce highly conductive electrolytes to achieve greater than 0.5 mill-Amps/square centimeter current densities; demonstrated lithium air cells/batteries having energy densities greater than 800 Watt-hours/kilogram; demonstrated material stability of lithium air cell components to achieve high shelf life (greater than one year).                      In FY09, develop material and cell fabrication processes to produce high energy density, stable, safe lithium air battery; demonstrate lithium air cells/batteries having energy densities greater than 1,000 Watt-hours/kilogram.</p>	2.110	2.935	.000	
<p><b>Silent Mobile Power:</b>                      This effort investigates component and system level power technologies that will provide higher energy, reduced weight, quiet, more fuel and cost efficient power generation sources to support the full spectrum of C4ISR power consumers. Products are silent mobile power sources of 2-5kW, cogeneration cooling systems, and transitional power sources in the 500W-2kW range.                      In FY08, conducted testing in a laboratory environment of 1-2 kW Stirling engine generator on JP-8 fuel; demonstrated controlled operational testing in a laboratory environment of 2 kW fuel cell generator on JP-8 fuel; demonstrated a preliminary prototype cogeneration cooling system using waste heat from a quiet power source.                      In FY09, develop integrated system controls in order to demonstrate breadboard 2 kW solid oxide fuel cell generator and 1-2 kW engine generator in relevant environments; demonstrate integrated power/cooling/waste heat recovery system.                      In FY10, will demonstrate in a laboratory environment a waste heat recovery system and a 500W transitional power source.</p>	3.376	3.377	3.701	
<b>Total</b>	<b>13.276</b>	<b>13.121</b>	<b>12.837</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				

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**E. Performance Metrics**

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

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H17: FLEXIBLE DISPLAY CENTER	5.863	6.540	7.007						Continuing	Continuing

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

The objective of this project is to fund 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, low power. The resultant display technology would enable enhanced and new capabilities across a broad spectrum of Army applications. Work in the FDC is performed collaboratively with the Natick Soldier Research, Development and Engineering Center (NSRDEC).

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 executed by the Army Research Laboratory (ARL), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.179	.000	
FDC: In FY08, the FDC developed and delivered 3.8" diagonal reflective displays and integrated the displays into Army Demonstrator systems. The FDC showed high resolution displays and flexible reflective displays running at video rates. In FY09, develop and deliver up to 6" diagonal reflective and emissive displays from the pilot line with increasing performance for next generation platforms (specific display sizes depend on Army customer specifications). In FY10, the FDC will begin full color designs and implement color versions of flexible displays up to 6" diagonal (reflective) and 4" diagonal (emissive).	4.863	4.861	5.038	
U.S. Displays Consortium (USDC): Flexible display partnerships funded through the USDC for tools, process, and materials development that directly support the FDC. In FY08, established programs through the USDC that support the FDC with existing tool modifications, processes, related material, and device development. These programs directly supported the FDC and the Army's mission to develop flexible displays and manufacturing technology for flexible displays.	1.000	1.500	1.969	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, integrate the USDC programs that directly support the FDC and the Army's mission to develop flexible displays and manufacturing technology for those displays. In FY10, the USDC will test the integrated programs and identify new technology gaps for flexible displays. In addition, programs will be developed to support emerging display technologies, such as higher performing thin film transistors for emissive displays, processes to enable flexible color filters and related integration. Flexible display partnerships will be reviewed and modified to ensure state-of-the-art tools, materials development and materials processes that directly support the goals of the FDC.				
Total	5.863	6.540	7.007	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H94: ELEC & ELECTRONIC DEV	23.541	25.466	27.609						Continuing	Continuing

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

The objective of this project is to conduct applied research on electronics and electronic devices including opto-electronics to support advanced power and energy generation and storage; Command, Control, Communications, and Computers (C4); and Intelligence, Surveillance, and Reconnaissance (ISR) technologies. Areas of investigation include: low noise clocks and oscillators; lasers and focal plane arrays for eye-safe laser radar (LADAR) and standoff target acquisition sensors like forward-looking infrared (FLIR); micro-electromechanical systems (MEMS) for multi-function radio frequency (RF) applications as well as smart munitions; advanced RF modules to support radars and communications systems; high-temperature high-power inverter circuits for electric drives; prognostics and diagnostics to reduce logistics demands; micro-power generators and advanced batteries, fuel reformers, and fuel cells for hybrid power sources; and novel structures on new electronic materials for oscillator and opto-electronic applications. This research enables enhanced battlefield situational awareness; increased vehicle mobility, survivability, and lethality; reduced acquisition cost; and reduced operations and support costs.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Infrared (IR) Imaging:</b> Investigate large area multi-color, passive infrared (IR) imaging focal plane arrays (FPAs) for long range target detection and identification. Investigate molecular beam epitaxy (MBE) growth techniques for the growth of 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 region to significantly decrease the focal plane array cost. Design and fabricate arrays for higher operating temperature. In FY08, investigated multi color (Short Wave IR (SWIR)/MWIR/LWIR) FPAs for enhanced range and detection. In FY09, decrease defect density of HgCdTe on Si, evaluate dual color C-QWIPs and determine transport properties in SLS structures. Collect radiometrically calibrated signatures for threat events in an effort to design a test sensor and implement modeling of range performance. Exploit IR, narrow-band, and optical augmentation sensors for threat detection and evaluate utility for ground vehicle, rotary wing, and dismounted Soldier platforms.	2.139	2.170	2.194	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will determine tradeoffs between filter complexity to best exploit high intensity emissions associated with hostile fire via a visible optic sensor. Will characterize dual color HgCdTe FPAs on Si substrates, evaluate large area dual color C-QWIPs and improve lifetime in SLS detectors.				
<p><b>Prognostics and Diagnostics:</b> Investigate and evaluate prognostics and diagnostics (P&amp;D) algorithms; design, fabricate, and evaluate MEMS and other sensors; and design, develop code, and evaluate database for the integration into decision systems to extend sensor rationalization and minimize downtime via condition-based maintenance.</p> <p>In FY08, fabricated core module applied to specific commodities. Module entails a coded algorithms transceiver, core sensors, processor, and remote sensor interface. Conducted preliminary tests on networked RF link and incorporated fault algorithms.</p> <p>In FY09, implement cross-correlated algorithms in an open architecture P&amp;D system and conduct fault prognostic tests enhancing algorithms and user interface in an open architecture environment.</p> <p>In FY10, will evaluate multi-mode algorithms for diagnostic extension of electronics.</p>	2.853	2.954	2.888	
<p><b>LADAR:</b> Investigate eye-safe, scanned and scannerless, 3-D imaging laser radar (LADAR) for both long-range reconnaissance and short-range unmanned ground and air vehicle applications. Investigate optical limiter designs with promising nonlinear materials in order to provide passive protection of electro-optic (EO) vision systems from damage from laser threat devices.</p> <p>In FY08, utilized Tank and Automotive Research, Development, and Engineering Center (TARDEC) testing results on the system demonstrator to further maximize performance of materials for Charge Coupled Device (CCD) protection and fabricated an integrated solid-state version of the LADAR architecture for transition to CERDEC and Armaments Research, Development, and Engineering Center (ARDEC).</p> <p>In FY09, transition optimized sacrificial mirrors for TARDEC Vision Protection ATO Demonstrators and implement compact, low-power MEMS scanned LADAR for robotic autonomous navigation.</p> <p>In FY10, will implement broad-aperture fast opto-electronic shutters for optical sights, sensors, and Soldier vision and evaluate 3-D autonomous navigation LADAR integrated onto a small robotic platform (Packbot).</p>	1.835	1.132	3.230	
<p><b>Millimeter Wave Components:</b> Research, design, and investigate new component materials, structures, devices, and electromagnetic issues of millimeter wave (mmW) components and active devices, such as vacuum electronic (VE) devices and millimeter wave integrated</p>	3.497	3.205	7.349	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
circuits (MMICs), to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range. In FY08, completed efforts on Ka-band millimeter wave power module and Gallium Nitride (GaN) modules. Designed GaN amplifier integrated in mini-package and analyze thermal properties for high power packaged amplifiers. In FY09, design and fabricate integrated high power integrated circuit package for antenna array. In FY10, will design advanced mixed-signal RF integrated circuits, and implement models to investigate new materials and processes for high speed and high power electronic devices.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.132	.000	
<b>RF MEMS:</b> Investigate micro- and nano- technology for small, low cost, highly reliable, RF MEMS switches, resonators, and filters for multifunction RF applications; design highly stable low-noise oscillators with low-acceleration sensitivity by integrating photonic resonators and conventional microwave components to improve the capability of radar systems to detect slow moving targets; mature components and software for C4 technology; and perform research in advanced tactical software tools for mobile, ad hoc network access control, intrusion detection, and authentication techniques. In FY08, devised a process for wafer-level packaging with a MEMS phase shifter for multifunction RF applications and completed investigation of noise perturbations and dual-mode resonators for stable oscillators. In FY09, investigate approaches for a wafer level antenna. Prepare and integrate passive RF electronics with RF MEMS switch fabrication process. In FY10, will evaluate beam steering using an integrated piezoelectric MEMS (PiezoMEMS) enabled wafer level antenna, will evaluate an integrated PiezoMEMS switchable filter combining both low voltage switches with high-Q filters.	3.420	3.702	1.615	
<b>Antennas:</b> Design and develop high performance antennas and antenna arrays for RF front-end architectures supporting multifunction radar and communication systems. This work also includes evaluation and validation of these designs. Among the issues addressed in this antenna development are scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability. In FY08, validated antenna designs for integration into Army platforms through simulations and laboratory validation. In FY09, further develop these designs based on the measured laboratory data and transition the work to Communications and Electronics Research, Development, and Engineering Center (CERDEC). In FY10, will develop and assess novel platform based antenna designs.	2.662	2.507	1.757	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p><b>Photonics:</b> Investigate a broad base of extremely quick, accurate, and novel photonic architectures to enable detection of hazardous substances to enhance Soldier survivability. Investigate the hybridization of OE devices with electronics for IR scene projectors and extremely compact low-cost 3-D proximity sensing and imaging. In FY08, characterized current biomimetic recognition elements using several laboratory analytic methodologies; evaluated olfactory sensor based on integrated MEMS photoacoustic system; characterized efficacy of molecular recognition elements devised using rapid directed evolution methodologies and investigated multi-band IR 2-D arrays for scene generation. In FY09, assess recognition elements as alternative biologically-inspired methods to produce advanced photonic and electronic structures; investigate hybrid techniques incorporating novel recognition elements and spectroscopic inspection; and investigate highly compact OE transceivers for 3-D proximity sensor arrays and imaging; extend IR scene generation to more dense arrays and higher thermal resolution. In FY10, will evaluate hybrid recognition element/spectroscopy optical assay for hazardous chemical and/or energetics detection from previous down-selected evaluations; will improve power consumption and array density in OE proximity sensors.</p>	2.642	3.956	3.384	
<p><b>MEMS:</b> Investigate, design, and fabricate MEMS based components to improve power generation and micro-cooling technology for both the dismounted Soldier and future force systems. In FY08, investigated advanced MEMS cooling systems, demonstrated MEMS components on a small system and fabricated MEMS valves for high flow applications. In FY09, investigate improved MEMS rotary pumps, MEMS valves, and high flow low power atomizers. In FY10, will develop miniature power converters using MEMS passive components.</p>	3.319	4.148	2.082	
<p><b>Power and Energy:</b> Investigate technology for advanced batteries, fuel reformers, and fuel cells to be used in hybrid power sources for future electromagnetic armor and smart munitions. Investigate silicon carbide (SiC) power module technologies to enable compact high temperature (up to 150C heat sink temperature) and high power density converters for motor drive and pulse power applications.</p>	1.174	1.560	3.110	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602705A ELECTRONICS AND ELECTRONIC DEVICES			<b>PROJECT NUMBER</b> H94	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, explored new technology for reserve batteries and more stable sulfur tolerant catalysts. Investigated high-temperature (90 - 120C) SiC power modules implemented in voltage-controlled SiC power devices for low power hybrid electric vehicle (HEV) power conversion.</p> <p>In FY09, explore higher energy reserve battery materials and higher power Li-ion battery materials. Investigate high-temperature (90 - 120C) SiC power modules for medium power conversion.</p> <p>In FY10, will investigate and develop high-temperature (100-130 C) SiC power modules for high-efficiency medium power conversion and implement new gas gettering agents in thermal batteries, investigate and implement heat sources for thermal batteries, and explore higher energy materials for primary batteries.</p>						
Total			23.541	25.466	27.609	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	34.440	46.691	26.893						Continuing	Continuing
H95: Night Vision and Electro-Optic Technology	24.005	25.562	26.893						Continuing	Continuing
K90: NIGHT VISION COMPONENT TECHNOLOGY (CA)	10.435	21.129	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>Efforts in this program element (PE) design, develop and apply core night vision and electronic sensor technologies to improve the Army's capability to operate in all battlefield conditions. Technologies pursued in this PE have potential to provide the Army with new, or enhanced, capabilities to see and target farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). Project H95 researches new infrared (IR) Focal Plane Array (FPA) technologies, assesses and evaluates materials and develops designs for advanced multi-function lasers for designation and range finding, and develops modeling and simulation for advanced sensor technologies. Project K90 funds congressional special interest items.</p> <p>Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermining Technology), and PE 0603710A (Night Vision Advanced Technology).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.</p>										

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	34.924	25.647	26.381	
Current BES/President's Budget	34.440	46.691	26.893	
Total Adjustments	-.484	21.044	.512	
Congressional Program Reductions	.000	-.156		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	21.200		
Total Reprogrammings	-.484	.000		
SBIR/STTR Transfer	.000	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY					<b>PROJECT NUMBER</b> H95	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H95: Night Vision and Electro-Optic Technology	24.005	25.562	26.893						Continuing	Continuing

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

Efforts in this project research and develop component technologies that enable improved 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 shape design. This research will focus on efforts that benefit the Warfighter using novel affordable large format long wave infrared (LWIR) and visible near infrared (VISNIR) imagery for the Warfighter in all day/night visibility conditions. This research will focus on depositing HgCdTe on low cost substrates, e.g., Si or GaAs as an alternative to CdZnTe, enabling very large format FPAs, and multi-spectral sensors at costs not attainable with current technology. Alternatively, research to find other viable technologies will be examined such as corrugated large format (2k x 2k) corrugated-quantum well infrared photodetectors (C-QUIPS) and type II Strained Layer Superlattice that offer potential performance comparable to or exceeding HgCdTe at higher operating temperature and will also result in a low-cost system. With the development of multispectral and hyperspectral algorithms, advanced dual band FPAs are being developed with on-chip hyperspectral functionality. These FPAs offer the Warfighter the ability to perform detection, identification, and signature identification at extended ranges as well as the ability to detect targets in "deep hide".

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Modeling, Measurements and Simulation Applied Research for Sensor Design and Evaluation: This effort develops and investigates supporting engineering models, measurement techniques, and simulations concurrently with the development and transition of core sensor technologies. In FY08, designed, validated and delivered an aided target recognition performance model for use in combat simulations; developed a flash signature library and discrimination model for sensor design and combat simulations.	4.987	4.987	5.083	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY		<b>PROJECT NUMBER</b> H95	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, incorporate into the family of models and further study the ability to predict the range performance benefits of advanced signal processing (turbulence reduction, contrast enhancement, super resolution, compression, dither and image fusion) as new image processing techniques are enhanced or developed; develop and validate model for laser range gated active systems, and short wave infrared passive sensors; begin the development of a persistent surveillance model for air to ground systems. In FY10, will complete the development and validation of an air to ground persistent surveillance model; will develop and validate sensor performance model improvements to more accurately address the search process to include; moving targets, moving observers, environmental effects such as glint (reflective components, and complex clutter (foliage and urban structures)).				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.202	.000	
High Performance Small Pixel Uncooled Focal Plane Array (FPA): This effort researches high performance small pixel uncooled LWIR technology with the objective of using large format arrays to increase recognition and identification ranges. In FY10, will investigate and develop high definition format uncooled FPA material structures enabling greater sensitivity, lower noise and faster time constants than current sensors.	.000	.000	2.479	
Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence: This effort researches a Defense-wide virtual/distributed capability to interactively process both real and generated 3-D multispectral scenes from sensors simulations for evaluation of automatic target recognition (ATR) algorithms against realistic operational scenarios in aided or fully autonomous reconnaissance, surveillance, and target acquisition (RSTA) missions to include roadside threats/explosively formed projectiles. In FY08, conducted four field demonstrations and evaluated the effectiveness of the ATR algorithms using single and multiband (mid wave and long wave) ground based sensors against man-made and natural cluttered environments for stationary and mobile target detection and identification. In FY09, complete data collection and evaluation efforts for assessment of algorithm performance. In FY10, will continue testing of fused multiple ground-based sensors; will investigate and develop hyperspectral and multi-spectral sensors.	1.247	1.220	1.305	
Low Cost High Resolution Focal Plane Arrays (FPA): This effort investigates new infrared focal plane array (IR FPA) technologies for both cooled, high performance IR FPAs and uncooled, low cost IR FPAs.	3.559	3.323	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY			<b>PROJECT NUMBER</b> H95	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, investigated 2-color, midwave infrared/longwave infrared (MWIR/LWIR) arrays on low cost silicon substrates with pixel operability of greater than 90 percent and 96 percent respectively for both threat warning and enhanced situational awareness; began development of 1024x768 read out integrated circuits for 17 micron uncooled focal plane arrays and researched a 1024x768 array with 6 ms time constant.</p> <p>In FY09, integrate and refine sensor development to achieve pixel operability for 2-color midwave/longwave (MWIR/LWIR) sensor arrays on silicon substrates to greater than 95 percent/98 percent respectively; advance current FPA design to increase image resolution for mini-unmanned air system applications for target identification and tracking at extended ranges.</p>						
<p><b>Advanced Multifunction Laser Technology:</b> This effort investigates and evaluates laser architectures and materials required to produce multiple wavelength bands and pulse modulation formats for future laser-based systems, including laser designation, range finding, explosive detection and warning lasers.</p> <p>In FY08, developed and evaluated laser designs and materials for a multi-function (2 band) laser system, including laser designation and range finding.</p> <p>In FY09, develop and validate performance of the laser designator and laser rangefinder components in a relevant environment, test laser energy, beam quality, pulse duration and timing jitter under relevant temperature range.</p> <p>In FY10, will complete component testing and integrate laser components (to include optical receivers and electronics suitable for small unmanned aerial sensors and lightweight Soldier applications) into multi-function brass-board system. Related work in this technology area is also being performed under a manufacturing technology effort in PE 0708045A.</p>			2.978	3.139	4.171	
<p><b>Soldier Sensor Component and Signal Processing:</b> This effort investigates new digital image intensified (I2) components to improve maneuver and situational awareness for the dismounted and mounted Soldier, benefiting pilotage, unmanned aerial systems and unmanned ground vehicle (UGV) applications.</p> <p>In FY08, developed and evaluated co-location of sensor focal plane array and processing resources on the same chip; evaluated high resolution low power pixel mosaic structure display for infrared, hyperspectral, and visible sensors; conducted evaluation and design trade study of advanced adaptive light weight optics for hands-free focus operations. Conducted demonstration of compression algorithm in field programmable gated array micro-core environment.</p> <p>In FY09, complete co-location of sensing and processing resources on same chip allowing for immediate feedback of processing results to enable real-time clutter rejection for hyperspectral and multispectral applications; complete design and fabricate demonstrator of advanced pixel mosaic, high resolution, low light visible sensor display; fabricate and evaluate brassboard advanced adaptive optics.</p>			6.367	7.778	6.808	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY		<b>PROJECT NUMBER</b> H95	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate and develop a brass-board sensor, objective lens and monochrome display with field programmable gated array image processing.				
Advanced Structures for Cooled Infrared (IR) Sensors: This effort researches new detector materials and substrates and develops technologies to minimize detector defects and increase reliability through new growth and substrate preparation techniques. In FY08, evaluated and developed 2-color 256x256 longwave infrared (LWIR) and 640x480 mid-wave infrared (MWIR). In FY09, research an increase in 1k x 1k quantum well infrared photodetector focal plane array quantum efficiency; investigate dual band HgCdTe arrays produced on alternate substrates with 99% operability. In FY10, will develop and evaluate large area high performance dual color (midwave/longwave) infrared FPAs grown on low cost substrates such that defective pixels are reduced to less than 1%.	4.867	4.913	4.334	
Compact Hyperspectral Imaging (HSI) Component Technology: This effort investigates hyperspectral focal plane arrays and sensors for ground and air based platforms, and will potentially 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. In FY10, will develop a hyperspectral imaging (HSI) program to investigate advanced focal plane arrays in the visible, near and long wave IR region, incorporating on-chip multispectral capability via novel processing, to assist in identification of difficult military significant targets in urban and rural environments; will investigate and select best HSI configurations for visible and near IR and long wave IR HSI, including FPAs.	.000	.000	2.713	
Total	24.005	25.562	26.893	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY					<b>PROJECT NUMBER</b> K90	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K90: NIGHT VISION COMPONENT TECHNOLOGY (CA)	10.435	21.129	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Night Vision Component Technology applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Enhanced Micro-Image Display Technology							1.545	.000	.000	
Miniaturized Sensors for Small and Tactical Unmanned Aerial Vehicles (MINISENS)							.966	1.163	.000	
Power Efficient Microdisplay Development for US Army Night Vision							2.319	.000	.000	
Small Business Infrared Materials Manufacturing - Silicon Alternatives							1.545	5.425	.000	
Hyperspectral Sensor for UAV Surveillance/Targeting							1.545	.000	.000	
Next Generation Communications System							.967	1.163	.000	
Personal Miniature Thermal Viewer (PMTV)							.774	.000	.000	
Robotics Workforce and Military Curriculum							.774	.000	.000	
Lightweight Polymer Designs for Soldier Combat Optics							.000	1.162	.000	
Uncooled Metal-Oxide Semiconductor Field-Effect Transistor (MOSFET) Embedded Micro-cantilevers							.000	2.325	.000	
Night Vision Technology Research							.000	9.300	.000	
SBIR/STTR							.000	.591	.000	
Total							10.435	21.129	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602709A NIGHT VISION TECHNOLOGY	<b>PROJECT NUMBER</b> K90
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602712A Countermines Systems					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	24.252	32.308	18.945						Continuing	Continuing
HB2: COUNTERMINE COMPONENT TECHNOLOGY (CA)	3.092	10.564	.000						Continuing	Continuing
H24: COUNTERMINE TECH	18.426	18.899	16.084						Continuing	Continuing
H35: CAMOUFLAGE & COUNTER-RECON TECH	2.734	2.845	2.861						Continuing	Continuing

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

This program element (PE) investigates and develops applied technologies to improve countermines, signature management, and counter-sensors capabilities. The focus is on sensor technologies to improve detection of mines and directed energy; ballistic methods to defeat mines; and signature management technologies to reduce recon capabilities of the enemies. This PE also supports DoD's Center of Excellence for Unexploded Ordnance which coordinates and standardizes land mine signature models; maintains a catalogue of mine signatures; supports the evaluation of mine detection sensors and algorithms; and working in conjunction with the US Army Engineering, Research and Development Center (ERDC), examines countermines phenomenology of surface and buried mines, and booby traps. This PE advances the state of the art in Countermines Technologies (project H24) and Camouflage and Counter Recon Technologies (project H35). Countermines Component technology (project HB2) funds congressional special interest items.

Work in this PE is related to and is fully coordinated with PE 0602120A, (Sensors and Electronic Survivability), PE 0602624A, (Weapons and Munitions Technology), PE 0602709A, (Night Vision Technology), PE 0602784A (Military Engineering Technology), PE 0603606A, (Landmine Warfare and Barrier Advanced Technology), PE 0603710A (Night Vision Advanced Technology), and the US Marine Corps.

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 PE is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA; the US Army Corps of Engineers Research and Development Center (ERDC), Vicksburg, MS; and the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny, NJ.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermines Systems
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	30.294	21.815	22.050	
Current BES/President's Budget	24.252	32.308	18.945	
Total Adjustments	-6.042	10.493	-3.105	
Congressional Program Reductions	.000	-.107		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	10.600		
Total Reprogrammings	-5.297	.000		
SBIR/STTR Transfer	-.745	.000		

**Change Summary Explanation**

FY08 funding decrease due to transfer of Congressional adds for proper execution.

FY09 funding increase is due to Congressional adds.

FY10 decrease reflects the transfer of Countermines Phenomenology funds to PE 0602784A, project T40 and a reduction to support higher priority efforts.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermine Systems					<b>PROJECT NUMBER</b> HB2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
HB2: COUNTERMINE COMPONENT TECHNOLOGY (CA)	3.092	10.564	.000						Continuing	Continuing

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

Congressional Interest Item funding for Countermine Systems applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Standoff Improvised Explosive Device Protection Program	3.092	4.650	.000	
Hawaii Undersea Chemical Military Munitions Assessment Plan (pending transfer to 643779)	.000	3.874	.000	
Spectroscopic Materials Identification Center	.000	.775	.000	
UXO Detection and Classification in Volcanic Soil Using an Integrated Fully Polametic GPR and Chemical Sensor Technology	.000	.969	.000	
SBIR/STTR	.000	.296	.000	
<b>Total</b>	<b>3.092</b>	<b>10.564</b>	<b>.000</b>	

**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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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermines Systems					<b>PROJECT NUMBER</b> H24	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H24: COUNTERMINE TECH	18.426	18.899	16.084						Continuing	Continuing

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

Efforts in this project investigate and develop new countermines technologies that use man-portable, ground-vehicular, and airborne platforms for detection, discrimination, and neutralization of individual mines, minefields, and other threats. The goal of this project is to detect threats with a high probability, reduce false alarms, and enable an increased operational tempo.

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

Work in this project is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA; the US Army Corps of Engineers Research and Development Center (ERDC), Vicksburg, MS; the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny, NJ; and the CERDEC Intelligence and information Warfare Directorate, Fort Monmouth, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Department of Defense Unexploded Ordnance (UXO) Center of Excellence (UXOCOE): The Army serves as executive agent of the UXOCOE, which provides for the coordination of Unexploded Ordnance (UXO) across the Department of Defense (DoD) and serves as the focal point for research, development, testing and evaluation (RDT&E) UXO detection and clearance. In FY08, catalogued UXOCOE countermines, explosive ordnance disposal, humanitarian demining, range sustainment and munitions response technology programs and requirements; established a web-based reporting matrix to catalogue and disseminate requirements and technology information. In FY09, review requirements and technologies to identify opportunities for multiple Services/Components to leverage common requirements and/or technologies. In FY10, will analyze catalogued detection and clearance requirements and technologies to determine RDT&E shortfalls and leveraging opportunities.	.486	.484	.498	
Sensors for Explosive Detection: This effort investigates and develops short range standoff capability to detect traces of explosive compounds with a low false alarm rate.	1.930	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermine Systems			<b>PROJECT NUMBER</b> H24	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, evaluated emerging detection technologies and compared results to sensor metrics based upon the Training and Doctrine Command (TRADOC) requirement for detection of explosive compounds (e.g. sensor sensitivity, short time detection, explosive compound selectivity); investigated and evaluated promising technologies (e.g., use of laser induced breakdown spectroscopy to identify the explosive signature, behavior and concentration on small amount of compound ) for explosives and weapon cache detection.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.429	.000	
<p>Phenomenology Sensors: This effort investigates and evaluates the key geo-environmental parameters such as weather conditions, soil composition, soil moisture, soil electromagnetic properties, and ground cover that affect mine/minefield detection and false alarm rates.</p> <p>In FY08, extended the electro-optic/infrared (EO/IR) models in the countermine computational test bed to cover full minefield-sized images and selected urban areas; completed large scale validation for the EO/IR models; validated synthetic aperture radar electromagnetic model for small scale imagery.</p> <p>In FY09, extend synthetic aperture radar (SAR) and the electromagnetic models to full minefield-size images; validate large scale model that includes ground penetrating radar (GPR), SAR, and EO/IR for countermine system performance predictions in a variety of real world environments.</p>			1.970	1.963	.000	
<p>Anti-personnel/Anti-Tank Mine False Alarm Reduction: This effort investigates new sensor and signal processing component technology for ground based and airborne systems that provide the Warfighter inexpensive solutions to standoff mine/emerging threat detection while reducing false alarm rates.</p> <p>In FY08, investigated new sensor and signal processing component technology, (compact radar, electro-optic and standoff acoustic sensor technologies), for ground based systems to provide the Warfighter inexpensive solutions for standoff detection of the full spectrum of threats (artillery shells, explosively formed penetrators, underbody attacks, command detonated mines, traditional landmines) while on the move.</p> <p>In FY09, investigate and evaluate additional low cost sensor products and phenomenologies including multispectral electro-optical sensors/detectors, scalar and vector magnetometers and ground penetrating radars and select the best candidates for reducing false alarm rates and improving rate of advance.</p> <p>In FY10, will perform a comprehensive evaluation of the candidate sensors to assess the threat detection performance using the processor in a variety of operational conditions and will complete the phenomenology study and signal processing algorithm development.</p>			4.367	5.849	4.682	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermines Systems			<b>PROJECT NUMBER</b> H24	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Standoff Explosive Compound Detection Technology: This effort investigates ground based detection and confirmation technologies of explosives compounds from tactically relevant standoff distances.</p> <p>In FY08, conducted preliminary surface signature studies to examine the behavior and lifetime of explosive residues on various surface types for use in the standoff detection program; designed and executed 3 field tests using hyperspectral imaging sensors for the detection, of explosive precursor compounds at standoff distances; investigated UV Resonance Raman spectroscopy for standoff detection applications. In FY09, expand studies in the areas of chemical, nuclear, and biosensors applied to the explosive detection problems; investigate standoff explosive compound detection technologies to selectively detect multiple explosives (RDX, TNT, C4, etc.) in both vehicle borne and stationary environments; investigate non-contact sensing techniques to extend standoff range.</p> <p>In FY10, will perform an explosive behavioral study on different surfaces under various environmental conditions; and will determine phenomenology of ground based and airborne detection systems for full spectrum of threats.</p>		2.685	4.004	3.132		
<p>Standoff Mine/Defeat Neutralization Technology: This effort investigates and evaluates the ability to pre-detonate and neutralize mines and emerging threats at tactically relevant standoff ranges.</p> <p>In FY08, investigated and evaluated the effects of a high power, long-pulse drilling laser on mines and other threats; measured and developed the power, energy and laser requirements for the drilling laser to determine its feasibility and practicality for use in neutralizing threats in varying surfaces, overburden, and buried conditions; designed and began enhancements to precision munitions that can be used for threat neutralization in existing and newly developed weapon systems. Identified, conducted tests, and evaluated technologies for the detection of surface, obscured, and buried threats. In FY09, improve standoff capability for threat neutralization by investigating and developing advanced directed energy techniques and/or explosively formed munitions to achieve increased accuracy with reduced collateral damage and logistics burden.</p> <p>In FY10, will develop and evaluate a brassboard for laser drilling technologies and a brassboard for munitions against buried and obscured threats.</p>		6.988	6.170	7.772		
Total		18.426	18.899	16.084		
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermine Systems	<b>PROJECT NUMBER</b> H24
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermine Systems					<b>PROJECT NUMBER</b> H35	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H35: CAMOUFLAGE & COUNTER-RECON TECH	2.734	2.845	2.861						Continuing	Continuing

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

Efforts in this project evaluate and develop advanced signature management and deception technologies for masking friendly force capabilities and intentions. Technologies pursued under this effort include measures to reduce the optical cross section of the third generation dual band forward looking infrared (FLIR) both intrinsically within the detection/dewar and externally in the sensor system. Technologies investigated include the decentered field lens, wavefront coding, and spectral filtering and threat sensing algorithms.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Protection for Third Generation Sensors: The goal of this effort is to design, research, and evaluate advanced signature management and deception technologies for masking friendly force capabilities. In FY08, selected dual band sensor technologies for a threat sensing algorithm assessment. In FY09, evaluate and select algorithm based upon prior analysis and measurement performance. Down select technologies for investigation and fabrication of reduced signature third generation FLIR breadboard.	2.252	2.296	.000	
Camouflage and Counter-Recon Tech for Advanced Spectral Sensors: This effort investigates and advances new technologies to reduce susceptibility of sensors and extends camouflage technology. In FY08, selected 3-D target geometry model and generated or adapted first 3-D computer model for use in Spectral Camouflage Optimization of Patterns (SCOOP) optimizations; made appropriate modifications to SCOOP to permit use of 3-D target geometry; continued database development for backgrounds and coatings; evaluated means of utilizing satellite spectral data in lieu of ground-to-ground data. In FY09, generate 3-D camouflage patterns, including visible and near infrared/shortwave infrared/mid wave infrared/longwave infrared signatures for at least one target; test in a virtual environment; and continue database development for backgrounds and coatings of 3-D camouflage patterns.	.482	.484	2.861	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602712A Countermine Systems			<b>PROJECT NUMBER</b> H35	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate the advanced signature reduction approaches for uncooled and dual band staring sensors and other staring sensors; will investigate the susceptibility of foreign and friendly systems to hyperspectral detection methods; and will develop near-term improvements to camouflage paints, coatings, and systems in both the visible and non-visible wavelength regions.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.065	.000	
Total			2.734	2.845	2.861	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	38.604	42.208	18.605						Continuing	Continuing
H70: HUMAN FACT ENG SYS DEV	16.769	17.291	18.605						Continuing	Continuing
J21: HUMAN FACTORS APPLIED RESEARCH CA	21.835	24.917	.000						Continuing	Continuing

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

The objective of this program element (PE) is 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. 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 (project H70). Project J21 funds congressional special interest items.

Work in this PE is related to, and fully coordinated with, efforts in 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	39.763	17.348	18.656	
Current BES/President's Budget	38.604	42.208	18.605	
Total Adjustments	-1.159	24.860	-.051	
Congressional Program Reductions	.000	-.140		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	25.000		
Total Reprogrammings	-.529	.000		
SBIR/STTR Transfer	-.630	.000		

**Change Summary Explanation**

FY09 increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> H70	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H70: HUMAN FACT ENG SYS DEV	16.769	17.291	18.605						Continuing	Continuing

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

The objective of this project is 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 and manpower requirements to improve equipment operation and maintenance. Application of advancements yields reduced workload, fewer errors, enhanced Soldier protection, user acceptance, and allows the Soldier to extract the maximum performance from the equipment.

Major efforts in this project include research to identify sources of stress, potential stress moderators, intervention methods, adaptive learning, and supporting information technology to reduce uncertainty and improve decision quality for leaders and teams engaged in Command and Control (C2) planning and execution; enhancement of human performance modeling tools to optimize Soldier machine interactions and the collection of empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models; investigations on the effects on Soldier performance from integration of advanced concepts in crew stations designs; the identification, assessment, and mitigation of the effects of vehicle motion on Soldier performance; investigations to determine interface design solutions for brigade combat teams (BCT) information systems that enhance situational understanding and decision cycle performance; identification and quantification of human performance measures and methods to address future warrior performance issues; and improvement of human robotic interaction (HRI) in a full mission context.

Work in this project is conducted in cooperation with Tank and Automotive Research, Development, and Engineering Center (TARDEC); Natick Soldier Research, Development, and Engineering Center (NSRDEC); Communications-Electronics Research, Development, and Engineering Center (CERDEC); Simulation and Training Technology Center (STTC); Engineer Research and Development Center (ERDC); Army Research Institute (ARI); and Army Materiel Systems Analysis Activity (AMSAA).

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 performed by the Army Research Laboratory (ARL), Aberdeen, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Human-Robotic Interaction (HRI): Develop requirements and technologies for supervision and Soldier intervention for multiple semi-autonomous unmanned vehicles (UVs) in an urban environment.	3.668	3.800	2.371	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY			<b>PROJECT NUMBER</b> H70	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, transitioned HRI modeling results and design guidelines for automation and interface design and provided empirically-based recommendations for improving teaming performance to TARDEC; contributed to data collection and HRI analysis of TARDEC's field evaluations using multiple UVs to validate workload reduction and performance effects. In FY09, devise multimodal and performance based adaptive automation interfaces to control multiple, non-heterogeneous, aerial, and ground robotic systems. In FY10, will devise intuitive interface designs for supervising multiple assets. Will conduct baseline field evaluation for safe robotic operations in urban environments. Will collect Soldier performance data for marsupial small unattended ground vehicle missions at Ft. Benning.</p>						
<p><b>Adaptive Learning:</b> Identify sources of usability deficiencies and mismatches between Soldier capabilities and technological advances and provide tools to enable adaptive learning, reduce uncertainty, and increase situational awareness to improve decision quality for leaders and teams engaged in C2 planning and execution. In FY08, performed studies of team skills and acuity while performing multiple concurrent tasks and functions using integrated Intelligence, Surveillance, and Reconnaissance (ISR) technologies. Used field and lab venues to investigate real-time human-system/-network interaction measurement, monitoring and facilitation techniques. In FY09, determine methods to identify and monitor neural and behavioral markers of pending performance drops; consider correlates such as fatigue and system reliability issues. Incorporate these methods into the cognitive fight-ability model-based evaluation tool for use within the acquisition and system design process as a candidate information system to recommend design modifications before prototypes are developed. In FY10, will assess performance of Soldiers executing multiple tasks simultaneously when using integrated technologies under differing conditions of task priority.</p>			4.095	3.855	4.502	
<p><b>Improved Man-Machine Interfaces:</b> Investigate and determine interface design solutions for maneuver team information systems that enhance situational understanding and decision cycle performance. Identify, mature, and quantify human performance measures and methods to address future warrior performance issues. In FY08, explored the effects of advanced technologies, weight distribution, and focused on small arms shooting performance and incorporated data to refine Soldier small arms shooter model. In FY09, explore advanced technologies to identify improvements in dismounted squad performance; and transition the small arms shooter model to the Soldier Program Executive Office.</p>			4.538	4.822	4.908	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> H70	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will examine the effects of information content and information display on individual and team performance in an operational setting. Conduct research to identify assault rifle and optic characteristics that would improve Soldier reflexive firing performance.				
<p>Vehicle Mobility Systems: Develop and integrate intelligent, indirect-vision-based vehicle mobility; advanced crew stations; 360/90 degree situational awareness systems; crew and dismount scalable interfaces; and neurophysiologically- and 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.</p> <p>In FY08, explored techniques to improve Soldiers' ability to simultaneously perform visual scanning for targets and mobility-related tasks and transitioned recommendations to TARDEC.</p> <p>In FY09, determine Soldier machine interface design recommendations to enable the local area security function and the optimization of performance in mixed autonomous driving environments.</p> <p>In FY10, will devise and conduct an evaluation focused on indirect vision driving and local area security workload; will devise guidelines for noise-reduction and cognitive state classification algorithms; will advance multi-aspect measurement of Soldier, system, and environment.</p>	2.000	2.240	3.766	
<p>Human Performance Modeling: Enhance human performance modeling tools to optimize Soldier machine interactions. Collect empirical data on human perception (vision and hearing) to support human and system performance models.</p> <p>In FY08, incorporated stressor algorithms from other Services into Improved Performance Research Integration tool (IMPRINT 8 (Pro)), re-verified and distributed the tool; collected human performance data using head-mounted, dual waveband sensors for room clearing, and other operations in urban environments.</p> <p>In FY09, verify and distribute linked basic task, cognitive and human motion models to the human systems integration community and platform developers; validate approach to modeling body size increase due to clothing; transition data to Army Night Vision and Electronic Sensors Directorate to verify metrics for the evaluation of algorithms for fusing imagery from multiple-waveband sensors.</p> <p>In FY10, will link manpower and personnel tradeoff tools such as IMPRINT with Army/DoD personnel cost tools; develop tradeoff tool for multimodal interface design; evaluate the use of head-mounted displays for sniper localization; quantify differences in human spatial vision sensitivity from fixation to 30 degrees for incorporation into ACQUIRE</p>	2.468	2.574	3.058	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> H70	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Model simulations. Conduct a series of human-observer studies to characterize the situational-awareness benefits of various dynamic-range algorithms and devices.				
Total	16.769	17.291	18.605	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> J21	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J21: HUMAN FACTORS APPLIED RESEARCH CA	21.835	24.917	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Human Factors applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
High Optempo Performance Soldier Training							1.546	.000	.000	
Leonard Wood Institute (LWI) Training-Based Collaborative Research							20.289	24.219	.000	
SBIR/STTR							.000	.698	.000	
Total							21.835	24.917	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602720A Environmental Quality Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	16.651	19.799	15.902						Continuing	Continuing
EM5: ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)	1.158	2.990	.000						Continuing	Continuing
F35: Environmental Quality Applied Research (CA)	.000	.797	.000						Continuing	Continuing
048: IND OPER POLL CTRL TEC	2.937	3.028	3.128						Continuing	Continuing
835: MIL MED ENVIRON CRIT	3.173	3.288	3.284						Continuing	Continuing
895: POLLUTION PREVENTION	3.601	4.023	3.729						Continuing	Continuing
896: BASE FAC ENVIRON QUAL	5.782	5.673	5.761						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This program element (PE) provides technologies that support the long-term sustainment of Army training and testing activities by improving the Army's ability to comply with requirements mandated by federal, state and local environmental/health laws and reducing the cost of this compliance. This program provides the Army with capabilities 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, by reducing hazardous waste generation through process modification and control, materials recycling and substitution. This program develops technologies to predict and mitigate range and maneuver constraints associated with current and emerging weapon systems, doctrine, or regulations. Research is transitioned to PE 0603728A (Environmental Quality Technology Demonstrations).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, the Army Science and Technology Master Plan, and supports the Army Strategy for the Environment.</p> <p>Work in this PE is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS, the Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD, and the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.</p>										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602720A Environmental Quality Technology

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	20.076	16.064	15.766	
Current BES/President's Budget	16.651	19.799	15.902	
Total Adjustments	-3.425	3.735	.136	
Congressional Program Reductions	.000	-.065		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	3.800		
Total Reprogrammings	-3.082	.000		
SBIR/STTR Transfer	-.343	.000		

**Change Summary Explanation**

FY08 funding decrease was due to transfer of congressional interest items.  
 FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> EM5		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
EM5: ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)	1.158	2.990	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Environmental Quality applied research.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Propelling Agent for Slurry Gel								1.158	.000	.000	
MLRS Disposal System (pending transfer to 633103)								.000	2.906	.000	
SBIR/STTR								.000	.084	.000	
Total								1.158	2.990	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> F35	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
F35: Environmental Quality Applied Research (CA)	.000	.797	.000						Continuing	Continuing

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

Congressional Interest Item funding for Environmental Quality applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Range Scrap Disposal, Hawthorne Army Depot (pending transfer to 633103)	.000	.776	.000	
SBIR/STTR	.000	.021	.000	
<b>Total</b>	<b>.000</b>	<b>.797</b>	<b>.000</b>	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> 048	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
048: IND OPER POLL CTRL TEC	2.937	3.028	3.128						Continuing	Continuing

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

This project will provide technologies 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 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 worldwide. Efforts include a focus on the impacts of new materiel that will enter the Army inventory within the next decade and beyond. This project focuses on industrial pollution sources from production facilities, facility contamination, and other waste streams providing compliance through sustainable environmental protection technologies. Efforts abroad include a focus on technologies to provide deployed forces with environmentally safe and cost effective technologies and/or processes to achieve maximum diversion, minimization, or volume reduction of basecamp and field waste. Additional work is focused on environmental risk assessment for ranges associated with noise and air quality.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Industrial Compliance and Pollution Prevention Readiness:</b> In FY08, completed development of a structural activity relationship (SAR) predictive model for insensitive munitions treatment kinetics. Completed initial design of miniaturized enzyme electrodes for detection of biomarkers, and a sensor to demonstrate living cell behavior to toxins. Completed algorithms for weather and nonlinear effects on sound propagation. Completed an investigation of high-amplitude nonlinear blast wave emission from Army weapons that enables enhanced accuracy of noise footprint prediction. In FY09, develop new sensing modalities using mimicked human physiological responses to detect acutely toxic substances in water. Also, begin development of attenuation functions in frequency and distance using a variety of sound propagation calculation models.	2.937	2.990	3.128	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology		<b>PROJECT NUMBER</b> 048	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will develop physiologically relevant chip/organ response on micro-fluidic sensing platforms. Will also finalize blast noise propagation attenuation functions for incorporation into blast noise models and assessment tools.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.038	.000	
Total	2.937	3.028	3.128	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> 835	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
835: MIL MED ENVIRON CRIT	3.173	3.288	3.284						Continuing	Continuing

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

This project will provide a quantitative means to determine the environmental and human health effects resulting from exposure to explosives, propellants, and smokes produced in Army industrial, field, and battlefield operations or disposed of through past activities. The end results of this research are determinations of acceptable residual munitions constituents (MCs) and munitions and explosives of concern (MECs) contaminant concentration levels that minimize adverse effects on the environment and human health. This research is supported by the previously developed Army Risk Assessment and Modeling System (ARAMS) that links models and databases of expected result and transport to the exposure and effects of explosives and their degradation by-products. The Long-Term Monitoring program reduces or eliminates the costly and lengthy operation of off-site analyses and enhances overall monitoring capabilities by providing continuous/autonomous detection/analysis. The program of Characterization/Assessment of Distributed Source MCs on ranges yields knowledge and technologies to quantify MC transport and fate (what substances become through assimilation, chemical reactions and decay) in terrestrial range environments. New research in toxicogenomics, nanomaterial technologies, and computational/molecular modeling tools for toxicity and exposure assessment further reduces the uncertainty associated with both the probability of exposure and the ultimate effect if exposed. 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.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.074	.000	
Effects of Munitions Constituents/Munitions and Explosives of Concern: In FY08, designed a laboratory-scale gene signature array microchip sensor, evaluated field negative ion miniature mass spectrometry for detection of MCs, defined statistically valid range characterization/sampling protocols for MC sources, constructed a toxicogenomic assessment framework for several organisms as modeling platforms, identified methods for	3.173	3.214	3.284	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology		<b>PROJECT NUMBER</b> 835	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>computational chemistry prediction of effects of explosives dissolved in water, and identified analytical approaches to characterize nanomaterial properties to support toxicological and remediation.</p> <p>In FY09, evaluate in-situ biosensor technologies for direct push wells (installed by pushing or hammering the drive rods as opposed to drilling or augering), finalize protocols for MC residue reduction, further the mathematical modeling of biological impacts due to existing MCs and devise computational chemistry methods for the prediction of reactivity and toxicity of explosives and decomposition products dissolved in water. Identify exposure quantification metrics for select representative nanomaterials. Explore a common framework to consolidate tools for comprehensive, multi-stressor range environmental risk assessments.</p> <p>In FY10, will establish mathematical biological models forecasting MC toxicology. Will complete computational chemistry methods for the prediction of explosives degradation in water and explore methods for predicting MC binding and movement in soil. Will establish a nanomaterial periodic table and framework for integrating environmental attributes with nanotechnology development.</p>				
Total	3.173	3.288	3.284	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> 895	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
895: POLLUTION PREVENTION	3.601	4.023	3.729						Continuing	Continuing

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

The objective of this project is to develop 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 matures 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 designer energetic molecules engineered by molecular modeling and simulation using Department of Defense (DoD) 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 heavy metal reductions from surface finishing processes. The project develops technologies for advanced development under PE 0603728, project 025.

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

Work in this project is performed by the Research, Development, and Engineering Command's (RDECOM) Army Research Laboratory (ARL), Aberdeen Proving Ground, MD, in collaboration with the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ, the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL, and the Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Rocket and Missile Propellants: In FY08, modeled performance of propellant-engine combinations. In FY09, optimize and evaluate performance of propellants in new engine. In FY10, will design and model next generation environmentally benign propellant ingredients.	3.601	3.910	3.729	
Conventional Ammunition:				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology			<b>PROJECT NUMBER</b> 895	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, refined green chemistry synthesis procedures and performed full chemical and physical characterization of new explosive molecules.</p> <p>In FY09, model performance of new environmentally benign explosive molecules in weapons systems.</p> <p>In FY10, will design novel, environmentally benign explosive compositions consisting of new molecules.</p> <p>Pyrotechnics:</p> <p>In FY08, optimized characteristics of low-toxicity smoke formulations. In FY09, investigate environmentally sustainable simulators, flares, delays, and signals.</p> <p>In FY10, will down-select candidate compositions for environmentally friendly obscurants.</p> <p>Heavy Metal Reduction:</p> <p>In FY10, will evaluate chromate/cadmium-free materials and processes in a laboratory environment.</p> <p>Zero Footprint Camp:</p> <p>In FY10, will evaluate technologies in a laboratory environment that reduce base camp energy and water supply demands.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.113	.000	
Total			3.601	4.023	3.729	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology					<b>PROJECT NUMBER</b> 896	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
896: BASE FAC ENVIRON QUAL	5.782	5.673	5.761						Continuing	Continuing

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

This project will provide environmental risk assessment, analysis, monitoring, modeling, and mitigation technologies to support sustainable use of the Army's 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 provides 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 provides tools and technologies to avoid training restrictions and costs due to training and testing noise and reduce constraints on training lands associated with invasive species.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Threatened and Endangered Species (TES) Management to Reduce Operational Constraints: In FY08, completed projects identifying effects of noise and physiological stress of transient training activities on the Indiana bat and gopher tortoise, conducted research in support of a Candidate Conservation Agreement for gopher tortoise, and enhanced Light Detection and Ranging (LIDAR) applications for habitat assessment. Completed projects to reduce potential constraints on military training associated with the Indiana Bat Recovery Plan and a possible Endangered Species Act listing petition for the gopher tortoise. In FY09, evolve research from high priority species that are listed to research involving a multi-species approach for improved detection of species at risk and predictive synthesis models for effects of military disturbance on species at risk.	3.079	2.939	1.545	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602720A Environmental Quality Technology			<b>PROJECT NUMBER</b> 896	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will complete development of detection techniques, multi-species population and risk prediction models and understanding of advanced genetic methods to manage species at risk. This will assist the Army in reducing the number of future listed species and their associated constraints on military training.						
Predictive Risk Assessment and Management for Army Ranges and Training Lands: Technologies developed in this effort are also aimed at minimizing Training Land/Natural Resource Conflicts for Sustained Mission Support. In FY08, developed and evaluated strategies to mitigate high priority invasive species impact on training. In FY09, complete algorithms for weather and nonlinear effects on sound propagation for determining discrete noise impacts and describing variance in noise level decay with distance. In FY10 will complete biometric sampling for detecting and assessing species invasiveness on Army ranges and training lands. Will begin multi-platform optical remote sensing systems development to measure training and prescribed fire emissions, monitor fenceline conditions, and visualize large scale plume generation and transport. Will also develop unified landscape utility metrics for mission and resource condition to maximize landscape resources supporting evolving training doctrine.			2.703	2.734	4.216	
Total			5.782	5.673	5.761	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	42.004	41.218	24.833						Continuing	Continuing
H92: Communications Technology	13.845	14.427	14.777						Continuing	Continuing
TR9: C3 COMPONENT TECHNOLOGY (CA)	20.387	17.283	.000						Continuing	Continuing
779: Command, Control and Platform Electronics Tech	7.772	9.508	10.056						Continuing	Continuing

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

Efforts in this program element (PE) research and develop communications technologies, command and control (C2), and electronics systems and subsystems 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. This PE researches and develops technologies that; enable management of information across the tactical and strategic battle space; provide automated cognitive reasoning and decision making; and allow timely distribution, display, and use of C2 data on Army platforms (project 779). This PE also supports research in technologies which allow field commanders to communicate on-the-move to/from virtually any location, through a seamless, secure, self-organizing, self-healing, network (project H92). Project TR9 funds congressional special interest efforts.

Work in this PE is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602783A (Computer and Software Technology), PE 0602874A (Advanced Concepts and Simulation), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor 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 in this PE is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602782A Command, Control, Communications Technology

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	36.955	24.014	24.519	
Current BES/President's Budget	42.004	41.218	24.833	
Total Adjustments	5.049	17.204	.314	
Congressional Program Reductions	.000	-.136		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	17.340		
Total Reprogrammings	5.696	.000		
SBIR/STTR Transfer	-.647	.000		

**Change Summary Explanation**

FY08 funding increase was due to transfer of congressional interest items.  
 FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology					<b>PROJECT NUMBER</b> H92	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H92: Communications Technology	13.845	14.427	14.777						Continuing	Continuing

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

Efforts in this project investigate, develop and apply advanced communications and network technologies; the strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing research efforts on emerging technology areas (e.g., mobile radio based infrastructures, information assurance, security in narrowband environments, multiband on-the-move (OTM) transmit and receive antennas, adaptive protocols, and low probability of interception/low probability of detection waveforms).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Communications Planner for Operational and Simulation Effects with Realism (COMPOSER):</b> This effort develops technologies to observe and predict the performance of wireless tactical networks at faster than real time: COMPOSER consists of the following software modules: communication effects simulator (CES), network visualizer (NV), spectrum manager, and architecture framework. In FY08, completed enhancements to CES; increased the integration of waveform models to CES; completed spectrum management capability; developed final version of COMPOSER for transition to the Coalition Joint Spectrum Management Planning Tool (CJSMPT) Joint Concept Technology Demonstrations. Work on this effort is also being accomplished under PE 0603008A/project TR1.	.289	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.185	.000	
<b>Wireless Information Assurance (IA):</b> This effort investigates and develops technologies to protect wireless tactical networks against computer network attacks. In FY08, developed software (SW) based tactical automated intrusion detection and response components capable of detecting "zero day" or previously unseen cyber attacks on "red-side"(unencrypted) host internet protocol networks;	3.166	2.548	2.616	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> H92	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>provided the capability to automatically respond and mitigate/recover from the malicious activity; validated the maturity and performance in a fully scaled mobile ad hoc emulation environment.</p> <p>In FY09, develop a suite of IA technologies to enable tactical battlefield information sharing across multiple security classification domains (i.e., TS/SCI to Unclassified), (technologies include cross domain boundary services with trusted labeling and data sanitization to enforce data release restrictions from higher to lower classified domains, smart pull information requests from higher domains, and trusted SW partitioning and kernel technology with controlled interface filtering to enforce push/pull of information across security domains for severely resourced constrained environments); develop and assess operating system agnostic malicious code detection technology to find vulnerabilities and software flaws via source code analysis and reverse engineering.</p> <p>In FY10, will investigate distributed key management concepts that allow mobile users to automatically affiliate, de-affiliate, and re-key the network to respond to a change or a compromise without requiring pre-placed keys; will evaluate SW cross domain security (CDS) services providing SW separation of kernel that protect and establish separation of classification levels; will investigate adaptive middleware and conduct lab testing. Work on this effort is also being accomplished under PE 0603008A/project TR1.</p>				
<p><b>Encryption Technologies:</b> This effort is a Jointly funded effort with US Navy, Air Force, Marine Corps, to develop high speed, 4-channel, remotely manageable, programmable, embeddable crypto device.</p> <p>In FY08, completed development of the engineering development model (EDM) and delivered Non-Certified EDMs for start of Government Lab Evaluation/Test with a simulated host terminal; performed initial NSA Certification testing and implement design changes based on test results.</p> <p>In FY09, conduct lab evaluation; conduct the security certification process, and complete the program effort with Certified EDM delivery.</p>	1.441	1.502	.000	
<p><b>Network Designs:</b> This effort investigates and develops technologies to design the next generation mobile ad hoc wireless networks.</p> <p>In FY08, evaluated the network design capability on a surrogate future force network; interfaced the network design algorithms with the simulation; characterized detailed end-to-end user performance metrics; and assessed the effectiveness of new networking technologies. In FY09, extend the basic design tool to include distributed reasoning/learning in a mobile Ad Hoc Network environment; develop a comprehensive representation of the internal operation and performance of network data dissemination mechanisms; improve the network traffic characterization model.</p>	2.691	3.399	3.224	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> H92	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will enhance the basic design and perform evaluation on a number of typical military maneuver and network traffic scenarios.				
<p><b>Antenna Technologies:</b> This effort develops low cost, power efficient, directional antenna technologies for terrestrial and tactical satellite ground terminals to enable them to operate on the move over multiple frequency bands.</p> <p>In FY08, completed development of terrestrial directional antenna (TDA) technologies for mobile ground platforms (WIN-T) providing air interface for terrestrial directional networking and beam steering protocols; investigated hybrid scan and phased array antenna technologies for a low profile multi-beam OTM SATCOM antenna for use with military Ka band and commercial Ku band satellites.</p> <p>In FY09, develop and demonstrate multi-beam low profile electronically steered OTM SATCOM antenna components that functions in two frequency bands (Ka/Q); develop and demonstrate Ka and Q band high efficiency power amplifier; develop TDA C/Ku affordable directional antenna brassboard.</p> <p>In FY10, will develop TDA C/Ku directional antenna and integrate platform feed and evolutionary aperture design to reduce antenna profile and cost; will develop multi-beam low profile electronically steered Ka/Q band SATCOM OTM antenna components. Work on this effort is also being accomplished under PE 0603008A/project TR1.</p>	4.486	6.793	4.170	
<p><b>Radio Enabling Technologies and Nextgen Applications (RETNA):</b> This effort develops technologies that enable the porting of radio waveforms onto software defined radios at reduced cost and complexity.</p> <p>In FY08, performed detailed assessment and evaluation of the hardware/software and porting of waveforms onto joint tactical radio system (JTRS) representative software defined radio (SDR) platforms; developed capability to reduce the complexity of porting software waveforms onto SDR hardware.</p>	1.772	.000	.000	
<p><b>Cognitive Networking:</b> This effort develops technologies enabling wireless networks to sense network and spectrum conditions and automatically adapt for more efficient use.</p> <p>In FY10, will begin the design and development of cognitive network tools for mobile ad hoc networks that will take into consideration network connectivity, end-to-end user requirements (bandwidth), survivability and optimality (goodness of design), provide knowledge oriented representation of radio frequency (RF) connectivity, network operations/ behaviors, and effectiveness of learning/prediction techniques in dynamic environment. Work on this effort is also being accomplished under PE 0603008A/project TR1.</p>	.000	.000	1.883	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> H92	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Dynamic Spectrum and Network Technologies: This effort develops and investigates technology for radios and network management systems to enable access to spectrum currently unavailable because of current spectrum management methods. In FY10, will investigate and develop software policy agents for integration into software defined radios to allow the radios to accept Dynamic Spectrum Access (DSA) from the network management system over the air, will adapt the DARPA Disruption Tolerant Networking (DTN) technology for military communications systems to improve reliability and transportability.	.000	.000	2.884	
Total	13.845	14.427	14.777	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology					<b>PROJECT NUMBER</b> TR9	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TR9: C3 COMPONENT TECHNOLOGY (CA)	20.387	17.283	.000						Continuing	Continuing

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

Congressional Interest Item funding for C3 Component Technology applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Innovative Wireless Technologies for Sensor Networks	.000	.678	.000	
Portable Flexible Communication Displays Devices	1.160	.000	.000	
Integrated Lightweight Electronics Shelter	1.352	.000	.000	
Lightweight Theater Transportable TOC	2.318	.000	.000	
C4ISR Integrated Digital Environment Service Model (IDESM)	1.932	.000	.000	
Dynamically Managed Data Dissemination	.966	1.163	.000	
Advanced 3-D Locator (A3DL) Technology	3.092	.000	.000	
Development of a High Performance Computing System Based on a Modem High Speed Switch Fabric	.966	.000	.000	
Intelligent Distributed Command & Control (IDC2)	1.933	2.325	.000	
Research of Advanced Communications Technologies for Enhanced Secure, Mobile, Networked Communications	.774	.000	.000	
Nanophotonic Devices	1.546	.000	.000	
Ruggedized Cylinders for Expandable Mobile Shelters	4.348	2.325	.000	
Tactical Booster for Mobile Network Centric Warfare	.000	1.550	.000	
Portable Non-Magnetic Compass/Positioning/Timing Device	.000	1.550	.000	
21st Century Command, Control, and Communications Technology	.000	.620	.000	
Automated Language and Cultural Analysis for National Security	.000	1.938	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> TR9	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
On-the-Move Telescoping Mast	.000	2.325	.000	
Modular Universal TOC Packages for Vehicles and Shelters	.000	2.325	.000	
SBIR/STTR	.000	.484	.000	
Total	20.387	17.283	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology					<b>PROJECT NUMBER</b> 779	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
779: Command, Control and Platform Electronics Tech	7.772	9.508	10.056						Continuing	Continuing

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

Efforts in this project research technologies that enable commanders at all echelons to have better and more timely information and allows them to command from 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 and navigation. This project researches technologies that support multi-modal man-machine interactive technology, battle space visualization, positioning and navigation in degraded environments, automated cognitive decision aids, real-time collaborative tactical planning tools, data transfer, distributed data bases, open system architectures, and integration concepts which contribute to more mobile operations.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>C2 On-The-Move (OTM) Enabling Technologies:                      This effort investigates and develops technologies to improve the Warfighters ability to access, use, present and understand relevant battle command information.                      In FY08, partnered with the Space and Missile Defense Command (SMDC) to develop intelligent software agents that operate in space and strategic (e.g., Missile Defense) as well as terrestrial domains; design, develop, assess and transition software agents that can be user defined and interoperable for battle command, intelligence, surveillance, and reconnaissance, and logistic customers; provided extraction of unstructured and structured data (graphics, numeric) from free text and identified report info for further analyses (Smart Filtering Service); supported generation of warnings and alerts relevant to Commander's Critical Information Requirements (Alert and Warning Service).                      In FY09, investigate digital OPORD representations to enable software agent based services; research baseline human cognitive limits for understanding while performing C2 workflows; continue to work with SMDC to further the development of intelligent software agent services with the addition of automatic discovery which enables the software agents to reduce the need for user intervention by automatically searching and retrieving data from other software</p>	4.890	7.720	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> 779	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
agent services; apply automatic discovery intelligent software agent technology to help optimize data initialization and information management in all domains and transition intelligent software agent services to PEO C3T; evaluate machine language translation tools and parsing techniques for the purpose of text-to-text and speech-to-speech translation to provide enhanced collaboration among Joint coalition forces.					
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.067	.000
<p><b>Battle Space Awareness and Positioning:</b>            This effort investigates positioning, navigation and tracking 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.            In FY08, investigated advanced positioning/navigation (pos/nav) and attitude sensor technologies; conducted trade studies to determine applicability of advanced network algorithms and processes within the context of emerging brigade combat team (BCT) architectures; continued the design and assessment of performance improvements in micro electro mechanical system (MEMS) inertial measurement units for dismounted Soldier and tactical vehicle applications.            In FY09, downselect the pos/nav sensor suite and develop integration techniques to incorporate radio network algorithm and processes to enable robust position information for enhanced situation awareness in global positioning system (GPS) denied, urban, and other complex environments.            In FY10, will continue development of pos/nav and attitude sensors, especially those that exploit the synergy between communications and position such as RF ranging and network assisted GPS. Work on this effort is also being accomplished under PE 0603772A/project 101.</p>			2.882	1.721	1.790
<p><b>C2 OTM Enabling Technologies (continued FY10):</b>            In FY10, will develop speech and optical character recognition translation services within a Service Oriented Architecture (SOA) framework to allow Coalition forces the benefit of communicating more efficiently and securely, while providing additional translation options; will develop text-to-text machine translation algorithms for low density languages to enable translation capabilities for languages currently not widely used, but are on the Defense Language Agency prioritized language list; will investigate unmanned ground vehicle/unmanned aerial system (UGV/UAS) platform behaviors and C2 info knowledge management of unmanned systems to provide capability to manage large numbers of air and ground robots over extended urban areas at scales beyond current robotic inventories; will develop benchmarks for decision-making and identify emerging patterns of interaction between individuals, intelligent agents, and teams of agents and</p>			.000	.000	8.266

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602782A Command, Control, Communications Technology		<b>PROJECT NUMBER</b> 779	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
humans; based on approved scenarios, will develop work flow analyses to identify and assess cognitive processes in decision-making.				
Total	7.772	9.508	10.056	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	8.676	6.274	5.639						Continuing	Continuing
Y10: COMPUTER/INFO SCI TECH	5.196	5.476	5.639						Continuing	Continuing
Y11: COMPUTER & INFORMATION SCIENCE APPLIED RES CA	3.480	.798	.000						Continuing	Continuing

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

The objective of this program element (PE) is to conduct applied research that would enable enhanced understanding and accelerate the decision cycle time for commanders and leaders operating in a mobile, dispersed, highly networked environment. This PE supports research on information and communications technology (project Y10). Project Y11 funds congressional special interest items.

Work in this PE is related to and fully coordinated with efforts in 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	9.803	5.495	5.591	
Current BES/President's Budget	8.676	6.274	5.639	
Total Adjustments	-1.127	.779	.048	
Congressional Program Reductions	.000	-.021		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	.800		
Total Reprogrammings	-.916	.000		
SBIR/STTR Transfer	-.211	.000		

**Change Summary Explanation**

FY08 decrease is due to transfer of congressional interest items.  
 FY09 increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY					<b>PROJECT NUMBER</b> Y10	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Y10: COMPUTER/INFO SCI TECH	5.196	5.476	5.639						Continuing	Continuing

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

The objective of this project is to fund applied research of information and communications technology towards the goal of developing information processing technologies to automate the delivery of local/global information for decision making (planning, rehearsal, and execution) so that it is synchronized, parallel and real-time; and devising communication/network technologies that will enable the synchronization of secure data/information from humans to humans, humans to computers, computers to humans, as well as reducing dependence on mouse and keyboard versus other modes of computer interaction. This is key to enabling enhanced understanding and accelerating the decision cycle time for commanders and leaders operating in the mobile, dispersed, highly networked environment envisioned for the future force.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.083	.000	
Information Processing: Enhance information processing techniques in order to inform and protect the force from imminent threats. User directed fusion techniques that combined with methods developed at the Communications-Electronics Research, Development, and Engineering Center (CERDEC) will enable semi-automated fusion to improve the completeness and timeliness of decision-making in command and control (C2) operations. The integrated technology will be matured for Distributed Common Ground Station-Army (DCGS-A) and future force assessment. In FY08, implemented ontology to formalize the representation, attributes, and transforms necessary to track a soft target using various data sources. Integrated soft target tracking algorithms as small, self-contained fusion services that support the Intelligence Analyst in interpreting battlefield events. In FY09, develop and transition fusion (relationship discovery) services to CERDEC for integration into DCGS-A.	1.075	1.090	1.121	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY			<b>PROJECT NUMBER</b> Y10	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will investigate measures of interest to mine relevant information from social network information sources and augment that information with data from local (sensor) assets for improved understanding of the human/terrain battlefield interactions.						
<p>Information Exchange: Investigate techniques to enable automated integration of global and local information, allowing tactical assets to cooperatively share sensed events within a wireless distributed fusion environment in order to inform the force of relevant events. In FY08, used social networking concepts to develop soft target tracking algorithms that can be used to identify relevant changes in the tactical environment. In FY09, integrate cross-security-level information exchange algorithms to ensure tactically relevant information is presented to the user in a minimally intrusive manner. In FY10, will investigate data structures for policy-based information exchange and integrate information assurance modules to support the evaluation in tactically relevant environments.</p>			1.050	1.103	1.172	
<p>Information Assurance: Conduct applied research on tactical information protection technologies for agent-based vulnerability assessment over wireless bandwidth constrained links and security infrastructures for sensor networks. The future force will operate in a complex wireless environment where survivability must be maintained in spite of inherent vulnerabilities of standardized protocols and commercial technologies. In FY08, investigated and evaluated an integrated distributed wireless intrusion detection system (IDS) capable of detecting multiple classes of intrusions from multiple simultaneous intruders. Enhanced network protocol to provide a more efficient healing process. In FY09, evaluate the scalability of the distributed wireless IDS system in large networks and determine the expected bounds of performance (e.g. overhead, missed detection probability, and false alarm probability). In FY10, will evaluate the wireless IDS system performance in terms of network overhead (i.e., bandwidth, energy and latency).</p>			1.033	1.040	1.119	
<p>Network Theory: Statistical based methods for studying networks supports theory development in network science. Provide a basis to validate or invalidate theoretical results, point gaps between theory prediction, and field performance, provide verification of mobility, channel, topology models, and of convergence of adaptive protocols, guide development of the theoretical</p>			1.497	1.615	1.675	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY		<b>PROJECT NUMBER</b> Y10	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>effort by providing a basis for refining models and assumptions. All of this leads to the right levels of robust abstraction to understand network behavior, resulting in a tight coupling between theoretical developments, simulation, emulation, and over-the-air testing in lab and field environments. The long-term goal is to develop a real-time adaptive statistical analysis system that is coupled to a monitoring system that can infer/learn global network behavior and to a control system that controls local behavior so as to predictively improve performance, while ensuring the stability of the overall system.</p> <p>In FY08, acquired software and hardware, including network monitoring tools, and setup emulation and in-the-lab/field assessments to gather network performance data, based on algorithms developed in this PE/project.</p> <p>In FY09, refine and expand the scope of the effort (size of the network, complexity of the deployed algorithms and protocols, heterogeneity of the nodes, harshness of the radio frequency (RF) channel conditions and sophistication of the adaptation). Theoretical work will be validated against the acquired data.</p> <p>In FY10, will create models that incorporate network characteristics and human information processing, and communication and decision making capabilities for enhanced system performance.</p>				
<p><b>Language Translation:</b> Conduct research into techniques for developing the underlying computational multilingual software framework to enable commanders and troops to bridge language barriers in order to anticipate adversaries and collaborate with allies.</p> <p>In FY08, implemented optical character recognition (OCR), machine translation (MT) and name extraction via web services in Deployable Harmony Document Exploitation (DOCEX) System (DHDS) and DCGS-A test beds.</p> <p>In FY09, evaluate use of document image processing tools operating through web service on noisy and handwritten foreign language documents.</p> <p>In FY10, will assess the impact of pre-processing tools on downstream processes, like named entity extraction, machine translation, and summarization that are critical to the Intelligence community.</p>	.541	.545	.552	
<b>Total</b>	5.196	5.476	5.639	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY	<b>PROJECT NUMBER</b> Y10

**E. Performance Metrics**

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

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602783A COMPUTER AND SOFTWARE TECHNOLOGY					<b>PROJECT NUMBER</b> Y11	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Y11: COMPUTER & INFORMATION SCIENCE APPLIED RES CA	3.480	.798	.000						Continuing	Continuing

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

Congressional Interest Item funding for Computer and Software Technology applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Biologically-Inspired Security Infrastructure for Tactical Environments	1.934	.000	.000	
Integrated Information Technology Policy Analyses Research	1.546	.000	.000	
Lightweight Soldier Sensor Computing	.000	.776	.000	
SBIR/STTR	.000	.022	.000	
<b>Total</b>	<b>3.480</b>	<b>.798</b>	<b>.000</b>	

**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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Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602784A MILITARY ENGINEERING TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	55.216	58.810	54.818						Continuing	Continuing
H71: Meteorological Research for Battle Command	6.629	6.705	5.656						Continuing	Continuing
T40: MOB/WPNS EFF TECH	17.458	17.750	20.445						Continuing	Continuing
T41: MIL FACILITIES ENG TEC	4.181	4.416	4.404						Continuing	Continuing
T42: Terrestrial Science Applied Research	4.520	4.752	5.555						Continuing	Continuing
T45: ENERGY TEC APL MIL FAC	3.231	3.198	3.263						Continuing	Continuing
T48: Center for Geosciences & Atmospheric Research	1.933	1.594	.000						Continuing	Continuing
T53: Military Engineering Applied Research (CA)	2.782	5.323	.000						Continuing	Continuing
855: TOPOGRAPHICAL, IMAGE INTEL & SPACE	14.482	15.072	15.495						Continuing	Continuing

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

This program element (PE) provides military engineering technologies. Research is conducted that supports special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Results are tailored to support the materiel development, test, and operations communities in evaluating the impacts of weather, terrain, and atmospheric obscurants on military materiel and operations. Major research efforts focus on: advanced distributed simulation including networking of models, complex data interchange, and collaborative training; military engineering including improving airfields and pavements, sustainment and cold regions engineering, vehicle mobility modeling, and reduced logistics footprint at base camps; facilities engineering including simulation of infrastructure capabilities for force projection, protection, and readiness; and geospatial research and engineering including terrain awareness. This research improves the efficiency and cost effectiveness of supporting the training/readiness/force projection

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b>		<b>R-1 ITEM NOMENCLATURE</b>			
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		PE 0602784A MILITARY ENGINEERING TECHNOLOGY			
<p>missions in garrison and force sustainment missions in theaters of operation. Research is transitioned to PE 0603734A (Military Engineering Advanced Technology), PE 0603125A (Combating Terrorism, Technology Development), and to Project Managers (PM) such as PM Force Projection and Project Director, Combat Terrain Information Systems.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>The work in this PE is being performed by the US Army Engineer Research and Development Center, Vicksburg, MS, and the Army Research Laboratory, Aberdeen Proving Ground, MD.</p>					
<b><u>B. Program Change Summary (\$ in Millions)</u></b>					
		<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>
Previous President's Budget		58.693	52.066	53.087	
Current BES/President's Budget		55.216	58.810	54.818	
Total Adjustments		-3.477	6.744	1.731	
Congressional Program Reductions		.000	-.196		
Congressional Rescissions		.000	.000		
Total Congressional Increases		.000	6.940		
Total Reprogrammings		-3.063	.000		
SBIR/STTR Transfer		-.414	.000		
<b><u>Change Summary Explanation</u></b>					
FY09 funding increase is due to Congressional adds.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> H71	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H71: Meteorological Research for Battle Command	6.629	6.705	5.656						Continuing	Continuing

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

The objective of this project is to perform applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environment simulations. The Army's transformation plan to the future force requires capabilities for battlefield commanders to make decisions based on tactical weather technology and impacts. This weather intelligence data must not only be accurate and timely, but distributed down to the lowest levels of command, which may include the individual Soldier. This project accomplishes this mission by transitioning technology to the Program Manager, Distributed Common Ground Station-Army (DCGS-A) through the integrated meteorological system (IMETS), through support to the Project Manager for Target Identification and Meteorological Systems (PM-TIMS) for field artillery systems, and to the Department of Defense (DoD) modeling community. It provides detailed model applications for various effects of the atmosphere on electro-optical and acoustic target detection, location, and identification. This project devises both physics-based decision aids and rule-based expert systems for assessing the impacts of weather on a very broad spectrum of friendly and threat weapons systems, sensors, platforms, and operations. These can be applied for mission planning, battlefield visualization, optimum weather sensor, and reconnaissance surveillance target acquisition (RSTA) sensor placement; route planning to maximize stealth and efficiency, tactical decision aids, and modeling and simulation of weather impacts for combat simulations and war games. This project supports the Army's transformation to the future force through future applications and platforms that support echelons at Brigade and below, down to the individual Soldier, weather/atmospheric impacts on sensor systems, and on-scene weather sensing and prediction capability.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Determine critical value thresholds for weather impacts on systems for tactical decision aids. Devise technology to improve environmental awareness of autonomous and semi-autonomous systems using bio-inspired approaches. In FY08, employed automated aviation weather routing tool (AWRT) UAS flight optimization capability enabling automated route adjustments based on atmospheric effects. In FY09, devise an acoustic model predicting effects of urban structures on detection and avoidance. Explore machine-to-machine options for autonomous flight control to eliminate need for the man-in-the-loop. Devise web-enabled decision aid capability for hosting on battlefield systems to enhance data availability in a net-centric environment. Integrate night-time	2.089	2.100	1.707	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY			<b>PROJECT NUMBER</b> H71	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
illumination model improvements into Tri-Service Target Acquisition Weapons Software (TAWS) to improve prediction of target acquisition. Devise bio-inspired technologies to protect small sensor platforms from environmental hazards, to aid in the location and navigation around hazards, and to locate sources based on environmental cues. Investigate use of ultrasonic detection and ranging technology to measure wind profiles to enhance sniper accuracy and to locate objects in low visibility. In FY10, will integrate acoustic detection algorithms into AWRT and verify the light urban model effects (LUME) integrated into TAWS to extend the capability to environmental effects in applications. Will devise a simulated bio-inspired environmental awareness capability for improving the survivability and effectiveness of autonomous and semi-autonomous vehicles that can be demonstrated using simulation techniques and archetyped on bench level systems.						
Develop new high resolution, short-range forecasting capability and high resolution urban diagnostic modeling capability: In FY08, integrated a complete weather running estimate-nowcast (WRE-N) capability for DCGS-A that supports the fidelity and timeliness of the forecasts. Evaluated the use of weather research and forecasting (WRF) model as part of the local analysis and prediction system (LAPS) package within the WRE-N system for improved ability to ingest data from both conventional and non-traditional sources. In FY09, formulate new methods to use microscale model output for critical micro-unmanned aircraft system (UAS) flight parameters that can improve launch, operation, and recovery of UAS assets. Research, design, and apply high resolution meteorological model improvements that account for fine scale structure in the urban boundary layer for an improved capability for predicting atmospheric effects. In FY10, will complete a dynamic weather data assimilation package for WRE-N and couple a diagnostic Microscale model such as 3D wind field (3DWF) to provide high resolution meteorological sources for weather products and applications. Will improve the physics and computational accuracy of the 3DWF model by applying an immersed boundary approach and parameterization of unresolved turbulence to better model the effects of complex steep topography such as mountains and high-rise buildings in urban terrain.			2.560	2.544	2.269	
Devise models to improve prediction of atmospheric conditions in urban and complex terrain that integrate high resolution boundary layer meteorological (MET) measurements. Verify high resolution boundary layer models with field measurements. In FY08, prepared a microscale wind model for urban domains initialized with WRE-N and WRF model output with computationally efficient data assimilation methods. Investigated the capture efficiency of single particle aerosol extraction technologies and explored urban field measurement data against urban wind flow predictive models.			1.980	2.061	1.680	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> H71	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, apply stable boundary layer research to improve existing high resolution boundary layer meteorological models. Deliver a database of detailed high resolution MET measurements including wind flow around a small set of buildings for verification and improvement of urban MET models. Devise an improved urban dust and smoke obscuration model (UDSOM) for electro-optical transmission effects of urban dust and smoke for use in infantry combat simulations. Simulate and evaluate use of a microscale wind model as an integrated part of the DCGS-A weather system. Devise and integrate a Doppler LIDAR analysis toolkit (DLAT) for semi-autonomous data assimilation and processing. In FY10, will complete and demonstrate the DLAT for improving the effectiveness of real-time LIDAR data. Will investigate receiver arrays for remote sensing LIDAR. Will investigate two-wavelength laser induced fluorescence spectra of aerosols, analyze chemical and biological assays of aerosols to improve environmental monitoring of soldier health and enhance force protection. Will verify the accuracy and generalize the UDSOM to extend its use in mission planning as well as combat simulations.				
Total	6.629	6.705	5.656	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T40	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T40: MOB/WPNS EFF TECH	17.458	17.750	20.445						Continuing	Continuing

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

This project will develop technologies for overcoming battlespace gaps (such as cliffs, ravines and other natural obstacles) through prediction, definition, avoidance, or defeat; for expedient force protection during contingency operations; and for rapid port enhancement. This research supports development of the future force by providing physics-based representations of mobility, obstacle and barrier placement, survivability, and weapons effects in urban terrain modeling and simulation. Additionally, the project develops and assesses technologies that increase the survivability of critical assets from conventional and terrorist weapons, and maneuver support of deployed forces, while reducing their logistical footprint.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Maneuver Support/Gap Defeat/scalable Weapons Effects: In FY08, participated in Multi Threat Objective Projectile (M-TOP) redesign using the ERDC-developed, DOD-accredited penetration model, PENCRV3D. Participated in the M-TOP integrated demonstration by providing the instrumented structural target and weapons effects analysis. Future Force Breaching in MOUT: In FY09, determine blast effects from multi-output explosive and coupled reactive materials, penetration performance of novel weapons geometries, and numerical simulations of blast, fragmentation and structural target debris. In cooperation with Armament Research, Development and Engineering Center (ARDEC), develop and transition a lightweight, single-stage explosive wall breaching system to Project Manager Close Combat Systems (PM-CCS) for system development and demonstration. In FY10, will demonstrate warhead technologies for rapid wall breaching (RWB) that can create a man-sized hole in a double-reinforced concrete wall in a single step, reducing time on target and enhancing Soldier survivability. Will demonstrate multi-purpose shoulder launched munitions (SLM) which can incapacitate personnel within bunkers behind 12 inch triple brick and 8 inch double reinforced concrete walls. Will complete evaluations of multi-phase low-to-high	2.453	1.707	5.107	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> T40	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
order detonation-blast effects against urban walls, conduct perforation tests against ultra-high strength concrete panels with current and advanced weapon designs, and characterize advanced materials.				
<p><b>Near Surface Computational Testbed:</b> This effort develops a physics-based, multiscale numerical testbed for virtual testing of unmanned systems (UMS) for intelligent autonomous navigation and tactical behaviors. In FY10, will provide sophisticated innovative physics models for disturbed soil phenomenology. Will develop Joint Architecture for Unmanned Systems (JAUS) compliant components for performance evaluations during mission simulations in complex environmentally enriched models.</p>	.000	.000	6.479	
<p><b>Adaptive Protection:</b> In FY08, created novel layered protective materials to defeat 50-caliber arms and developed procedures for numerical evaluation of protective materials through multi-scale modeling. Developed target recognition (TR) for tunnel and tunneling activity detection for use by Joint Task Force North in their interdiction mission. In FY09, design and assess protective systems and retrofits to defeat large caliber rockets, light artillery, and 50-caliber arms. Develop sensor/geophysical algorithms for disturbed material signatures to be utilized by sensors that detect buried objects. Commence development of tunnel sensor fusion algorithms and of real time analysis techniques for tunnel sensor performance assessment. Using the computational protection testbed, assess expedient protection against artillery and missiles. In FY10, will develop interim lightweight rapidly erected protective systems for use inside and outside base perimeters to defeat emerging weapons effects. Will develop the capability to accurately predict vehicle loadings due to subsurface explosive detonations to increase the survivability of the current and future tactical wheeled vehicle fleet by providing protection with significant weight savings</p>	6.433	6.979	8.398	
<p><b>Geospatial Research and Engineering Support:</b> In FY08, created an urban tactical decision aid for planning the best mix of infantry and small unmanned ground vehicles for clearing a building. In FY09, begin to develop bridging analysis tactical decision aid (TDA) for determining necessary bridging assets to conduct gap crossing and eliminate solutions, and will support geospatial battle management language (GEOBML) syntax in support of the Battlespace Terrain Reasoning and Awareness Battle Command (BTRA-BC) efforts. In FY10, will complete development of a bridging analysis TDA for determining necessary bridging assets to conduct gap crossing and defeat solutions.</p>	1.660	1.210	.461	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Austere Entry and Maneuver: In FY08, provided technical support to develop designs that enable final fabrication and/or modifications as necessary for the lightweight modular causeway system (LMCS) to be tested in a controlled field environment, including two full-scale LMCS sections and the Joint Enable Theater Access-Sea Ports of Debarkation (JETA-SPOD) analysis tool. Provided scientific expertise to monitor fabrication of the systems and provided quality assurance/quality control for the full-scale LMCS and provided design details and drawings for an emplacement and recovery system to be used on multiple launch platforms for the LMCS test series. In FY09, provide technical expertise to support Joint Capability Technology Demonstrations (JCTD) user evaluations and provide guidance and training to military units selected to test and evaluate the LMCS residuals. The residuals will include an emplacement and recovery system, two sections of LMCS (approximately 100 feet), and the associated mooring system. Develop and assess design modifications for the LMCS that arise from this series of tests and provide these design modifications to the Transition Manager.	6.912	7.854	.000	
Total	17.458	17.750	20.445	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T41	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T41: MIL FACILITIES ENG TEC	4.181	4.416	4.404						Continuing	Continuing

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

This project will deliver sustainable, cost efficient and effective facilities; and provide installation operations. The project focuses on facilities and operations technologies directly supporting training, readiness, force projection, force protection, homeland security, and urban 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 airborne dispersed contaminant effects on facilities and occupants; sustainable facility management; and collaborative decision support. In addition, technologies from this work will support analysis of cultural and facility issues in urban operations.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Facility Modeling and Simulation:</b> In FY08, developed methods to enable units to rapidly understand local societal power relations and anticipate local responses for stability, security, transition, and reconstruction operations in heterogeneous communities. Developed molecular models for sorption kinetics using dynamic, atom-by-atom buildup of contaminant on aged pipe-wall. Developed reaction kinetics in chlorinated/chloraminated water using computational chemistry models applied to the contaminant alone. In FY09, develop analysis and predictive capabilities to enable units to gain cultural competence relevant to their mission. Develop rate constants of uptake of contaminants on pipe wall, based on results of the dynamic models using static representation of the contaminant alone. In FY10, will provide framework for integrated ontology for facility life-cycle model.	2.643	2.367	1.590	
<b>Facility Engineering:</b>	1.538	2.049	2.814	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> T41	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, completed molecular design for a 1-million psi carbon-nanotube-based macro filament. In FY09, develop and validate predictive models and algorithms for durability of fiber reinforced polymer (FRP) composites for facilities and equipment, based on mechanisms of deformation and degradation. Also, devise molecular polarity maps for contaminant compounds using computational chemistry models. Synthesize a 1-million psi carbon-nanotube-based filament at the macro-scale. In FY10, will conduct assessment of material enhancement using self healing technologies.				
Total	4.181	4.416	4.404	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T42	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T42: Terrestrial Science Applied Research	4.520	4.752	5.555						Continuing	Continuing

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

This project will provide Warfighters with timely understanding of 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. Specifically, this project seeks solutions for minimizing or eliminating the adverse effects of dynamically changing terrain states on sensing capabilities, engineer construction, and tactical maneuver conducted by the Army. To achieve this, effective decision-making tools such as models, simulations, and mission planning and rehearsal factors are required that accurately predict the state of the ground, near-surface atmospheric conditions, and system performance in complex environments.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Terrain State:</b> In FY08, established and validated approaches such as real-time analysis techniques for sensor performance to greatly improve computational efficiency for carrying out terrain-state calculations. In FY09, assess the use of risk-based analyses in employing terrain-sensitive platforms and sensor mixes operating in harsh, complex environments with accompanying uncertainty about the physical environment. In FY10, will develop algorithms to interpret local terrain characteristics from on-board vehicle sensors (tactile and stand-off) through real-time terrain characterization for on-board mission decision logic to assure the tactical mobility of manned and unmanned ground vehicles on complex terrain.	2.852	2.744	1.795	
<b>Signature Physics:</b> In FY08, designed and evaluated tactical decision aids supporting multi-mode sensor missions with templates of geo-environmental effects. Developed algorithms to identify disturbed soil signatures based on sensor modality and geo-environment.	1.668	2.002	3.760	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, design and evaluate sensor data fusion aids based on predicted environmental effects for incorporation into geo-precise software tools; and implement infrared and acoustic sensor performance algorithms. In FY10, will build geo-precise software tools incorporating awareness about the physical environment (known and unknown) to optimize sensor emplacement and selection of sensor asset mixes.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.006	.000	
Total			4.520	4.752	5.555	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T45	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T45: ENERGY TEC APL MIL FAC	3.231	3.198	3.263						Continuing	Continuing

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

This project will provide 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. In addition, technologies from this work provide a better understanding of the battlespace environment as it relates to critical infrastructure.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Installation Modeling and Simulation: In FY08, developed analysis tools capable of identifying and summarizing a utility network's impact on military operations in urban terrain (MOUT).	1.444	.000	.000	
Systems Response to Threats: In FY08, developed predictive models and algorithms making use of activation energies for deformation and degradation mechanisms based on chemistry (moisture absorption, hydro-thermal effects and crack growth) for prediction of mechanical properties and durability of fiber reinforced polymer (FRP) composites for facilities and equipment. In FY09, evaluate and test simulation algorithms based on failure modes and mechanistic models under interactive conditions. Develop nanotechnology based detection and identification of targeted multiple contaminants in near-real-time for detect-to-warn sensing in mission critical facilities. In FY10, will predict nanosensing complex stability under long term storage conditions. This will involve evaluating the stability of fluorescent nanoparticles, conjugated with antibodies, at various temperatures and in different environments.	1.787	3.184	3.263	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.014	.000	
<b>Total</b>	<b>3.231</b>	<b>3.198</b>	<b>3.263</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY	<b>PROJECT NUMBER</b> T45
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A		
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T48	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T48: Center for Geosciences & Atmospheric Research	1.933	1.594	.000						Continuing	Continuing

**A. Mission Description and Budget Item Justification**  
Congressional Interest Item funding for Geosciences/Atmospheric Research.

<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Geosciences/Atmospheric Research	1.933	1.549	.000	
SBIR/STTR	.000	.045	.000	
Total	1.933	1.594	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> T53	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T53: Military Engineering Applied Research (CA)	2.782	5.323	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Military Engineering applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Airborne Threats						1.237	1.454	.000		
Nano-Crystalline Cement for High Strength, Rapid Curing Concrete with Improved Blast Resistance						1.545	1.395	.000		
Cellulose Nanocomposite Panels for Blast and Ballistic Protection						.000	2.325	.000		
SBIR/STTR						.000	.149	.000		
Total						2.782	5.323	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY					<b>PROJECT NUMBER</b> 855	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
855: TOPOGRAPHICAL, IMAGE INTEL & SPACE	14.482	15.072	15.495						Continuing	Continuing

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

This project will provide novel and innovative technologies for managing, transforming, updating, improving, and disseminating extremely large volumes of terrain and weather effects data at, or near, real-time and dynamic analysis and reasoning of this data to enable future force command and control systems with superior knowledge of the battlespace terrain and environment. Work in this project significantly enhances the Army's geospatial data management and dissemination capabilities. Weather and atmospheric data is provided for this project through the Army Research Laboratory efforts funded in PE 0601102A, project 52C and PE 0602784A, project H71.

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.

The work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Data Analysis: In FY08, developed a state of the art model for evidential reasoning that incorporates terrain and cultural conditions. In FY09, develop reasoning tools to include ability to connect to a Brigade Combat Team. In FY10, will evolve evidential reasoning model(s) from standalone to reachback services.	6.354	6.569	6.811	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.120	.000	
Terrestrial Data Generation: In FY08, developed suitable nanomaterial reporters for Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) and measured detection thresholds for optical and chemical resistance reporters. In FY09, model nanomaterial efficiency by Light detection and Ranging (LIDAR) equation under various environmental conditions. In FY10, will empirically test optical reporting as remote sensors.	2.408	2.484	2.567	
Data Generation and Management: In FY08, developed and refined tools to correlate and fuse geospatial data from various sources (including tactical sensors and other sources) into a common geospatial database that supports multiple applications.	5.720	5.899	6.117	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602784A MILITARY ENGINEERING TECHNOLOGY		<b>PROJECT NUMBER</b> 855	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, develop tools and techniques to improve the speed and accuracy to create orthophotos and support change detection. In FY10, will develop tools and techniques to exploit Buckeye, airborne and terrestrial LIDAR, and other sensor data, including bare earth digital elevation derivation, automated feature extraction, forest and tree canopy, and modeling extracted data into effective, realistic three-dimensional representations.				
Total	14.482	15.072	15.495	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602785A Manpower/Personnel/Training Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	15.841	16.358	18.701						Continuing	Continuing
790: Personnel Performance & Training Technology	15.841	16.358	18.701						Continuing	Continuing

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

The objective of this program element (PE)/project is to conduct behavioral and social science applied research that will provide 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. 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 the training techniques and procedures that will 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). This program leverages efforts and coordinates research with a number of other Laboratories and Research, Development, and Engineering Centers including, the Simulation and Training Technology Center (STTC), Natick Soldier Research, Development, and Engineering Center, Army Research Laboratory (ARL), and the Communications-Electronics Research, Development, and Engineering Center (CERDEC). This project is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI); research in this PE is related to and fully coordinated with efforts funded in PE 0601102/project 74F and PE 0603007/project 792.

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

Work in this project is performed by the US Army Research Institute for the Behavioral and Social Sciences (ARI) headquartered in Arlington, VA.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602785A Manpower/Personnel/Training Technology

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	16.102	16.412	16.539	
Current BES/President's Budget	15.841	16.358	18.701	
Total Adjustments	-.261	-.054	2.162	
Congressional Program Reductions	.000	-.054		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	.000		
Total Reprogrammings	.008	.000		
SBIR/STTR Transfer	-.269	.000		

**Change Summary Explanation**

FY10 funding is increased for Human Dimension Applied Research.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602785A Manpower/Personnel/Training Technology					<b>PROJECT NUMBER</b> 790	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
790: Personnel Performance & Training Technology	15.841	16.358	18.701						Continuing	Continuing

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

The objective of this program element (PE)/project is to conduct behavioral and social science applied research that will provide 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. 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 the training techniques and procedures that will 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). This program leverages efforts and coordinates research with a number of other Laboratories and Research, Development, and Engineering Centers including, the Simulation and Training Technology Center (STTC), Natick Soldier Research, Development, and Engineering Center, Army Research Laboratory (ARL), and the Communications-Electronics Research, Development, and Engineering Center (CERDEC). This project is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI); research in this PE is related to and fully coordinated with efforts funded in PE 0601102/project 74F and PE 0603007/project 792.

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

Work in this project is performed by the US Army Research Institute for the Behavioral and Social Sciences (ARI) headquartered in Arlington, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Training: FY08: developed tools/techniques to support rapid training development for network-enabled battle command; developed/validated procedures to enhance battle command and dismounted Soldier digital skills; developed preliminary skill retention curves for establishing refresher training schedules to improve retention of critical digital skills; developed methods/procedures to assess the value of a net-enabled alternative to the traditional after action reviews (AAR);	7.097	7.149	8.411	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602785A Manpower/Personnel/Training Technology		<b>PROJECT NUMBER</b> 790	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>conducted assessment of massively multiplayer simulations (MMPS) training effectiveness in multi-national coalition warfare; developed alternative blended training approaches/techniques for selected Soldier skills for evaluation comparison; and developed preliminary models for alternative collective training systems incorporating various mixes of training aids, devices, simulators, and simulations (TADSS).</p> <p>FY09: leverage basic and applied research on intelligent agents and integrate into MMPS environment for command post and tactical scenarios; begin research to assess the effectiveness of alternative blended training approaches for teaching selected basic Soldier skills and improving retention of those skills; determine differences in AAR requirements across simulation domains; and identify components and develop alternative models for effectively training collective maneuver and aviation tasks.</p> <p>FY10: will develop tools for unit-developed individual/small group training based on near-real time knowledge elicitation; will conduct field assessments of MMPS; will analyze methods for improving automated, diagnostic, and prescriptive tutoring systems to tailor training experiences; and will investigate methods to maintain relevance of unit and institutional training.</p> <p>FY11: will research innovative training methods and technology based on learning sciences; will refine tools/methods for rapid training development; will design/develop methods of diagnostic eval of individual and unit performance</p>				
Small Business Innovation Research/Small Business Technology Transfer Programs	.000	.262	.000	
<p>Personnel:</p> <p>FY08: conducted studies to assess effectiveness of potential retention intervention strategies by field testing with Soldiers in operational settings; revised model and established empirical strength of strategies to impact Soldier and Officer behavior based on findings from the field tests and extent the strategies actually relate to retention decisions; for selected MOS, developed improved job performance metrics as criteria for testing various instruments designed to assess the Knowledge, Skills, and Attributes (KSAs) needed for effective job performance; clustered KSAs using subject matter experts; and validated test batteries using Soldiers in operational units and computational methods.</p> <p>FY09: further validate behavioral retention strategies and develop guidelines to implement strategies and track effects on actual retention; and collect job performance data and supervisor's performance assessments to empirically test KSA instruments/clusters for strength in predicting actual job performance and longer-term Soldier success.</p> <p>FY10: will initiate 2-year longitudinal research to validate non-cognitive measures and the extent to which they predict Soldier job performance and overall success in the Army; and will investigate the use of non-cognitive measures for predicting attrition in precommissioning.</p>	4.906	5.071	5.805	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602785A Manpower/Personnel/Training Technology		<b>PROJECT NUMBER</b> 790	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
FY11: will continue longitudinal research to validate non-cognitive measures and the extent to which they predict Soldier job performance and overall success in the Army.				
<p>Leader Development:</p> <p>FY08: collected and analyzed data to assess the impact of leader skills and knowledge on performance in joint, interagency, and multinational (JIM) environments; designed training tools to enhance leader effectiveness in multi-team systems. Designed training methods to enhance capability of leaders to take a multicultural perspective for mission success; and started research to identify potential influence techniques leaders can use to be more effective in fighting Global War on Terror (GWOT).</p> <p>FY09: continue investigation of influence techniques and strategies that show potential to be most effective in GWOT scenarios, and that will improve leader capability for rapid team building. Further investigate methods and tools designed to improve training and collaboration in multi-team systems in complex and networked environments; develop a framework for investigating social and communication networks in complex organizations; and expand framework of human system automation reliance to team-system reliance.</p> <p>FY10: will assess multilevel influence strategies and the extent these strategies improve adaptive leadership and negotiation skills and techniques. Will develop team training modules for rapid team building and team adaptability; will investigate training strategies and design guidelines to promote appropriate trust and automation reliance in networked human system teams.</p> <p>FY11: will refine techniques and strategies for developing the influence skills of leaders; and will develop and refine model of multi-team system performance characteristics and effectiveness.</p>	3.838	3.876	4.485	
<b>Total</b>	15.841	16.358	18.701	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602786A Warfighter Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	36.752	36.133	27.109						Continuing	Continuing
E01: Warfighter Technology Initiatives (CA)	14.146	14.257	.000						Continuing	Continuing
H98: CLOTHING & EQUIPM TECH	15.146	14.215	19.152						Continuing	Continuing
H99: JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5.152	5.299	5.488						Continuing	Continuing
283: AIRDROP ADV TECH	2.308	2.362	2.469						Continuing	Continuing

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

This program element (PE) investigates and develops technologies which improve Soldier 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). Project E01 funds congressional special interest items. The projects in this PE adhere to Tri-Service Agreements on clothing, textiles, and food with oversight and coordination provided by the directors of Service laboratories through the Warrior Systems Technology Base Executive Steering Committee.

Work in this PE is related to, and fully coordinated with, PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0603001A (Warfighter 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.

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602786A Warfighter Technology

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	36.237	21.948	22.276	
Current BES/President's Budget	36.752	36.133	27.109	
Total Adjustments	.515	14.185	4.833	
Congressional Program Reductions	.000	-.119		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	14.304		
Total Reprogrammings	1.222	.000		
SBIR/STTR Transfer	-.707	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

FY10 funding increase to support Advanced Fibers/Textile Tech and Smart Materials; Optimizing Battlespace Awareness in the Dismounted Soldier; and Next Generation Body Armor.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology					<b>PROJECT NUMBER</b> E01	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
E01: Warfighter Technology Initiatives (CA)	14.146	14.257	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Warfighter Technology Applied Research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Fabric Treatment for Flame Resistant Uniforms							.966	.000	.000	
Biosecurity Research for Food Safety							3.131	1.550	.000	
Chemical and Biological-Protective Hangars (CAB-PH)							1.545	2.170	.000	
Active and Smart Packaging for Combat Feeding							.967	1.628	.000	
Injection Molded Ceramic Body Armor							.387	.775	.000	
Modular Ballistic System for Force Protection							3.864	.775	.000	
Carbon Nanotube Armor Protection System							1.546	.000	.000	
Protective Textile Fabric							.774	.775	.000	
Nano-Enabled Ultra High Storage Non-Volatile Memory for Next Generation Commander's Digital Assistan							.966	.000	.000	
Wearable Personal Area Network Technology							.000	2.325	.000	
Solid State Shelter Lighting System							.000	.372	.000	
Photovoltaic Tent Fabric							.000	2.713	.000	
Lightweight 1-2 Person Low-Pressure Inflatable Tents							.000	.775	.000	
SBIR/STTR							.000	.399	.000	
Total							14.146	14.257	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology	<b>PROJECT NUMBER</b> E01
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology					<b>PROJECT NUMBER</b> H98	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H98: CLOTHING & EQUIPM TECH	15.146	14.215	19.152						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 and the field environment (e.g., cold, heat, wet) -- increasing operational effectiveness while decreasing the Soldier's burden. Included are personnel armor, helmets, eyewear and protective inserts for shelters - efforts that focus on incorporating novel materials into designs that protect Soldiers against flame and thermal threats, blast and ballistic threats, as well as certain directed energy threats. In addition, this project supports the development and refinement of essential analytic tools needed to assess the combat effectiveness of next generation Soldier systems, with a focus on network centric warfare technologies.

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Biomechanical Tools for Individual Soldier Extremity Protection and Performance Enhancement: This effort focuses on human science, anthropometric, and psychophysical methods used to assess human responses to sensory, cognitive and affective stimuli to enable better prediction of the performance and effectiveness of items. In FY08, integrated fatigue prediction into biomechanical model; verified and validated integrated model; exercised the model to design a representative set of extremity body armor; defined cognitive performance metrics sensitive to the impact of physical stressors (such as extended load carriage); conducted human experiments to evaluate decrements in performance (i.e. fatigue) related to physical demands of warfighting, and established a model for predicting awareness decrements. In FY09, define additional complex Soldier output measures (energy expended and muscle force exercised) for incorporation into biomechanical model, scale biomechanical tools to address range of human male anthropometry (5 to 95% size and shape); conduct human experiments to refine fatigue prediction into short term and long term components; refine awareness model with additional human experimental data and begin investigating strategies for mitigating decrements in awareness documented by preceding experiments.	1.307	.588	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> H98	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>Ballistic and Blast Protection for the Individual Warrior: This effort focuses on technologies incorporating novel materials into component designs that protect Soldiers against ballistic and blast threats.</p> <p>In FY08, continued development of technology components for future body armor applications to include advanced fiber technology (e.g., carbon nanotube-based) for lightweight armor applications, investigated conformable material configurations to reduce weight, minimized performance vulnerability associated with complex shapes in smaller ceramics sizes and different surface patterns, and explored performance thresholds for increased protection levels for personal armor technology; defined and developed material system concepts for integrated ballistic and blast thorax protection.</p> <p>In FY09, validate performance of selected materials configurations for enhanced helmet performance; downselect materials and begin construction of helmet technology components into a breadboard system for next generation armor systems and evaluate breadboard in various environments; refine and validate material system components for integrated ballistic and blast protection for use in improved body armor for thorax protection.</p>			4.712	6.732	.000
<p>Electrotexiles-Self Powered, Conductive, and Smart Materials: This effort focuses on technologies which aid in the design and evaluation of clothing and equipment for signature management and conducting materials.</p> <p>In FY08, matured technologies for first active photovoltaic fabric, for unmanned photovoltaic ground sensors, and camo-patterned photovoltaic devices; matured flexible conductive networks and connector technologies for shelters and wearable electronics; investigated current polymer-based optical conductors for secure, non-emissive, high-speed data transmission for optical networks.</p> <p>In FY09, integrate sensing devices into photovoltaic fabrics to demonstrate a new class of self-powered, smart electrotextile applications; explore various textile integration methods to provide additional strength and protection to electronic and optical fibers; investigate eco-friendly fibers and materials and develop evaluation methods for laboratory testing of novel fibers and materials that provide future Soldier flame and thermal protection without the use of hazardous materials.</p>			2.279	2.516	.000
<p>Soldier Integrated Tunable (Frequency Agile) Laser/Ballistic Eye Protection: This effort focuses on technologies which will provide eye protection from laser/ballistic threats.</p> <p>In FY08, assessed potential of new ballistic materials achieved through leveraged efforts; prepared and analyzed hybrid lighter weight ballistic materials while maintaining the improved level of performance; integrated multi-layered laminates to provide multifunctional transparent armor materials with scratch resistance, and validated optical limiting concepts that do not require a lens system and that meet response time requirements over the visual spectrum.</p>			3.388	.976	2.173

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> H98	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, combine laser eye protection (optical limiting concepts), compatible ballistic materials, and abrasion resistance coatings into a new composite eye wear material; assemble components on breadboard and perform system evaluation in a simulated environment. In FY10, will develop a plastic eyewear lens scaffold (pixilated lens with a battery operated sensor) that can sense and respond (lighten/darken) to visible and infrared (IR) irradiation sources at precise lens locations to protect Soldiers' eyes, maximize overall visual acuity, and determine directionality of threats. Will mature lens technology to serve as the platform for subsequent vision protection and enhancement technologies; will consider producibility issues to combine vision protection and enhancement technologies with a ballistic lens; and will examine Soldier acceptance issues by testing the ability to differentiate color or objects in both day and night scenarios.				
<b>Soldier Borne Microclimate Cooling:</b> This effort focuses on technologies which provide cooling to the Soldier to reduce risk of heat stress. In FY08, continued the testing and integration of components (smaller engines and compressors) into a breadboard system. In FY09, complete testing the FY08 breadboard system, and use the test results to downselect cooling technologies for Soldier applications and establish a baseline technology capability. Transition downselected technologies to PE 0603001A/project J50 for further maturation.	1.159	.885	.000	
<b>Small Business Innovative Research/Small Business Technology Transfer Programs</b>	.000	.232	.000	
<b>Biomechanical Tools for Individual Soldier Extremity Protection and Performance Enhancement (cont'd):</b> This effort focuses on human science, anthropometric, and psychophysical methods used to assess human responses to sensory, cognitive and affective stimuli to enable better prediction of the performance and effectiveness of items. In FY10, will identify neurocognitive mechanisms, such as regions, networks and type of brain activity, underlying dismounted Soldier performance relative to battlespace awareness using human experimental studies and cognitive task analysis of squad-level operations under stressed and non stressed task situations. Work will be collaborative with the Army Research Laboratory and the Medical Research and Materiel Command.	.000	.000	2.236	
<b>Electrotexiles-Self Powered, Conductive, and Smart Materials (cont'd):</b> This effort focuses on technologies which aid in the design and evaluation of clothing and equipment for signature management and conducting materials. In FY10, will investigate alternative textile and film-based approach to wearable Soldier power; will investigate advanced analytical methods for predicting protection levels provided by flame-protective materials; will examine new fibers and	.000	.000	5.835	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> H98	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
materials created for potential application to Soldier flame and thermal protection; will complete laboratory testing of novel materials against thermal threats; will fabricate and characterize novel extruded multi-component fibers for potential application to Soldier protective materials.				
Ballistic and Blast Protection for the Individual Warrior (cont'd): This effort focuses on technologies incorporating novel materials into component designs that protect Soldiers against ballistic and blast threats. In FY10, will validate survivability modeling tool enhancements (including the Integrated Casualty Estimation Methods model) for personnel ballistic and blast protection systems development and will complete validation of selected configuration performance enhancements. To improve ballistic plate coverage areas and geometry with emerging technology components, will develop improved armor coverage map utilizing medical community data, and will extract geometric data from 3-D body scans for use in initial soft armor and ballistic plate designs.	.000	.000	6.631	
Infantry Warrior Simulation (IWARS): This effort focuses on incorporating data into modeling and analysis tools that enable technologists and military users to trade-off potential Soldier system capabilities and mature a human-centered Soldier system design. In FY08, extended advanced Soldier representations within IWARS to include effects of unmanned ground sensor systems and the User Defined Operating Picture (UDOP) to improve the ability to provide actionable information to small units. In FY09, enhance IWARS to include effects of netted communications and collaborative situational awareness to assess enhancements to Soldier capabilities. In FY10, will provide credible Soldier physiological representations within IWARS to include biomechanic effects of equipment load on Soldier movement and the effect of hearing protection and helmets on sound detection and direction; will expand analysis capabilities to determine impact to small unit effectiveness by using combined arms scenarios to identify a number of interactions that occur between ground Soldiers and vehicle platforms.	2.301	2.286	2.277	
Total	15.146	14.215	19.152	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology	<b>PROJECT NUMBER</b> H98

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology					<b>PROJECT NUMBER</b> H99	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H99: JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5.152	5.299	5.488						Continuing	Continuing

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

This project researchs, investigates and evaluates combat ration and field food service equipment component technologies. In addition, this project investigates novel ration packaging and combat feeding equipment/systems. 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.

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

Work in this project is performed 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 Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.033	.000	
<b>Combat Feeding Equipment Technologies:</b> This effort investigates equipment and energy technologies to reduce logistics footprint of field feeding. In FY08, completed concept development of an inline water heater as an initial application of flameless combustion; completed concept development of an air-activated, self-contained, exothermic, chemical heater for Meals Ready to Eat (MRE) including all safety/health/environmental regulatory compliance; and investigated novel co-generators for potential to operate on a range of fuel types from the Waste to Energy (WEC) produced gas to battlefield fuel (JP8). In FY09, complete concept evaluations of inline water heater; complete concept development of an ethylene control system (prolongs freshness and extends shelf life) for fresh fruits and vegetables. In FY10, will investigate and develop technology concepts for a standard size container that will extend the shelf life of semi-perishable rations in hot environments and an off-grid pallet chiller with self-containing power supply for bottled water; and will complete concept development of a flameless individual water heater.	2.319	2.160	2.276	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> H99	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Ration Stabilization and Novel Nutrient Delivery Technologies: This effort focuses on enhancing nutrient composition and consumption to maximize cognitive and physical performance on the battlefield.</p> <p>In FY08, continued incorporation and testing of probiotics (beneficial bacteria) for improved gastrointestinal health; incorporated selected performance enhancers for delivery via the mouth allowing for the immediate movement of the molecules into the blood; and transitioned protein encapsulation effort to PE 0603001A/project C07; validated Hybrid Optimal Processing (HOP) effectiveness to reduce processing time, increase food quality and nutrient retention, and scaled-up design with selected model ration components; planned scale-up HOP design and engineering to produce high quality components; and developed additional shelf-stable combat ration breakfast items and transitioned to PE 0603001A/project C07.</p> <p>In FY09, evaluate shelf stability of probiotic-enhanced ration components; ensure microbiological, chemical stability analyses of advanced shelf-stable meat products; and investigate stability and functional effectiveness of encapsulated oils for ration systems.</p> <p>In FY10, will test acceptance of shelf stable sandwiches containing emulsion based fillings to control food water content; will down-select component food matrices for incorporation of performance optimizing and nano-sized functional ingredients.</p>	1.505	1.650	1.663	
<p>Packaging and Food Safety Technologies: This effort investigates novel ration packaging technologies to minimize physical, chemical and nutritional degradation of combat rations during storage.</p> <p>In FY08, continued optimization of array technologies for pathogen detection; developed food degradation profiles for predicting quality kinetic rates for ration storage quality to correlate accelerated storage conditions to predict combat ration shelf life.</p> <p>In FY09, investigate multiplexing of electrospun nanofibers for improved capture of pathogens and incorporate into array systems to enable multiple pathogen detection from one sample; investigate molecular beacon signal (method to detect of nucleic acids) enhancement as an alternative technique to identifying pathogens using array-based (matrix) systems; investigate quality data reaction rates and determine kinetic correlations based on storage studies conducted in FY08; continue long-term storage study to include extensive analytical, microbiological, and sensory testing; complete food degradation profiles for quality kinetics.</p> <p>In FY10, will develop an integrated sensor circuit concept diagram for printed electronic display for real-time ration condition assessment to determine remaining shelf life; will develop a bacteriophage (viruses that infect specific bacteria) cocktail to reduce bacteria in fresh fruits and vegetables; will conduct polymer processing of thermoplastic materials to</p>	1.328	1.456	1.549	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> H99	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
optimize novel multilayer polymer films properties; will optimize conductive electrospun membranes for sensing and integrate with capture/detection assemblies to test with optical detection techniques.				
Total	5.152	5.299	5.488	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology					<b>PROJECT NUMBER</b> 283	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
283: AIRDROP ADV TECH	2.308	2.362	2.469						Continuing	Continuing

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

This project researchs, 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.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Enabling Airdrop Research and Technologies: This effort investigates technologies for enhanced payload extraction and subsequent gliding capabilities. In FY10, will expand Domain Specific Software Architecture (DSSA) modeling capabilities to include low altitude opening and will design the main parachutes to allow both extracting the payload from the aircraft and decelerating the payload to a desirable descent rate (extracting by mains).	.000	.000	1.138	
Precision Airdrop Enhancements: This effort improves delivery accuracy of varying load weights and transitions technology for maturation and demonstration to PE 0603001A/project 242. In FY08, evaluated favorable Guidance, Navigation and Control (GN&C) component technologies to mature sensing, guidance, navigation, and control algorithms for precision airdrop. In FY09, downselect and implement the most mature and favorable GN&C component technologies (e.g., glide modulation) into precision airdrop designs. In FY10, will research and evaluate performance of height sensor technology to include a laser range finder sensor to augment existing Sound Detection and Ranging (SODAR) height sensor.	1.230	1.275	1.331	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.002	.000	
Modeling and Simulation for Tactical Parachute System Performance Enhancement: This effort investigates technologies for safer, more efficient personnel parachutes.	1.078	1.085	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602786A Warfighter Technology		<b>PROJECT NUMBER</b> 283		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
In FY08, utilized experimental methodologies to develop a more detailed knowledge of fundamental parachute physics; completed investigation of a fully open parachutist control and rate of descent issues, and investigated parachute opening physical phenomena. In FY09, complete analysis of Advanced Tactical Parachute System (ATPS) parachuting opening and validate full fidelity model (physics based) against baseline physics from experiments; transition detailed ATPS performance enhancement assessment and test results to PM-Clothing and Individual Equipment (CIE) ATPS product improvement program.					
Total	2.308	2.362	2.469		
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602787A MEDICAL TECHNOLOGY					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	181.540	188.210	99.027						Continuing	Continuing
FH2: FORCE HEALTH PROTECTION - APPLIED RESEARCH	8.177	8.717	8.321						Continuing	Continuing
OA3: CENTER FOR ADV SURGICAL & INTERVENTIONAL TECH (CA)	.965	.000	.000						Continuing	Continuing
PA4: WOUND HEALING PROJECT (CA)	1.158	.000	.000						Continuing	Continuing
PA5: NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	.965	2.492	.000						Continuing	Continuing
UA8: PROTEIN HYDROGEL (CA)	1.932	.000	.000						Continuing	Continuing
VB3: MEDICAL TECHNOLOGY INITIATIVES (CA)	94.576	105.589	.000						Continuing	Continuing
VB4: SYSTEM BIOLOGY AND NETWORK SCIENCE TECHNOLOGY	.000	.000	1.175						Continuing	Continuing
VJ4: Suicide Prevention/ Mitigation	.000	.000	10.000						Continuing	Continuing
X06: HIBERNATION GENOMICS	1.545	.000	.000						Continuing	Continuing
	.773	.000	.000						Continuing	Continuing

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>								
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602787A MEDICAL TECHNOLOGY								
845: BONE DISEASE RESEARCH PROGRAM									
869: Warfighter Health Prot & Perf Stnds	2.970	3.130	35.282					Continuing	Continuing
870: DOD MED DEF AG INF DIS	14.848	15.465	17.190					Continuing	Continuing
873: HIV EXPLORATORY RSCH	10.953	11.351	9.248					Continuing	Continuing
874: CBT CASUALTY CARE TECH	16.139	11.936	17.811					Continuing	Continuing
878: HLTH HAZ MIL MATERIEL	11.857	14.264	.000					Continuing	Continuing
879: MED FACT ENH SOLD EFF	9.851	10.282	.000					Continuing	Continuing
968: SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	4.831	4.984	.000					Continuing	Continuing

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

This program element (PE) supports application of knowledge gained through basic research to develop drugs, vaccines, medical devices, diagnostics, doctrine, and other preventive measures essential to the protection and sustainment of Soldier 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.

Project (874) supports identification and evaluation of drugs, biologics (products derived from living organisms), medical devices, and diagnostics for resuscitation and life support, 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 as well as laboratory and animal studies of regenerating skin, muscle, and bone tissue for the care and treatment of battle-injured casualties.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY	
<p>Project (869) supports matures 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 development of Soldier protective equipment.</p> <p>Project (870) supports designing and developing medical protection and treatment against naturally occurring diseases and wound infections of military importance, as identified by worldwide medical surveillance and military threat analysis.</p> <p>All medical applied research is conducted in compliance with US Food and Drug Administration (FDA) 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. Subsequent 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 study subjects as volunteers. This PE focuses on identifying candidate solutions and on completing preclinical technology maturation activities that involves pre-clinical and early human clinical testing.</p> <p>Program development and execution is externally peer-reviewed and fully coordinated with all Services and other agencies through the Joint Technology Coordinating Groups to prevent unnecessary duplication.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. In FY10, projects 878 and 879 will be consolidated into project 869.</p> <p>Work in this PE is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; US Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL; the Naval Medical Research Center (NMRC), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.</p>		

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	184.214	75.395	73.639	
Current BES/President's Budget	181.540	188.210	99.027	
Total Adjustments	-2.674	112.815	25.388	
Congressional Program Reductions	.000	-.625		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	113.440		
Total Reprogrammings	1.641	.000		
SBIR/STTR Transfer	-4.315	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

FY10 funds were increased for Medical Blast Trauma Research and Suicide Prevention Study.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> FH2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
FH2: FORCE HEALTH PROTECTION - APPLIED RESEARCH	8.177	8.717	8.321						Continuing	Continuing

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

This project funds research to support applied research directed toward the sustainment of a healthy force of Warfighters from accession through retirement. The program has the following three major thrust areas: (1) Physiological Response and Blast and Blunt Trauma Models of Thoracic (chest) and Pulmonary (lung) Injuries; (2) Millennium Cohort Research; and (3) Biomarkers of Exposure and Environmental Biomonitoring. 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 develop 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.

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

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Millennium Cohort Research: A long-term study of Soldiers that includes psychological, physical, and spiritual impacts of military service throughout their lifetime. In FY08 and FY09, this task was conducted under the Health Behavior/Weight Control program area. In FY10, will perform analyses of newly reported Post-Traumatic Stress Disorder (PTSD), depression, and anxiety symptoms among Millennium Cohort participants in conjunction with increased mental and physical health problems; will link Millennium Cohort data with DoD and Veteran Administration health risk databases;	.000	.000	3.233	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> FH2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
will conduct long term studies to investigate the use of tobacco and alcohol among Service members to provide policy recommendations that enhance the long-term health of deploying forces.				
Health Behavior/Weight Control: In FY08, assessed novel military weight management programs that include food intake monitoring, meal replacement, and portion size retraining. Completed analysis of two community-based intervention programs for military weight management in active duty and reserve forces. In FY09, evaluate associations between weight and chronic medical conditions (e.g. diabetes, cardiovascular disease, metabolic syndrome), test feasibility and efficacy of new approaches to enhance nutrition in military dining facilities, evaluate community-based environmental intervention programs for weight management by reserve personnel, evaluate associations between Service member weight/weight changes with number and location of deployments and presence of Post Traumatic Stress Disorder, characterize successful and unsuccessful weight management techniques by establishment of a military weight registry database. In FY10 will programmatically realign to Millennium Cohort Research.	2.095	4.082	.000	
Nerve-based Disease Research: In FY08, completed a study of relationships between military occupation and nerve degeneration diseases. Completed comprehensive data collection on the health effects of exposure to jet fuel in a military setting. Completed examination of individual permethrin (insect repellent) exposure and dose levels in different environmental settings, designed to simulate operationally relevant scenarios; conducted assessments of military relevant chemicals and materials to identify biomarkers of exposure and effect using genomic (DNA-based) and proteomic (protein-based) analyses. Identified potential multianalyte (multiple targets) testing platforms for ready determination of identified biomarkers. In FY09, complete analyses of the association between jet fuel exposure and nervous system health outcomes. Complete studies of head trauma (i.e., head impact due to poor parachute landings and boxing as models) and neuropsychological adverse effects (mood and cognitive function). Integrate Environmental Sentinel Biomonitor (ESB) components and conduct bench testing of the composite system. In FY10, will programmatically realign to Biomarkers of Exposure and Environmental Biomonitoring.	6.082	4.391	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.244	.000	
Physiological Response and Blast and Blunt Trauma Models of Thoracic (Chest) and Pulmonary (Lung) Injury: Modeling and assessment of the combined effects of blast, impact, and ballistic trauma on the chest and lung system. In FY08 and FY09, this task was conducted under the Pulmonary Hazards and Risk Assessment Models program area in Project 878. In FY10, will conduct modeling of lung function disruption due to blunt force trauma to the chest; will combine thoracic	.000	.000	2.090	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> FH2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
(chest) blunt trauma model with performance decrement models and compare with large animal exercise data for the development of advanced survivability assessment and health hazard analysis tools.				
Biomarkers of Exposure and Environmental Biomonitoring: Development and evaluation of methods to detect environmental contamination and toxic exposure during military operations. In FY08 and FY09, this task was conducted under the Nerve-based Disease Research program area. In FY10, will review available sensor technology and conduct down-selection of sensors best suited to meet user performance requirements; will evaluate biomarkers of exposure to selected Militarily Relevant Chemicals (MRCs) and relevant toxicity pathways to develop a method to detect toxic exposure in Soldiers.	.000	.000	2.998	
Total	8.177	8.717	8.321	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> OA3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
OA3: CENTER FOR ADV SURGICAL & INTERVENTIONAL TECH (CA)	.965	.000	.000						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b> Congressional Interest Item funding for the Center for Advanced Surgical and Interventional Technology.										
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Center for Advanced Surgical and Interventional Technology (CASIT)							.965	.000	.000	
Total							.965	.000	.000	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A										
<b><u>D. Acquisition Strategy</u></b> N/A										
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> PA4	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
PA4: WOUND HEALING PROJECT (CA)	1.158	.000	.000						Continuing	Continuing

**A. Mission Description and Budget Item Justification**  
Congressional Interest Item funding for Wound Healing applied research.

<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Rapid Wound Healing Technology Development	1.158	.000	.000	
Total	1.158	.000	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> PA5	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
PA5: NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	.965	2.492	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Nanofabricated Bioartificial Kidney applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Nanofabricated Bioartificial Kidney and Bioterrorism							.965	2.422	.000	
SBIR/STTR							.000	.070	.000	
Total							.965	2.492	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> UA8	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
UA8: PROTEIN HYDROGEL (CA)	1.932	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Protein Hydrogel applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
BioFoam Protein Hydrogel for Battlefield Trauma							1.932	.000	.000	
Total							1.932	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> VB3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
VB3: MEDICAL TECHNOLOGY INITIATIVES (CA)	94.576	105.589	.000						Continuing	Continuing

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

Congressional Interest Item funding for Medical Technology applied research.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Proton Therapy	2.318	.000	.000	
New Vaccines to Fight Respiratory Infection	3.864	3.875	.000	
Orthopedic Implant Design and Manufacturing for Traumatic Injuries	1.546	.000	.000	
Extended Duration Silver Wound Dressing-Clinical Trials	.000	1.550	.000	
Prevention of Compartment Syndrome, Ultrafiltration Catheter	.000	1.550	.000	
Consortium for Bone and Tissue Repair and Regeneration	.000	.774	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	2.957	.000	
Center for Research on Integrative Medicine for the - Military (CRIMM)	.967	.000	.000	
Epigenetic Disease Research	1.546	.000	.000	
Improving Musculoskeletal Health and Function	1.160	.000	.000	
Injury Research Center-Ryder Trauma Center	2.706	5.813	.000	
Military Interoperable Digital Hospital Testbed	3.867	9.687	.000	
Storage Area Network	.967	.000	.000	
Synthetic Malaria Vaccine	2.320	.000	.000	
Fibrin Adhesive Stat (FAST) Dressing	1.933	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY			<b>PROJECT NUMBER</b> VB3	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Armed Services Gynecological Cancer Health Program			1.546	.000	.000	
Biological and Immunological Infectious Agent and Cancer Vaccine Research			.000	.775	.000	
Combat Stress Intervention Program (CSIP)			.000	2.325	.000	
Respiratory Biodefense Initiative			1.546	1.550	.000	
Advanced Bio-engineering for Enhancement of Soldier Survivability			1.546	.000	.000	
Carbon Nanotube Production			.967	1.163	.000	
Cancer Prevention Through Remote Biological Sensing			1.545	1.550	.000	
Cedars-Sinai Core Imaging Center			2.318	.000	.000	
Center for Injury Biomechanics			3.090	3.100	.000	
Center for Ophthalmic Innovation			1.932	2.325	.000	
Minimizing Health Effects of Air Toxics on Military Personnel			.000	1.550	.000	
Advanced Functional Nanomaterials for Biological Processes			.000	1.937	.000	
Plasma Technology Laboratory			.000	.775	.000	
Military Photomedicine Program			.000	2.713	.000	
Freeze Dried Blood Technology Clinical Research			.000	1.938	.000	
Battlefield Research Accelerating Virtual Environments for Mil Indiv Neuro Disorders (BRAVEMIND)			.000	.775	.000	
Battlefield Treatment of Hemorrhagic Shock			.000	.775	.000	
Control of Vector-Borne Diseases			.000	1.163	.000	
Cone Beam CT Scanners			3.090	.000	.000	
Center for Vaccine Scale-Up Process Research (Phase I)			.773	.000	.000	
Defense Against Viral Infection (DAVI)			1.545	.000	.000	
Disposable Unit Dose Drug Pumps for Anesthesia and Antibiotics			1.932	1.695	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE: May 2009</b>			
<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>	<b>PROJECT NUMBER</b>			
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	PE 0602787A MEDICAL TECHNOLOGY	VB3			
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Electronic Technology-Infrastructure in Support of Military Missions	1.545	.000	.000		
Impact of Intensive Lifestyle Modification on Chronic Medical Conditions	1.932	1.695	.000		
Integrated Medicine, Communications, Compassion, Chronic Care Program	1.545	.000	.000		
Mass Decontamination and Biosecurity Initiative	.339	.000	.000		
Neuroscience Research Consortium to Study Spinal Cord Injury	.774	.775	.000		
Oxygen Diffusion Dressings for the Accelerated Healing of Battlefield Wounds and Burns	.483	.000	.000		
Plant-based Vaccine Research	1.932	1.937	.000		
Prevention of Radiation Injury by use of Statics	1.545	.000	.000		
Rapid Vaccine Discovery Technology	1.932	1.550	.000		
Regional Nuclear Magnetic Resonance (NMR) Facility	.965	.000	.000		
Remote Robotic Teleproctoring to Promote Rapid Surgical Skills Acquisition	.965	.000	.000		
Technological Regional Center of Excellence for PTSD	1.545	.000	.000		
West Nile Virus Vaccine	.908	.000	.000		
Wound Infection Treatment Program	1.159	2.325	.000		
Center for Resuscitation Research	2.898	.000	.000		
Cold Spring Harbor Laboratory Womens Cancer Genomics Center	3.091	2.713	.000		
Staph Vaccine	1.932	.000	.000		
MRI-DTI Technology to Improve Diagnostics and Treatment of TBI	2.415	.000	.000		
Copper Air Quality Program	1.545	1.938	.000		
Medical Image Database Holographic Archiving Library System (MIDHALS)	.966	.000	.000		
Medical Resources Conservation Technology Pilot Energy Cost Control Evaluation (PECCE)	1.159	2.325	.000		
Complementary and Alternative Medicine Research (MIL-CAM)	4.831	4.844	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY			<b>PROJECT NUMBER</b> VB3	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Molecular Switch Vaccines for Biodefense and Cancer			1.546	.000	.000	
Orthopaedic Extremity Trauma Research Program			4.639	4.844	.000	
Pain and Neuroscience Center Research Center			5.415	.000	.000	
Neural Controlled Prosthetic Device for Amputees			.000	1.550	.000	
Neutron/Hadron Particle Therapy			1.546	1.163	.000	
Nano-Imaging Agents for Early Disease Detection			.000	1.550	.000	
Neuroimaging of Brain Disorders			.000	.775	.000	
Self-Powered Prosthetic Limb Technology			.000	2.325	.000	
Use of Drugs to Reduce Hearing Loss from Acute Acoustic Trauma			.000	1.240	.000	
Vision Integrating Strategies in Ophthalmology and Neurochemistry (VISION)			.000	3.100	.000	
Center for Aerospace Human Factors Research and Innovation			.000	.775	.000	
Development of Drugs for Malaria and Leishmaniasis in US Military and Civilian Personnel			.000	3.294	.000	
Engineering Replacement Tissues			.000	1.550	.000	
Expansion and Development, Upper and Lower Bionic Limbs			.000	1.938	.000	
Facilitating Use of Advanced Prosthetic Limb Technology			.000	1.550	.000	
Mosquito Borne Disease Prevention: Malaria & Dengue Fever			.000	.775	.000	
Optical Neural Techniques for Combat/Post-Trauma Healthcare			.000	1.550	.000	
Soldier Survival in Extreme Environments			.000	2.868	.000	
Behavior and Neuroscience, Functional Magnetic Resonance Imaging Research Project			.000	.775	.000	
Plug-In Architecture for DoD Medical Imaging			.000	.775	.000	
National Eye Eval & Research Network (NEER)-Clinical Trials of Orphan Retinal Degenerative Diseases			.000	.775	.000	
<b>Total</b>			<b>94.576</b>	<b>105.589</b>	<b>.000</b>	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY	<b>PROJECT NUMBER</b> VB3
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A		
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> VB4	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
VB4: SYSTEM BIOLOGY AND NETWORK SCIENCE TECHNOLOGY	.000	.000	1.175						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project supports applied research in systems biology to provide a highly effective mechanism to integrate iterative biological tests, computer simulations, and animal studies. Such developmental efforts using systems biology could ultimately reduce the time and effort invested in medical product development.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the US Army Medical Research and Materiel Command, Fort Detrick, MD</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Systems Biology: In FY09, this research is funded in project 878 under the Systems Biology and Network Science task. Conduct research to refine the new mathematical and computational methods that have identified gaps in network linkages (such as protein to protein networks). Explore whether protein-protein network models developed for a particular pathogen are portable to a different pathogen sharing a common set of proteins. In FY10, will apply validated models to the identification of therapeutic candidates against common targets identified.							.000	.000	1.175	
Total							.000	.000	1.175	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
VJ4: Suicide Prevention/Mitigation	.000	.000	10.000						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 development of better methods for preventing and mitigating suicidal behavior and to improve the overall mental health and behavioral function of Army personnel during and after their Army service.

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 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.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, conduct research to better understand the apparent increase in suicide deaths and nonfatal attempts among Active Duty Soldiers. Initiate epidemiological (population-based) studies to identify determinants of suicidal behaviors and potential modifiable risk factors. Begin the process to develop better methods for preventing suicidal behaviors based on data driven recommendations to mitigate or prevent suicidal behaviors.	.000	.000	10.000	
<b>Total</b>	.000	.000	10.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
X06: HIBERNATION GENOMICS	1.545	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
These are Congressional Interest Items										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Hibernation Genomics							1.545	.000	.000	
Total							1.545	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 845	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
845: BONE DISEASE RESEARCH PROGRAM	.773	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Bone Disease applied research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Bone Health and Military Medical Readiness Program							.773	.000	.000	
Total							.773	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 869	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
869: Warfighter Health Prot & Perf Stnds	2.970	3.130	35.282						Continuing	Continuing

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

This project funds research to prevent and protect Soldiers from training and operational injuries, the development of mechanisms for detection of physiological and psychological health problems, the evaluation of hazards to head, neck, spine, eyes, and ears, standards for 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 forms the basis for behavioral, training, pharmacological (drug actions), and nutritional interventions.

The four main thrust areas are (1) Physiological Health (2) Environmental Health and Protection, (3) Injury Prevention and Reduction, and (4) Psychological Health.

(1) Physiological Health - develop and evaluate applied predictive modeling and simulation to support improvements in training doctrine and individual equipment; evaluate new methods of monitoring fluid consumption; demonstrate remote real-time prediction and management of thermal strain in physically active Soldiers; and evaluate methods for managing and controlling the effects of nutrition and fatigue on Soldier operational performance.

(2) Environmental Health and Protection -- evaluate remote monitoring of Soldier physiological status and mitigating/eliminating the effects of heat, cold, altitude and other environmental stressors on Soldier performance.

(3) Injury Prevention and Reduction - Musculoskeletal Injury Prevention: evaluate the effects of repetitive motion and military operations and training on the human body; analyze and model 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. Evaluate standards and methods for the rapid return to duty of Soldiers following injury.

(4) Psychological Health & Resilience - develop and evaluate methods to detect and treat concussion and identify and evaluate the effects of cognitive deficits in Soldiers during operations; assess psychological resilience factors and investigate methods of preventing or reducing the risk of psychological trauma in operational environments; investigate methods to treat PTSD in a military population and identify causative and preventative factors in military suicides.

Beginning in FY10, projects 878 and 879 will be consolidated into project 869. Promising efforts identified in this project are further matured under PE 0603002A, project MM3.

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.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY	<b>PROJECT NUMBER</b> 869		
<p>Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and the US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.</p>				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Physiological Health - Nutritional Sustainment and Fatigue Interventions: In FY08 and FY09, research efforts were/are funded in project 879. In FY10, will demonstrate efficacy of nutritional supplements for sustaining cognition during military operational stress; will determine impact of nutritional supplements on enhancing post-exercise recovery; will determine efficacy of zinc supplements for reducing the incidence of diarrhea; will develop models to study the relationship of hormonal regulation and eating behavior; will evaluate individualized alertness and performance prediction model software for the Sleep Management System.	.000	.000	2.569	
Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments: In FY08 and FY09, research efforts were/are funded in task Physiological Health - Life Sign Monitoring, in projects 878 and 879. In FY10, will employ hydration sensor technologies to conduct early device evaluations; will determine the efficacy of a 7 to 8 hour nighttime exposure to a normal altitude, low oxygen environment for high altitude pre-acclimatization; will evaluate current heat strain decision aid capabilities for potential future enhancement.	.000	.000	2.129	
Injury Prevention and Reduction - Neurosensory Injury Prevention: In FY08 and FY09, research efforts were/are funded in project 878. In FY10, will characterize blunt impact protection capabilities of current and future helmet designs to develop biomedically valid criteria for US Army Test and Evaluation Command (ATEC) to use in materiel development will develop realistic visual headforms and will model eye injury vulnerabilities for candidate protection solutions; will develop auditory test fixtures/headforms for model hearing protection solutions; will conduct assessment of candidate drugs to prevent hearing loss.	.000	.000	10.252	
Injury Prevention and Reduction - Musculoskeletal Injury Prevention: Evaluate and assess the effects of repetitive motion and military operations and training on the human body. In FY08 and FY09, research efforts were/are funded in project 878. In FY10, will characterize performance deficits from Warfighter injury and identify promising interventions for rapid return to duty following musculoskeletal injury; will provide high resolution musculoskeletal injury data for use in the training and overuse injury prediction model; will evaluate physical impact forces on the lower leg associated with prolonged running and fatigue; and will evaluate musculoskeletal adaptations in response to military-relevant training and injuries to assess mechanisms of skeletal muscle repair, regeneration, and adaptation.	.000	.000	4.793	
	.000	.000	2.622	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Injury Prevention and Reduction - Injury Return to Duty Standards: In FY08 and FY09, research efforts were/are funded in project 879. In FY10, will characterize specific performance deficits from Warfighter brain, eye, and hearing injury and develop promising interventions for rapid return to duty; develop Return to Duty Standards for mission-critical occupations following brain, eye, and hearing injury; and determine appropriate clinical and physical health assessment tools to enable early return to duty.				
Psychological Health - Psychological Resilience: In FY08 and FY09, research efforts were/are funded in project 879. In FY10, will develop initial Advanced Battlemind Training to reduce symptoms associated with Post-Traumatic Stress Disorder (PTSD), post concussive symptoms and other post-deployment problems; will evaluate stigma related to seeking mental health care and barriers to care; will complete study of behavioral health providers to determine current status of diagnostic decision-making, treatment trends, and standards of care.	.000	.000	5.472	
Psychological Health & Resilience - Suicide Prevention and Treatment of PTSD: In FY10, will initiate a new research effort that will evaluate PTSD risk factors, including co-occurring mild Traumatic Brain Injury (mTBI) and mental health problems, and other factors (i.e. deployment, combat, multiple deployments) to improve diagnostic capabilities; will conduct a laboratory study to compare sensitivity of existing neurocognitive tests for PTSD; will collect and evaluate all data on the suicide intervention programs.	.000	.000	5.201	
Psychological Health & Resilience - Concussion/Mild Traumatic Brain Injury (mTBI) Interventions: In FY09, research efforts are funded in project S15. In FY10, will compare initial sensitivity and practicality of neuropsychological performance tests/batteries for diagnosis of concussion in Soldiers and civilians; will conduct a study to determine susceptibility to concussion based upon baseline psychological and neurological functioning; will determine short term effects of concussion on sleep patterns and neurocognitive performance.	.000	.000	2.244	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.062	.000	
Physiological Health - Life Sign Monitoring: In FY08, developed and evaluated Spartan network (SPARNET) and next-generation Heat Strain Decision Aid (HSDA) model with Ranger Training Brigade; tracked Ranger student hydration and geo-location; demonstrated HSDA value in reducing likelihood of heat injury; applied predictive modeling and simulation to support improvements in training doctrine and individual equipment; evaluated new method of monitoring fluid consumption; demonstrated remote real-time prediction and management of thermal strain in physically active Soldiers. In FY09, demonstrate remote medical monitoring capability in mountain and swamp phases of Ranger training; evaluate models predicting thermal status and water requirements for missions in rugged terrain, swamps, and cold weather. In	2.970	3.068	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
FY10 these efforts are funded in Environmental Health and Protection - Physiological Awareness Tools and Warrior Sustainment in Extreme Environments.				
Total	2.970	3.130	35.282	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 870	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
870: DOD MED DEF AG INF DIS	14.848	15.465	17.190						Continuing	Continuing

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

This project funds 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 repellent 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 development of improved diagnostic tools to facilitate early identification of infectious 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) and other new biotechnologies into the development 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:** Conduct assessments and improve candidate drugs coming from the DoD discovery program and from other collaborations for prevention and treatment of malaria to counter continuing spread of drug resistance to current drugs. Assess in animal models currently available drugs for use against cutaneous leishmaniasis (a skin-based disease transmitted by sand flies that is restricted to the skin). This program selects the most effective and safe candidates for continued development and possible clinical testing.
- (2) **Vaccines for Preventing Malaria:** Conduct studies to investigate new candidate vaccines for preventing malaria, and select the best candidate(s) for continued development. A highly effective vaccine would reduce or eliminate the use of anti-malarial drugs and would minimize the progression of drug resistance to current/future drugs.
- (3) **Bacterial Threats:** Conduct studies to develop antibacterial countermeasures including vaccine candidates to prevent diarrhea (a common disease in deployed troops), meningitis (a threat to trainee and deployed troops and military families), wound infection, and scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics).
- (4) **Diagnostics and Disease Transmission Control:** Design and prototype new medical diagnostic and surveillance tools for the field, focusing on bedside and fieldable diagnostic systems. Develop interventions that protect Warfighters from biting insects that transmit diseases-sand flies can transmit leishmaniasis, and mosquitoes can transmit a variety of diseases including dengue fever, Japanese encephalitis, and malaria.
- (5) **Viral Threats Research:** Design and laboratory test new vaccine candidates against dengue and other hemorrhagic fever viruses such as hantaviruses (cause of Korean hemorrhagic fever) and other lethal viruses (i.e., Lassa fever and Crimean-Congo hemorrhagic fever), and assess other non-vaccine technologies to protect against such lethal viral diseases.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 870		
<p>For the development 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 US 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 development 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 needed to replace the products that fail in testing.</p> <p>Work is managed by the US Army Medical Research and Materiel Command. 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.</p> <p>Promising medical countermeasures identified in this project are further matured under PE 0603002A, project 810.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; the US 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.</p>					
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Bacterial Threats: In FY08, refined antidiarrheal vaccine candidates and assessed a potential vaccine made from bacterial proteins that are involved in allowing the bacteria to adhere to the gut, established a model of dysentery (bloody diarrhea caused by Campylobacter) in nonhuman primates that can be used to assess/demonstrate new candidate vaccines before taking into expensive human clinical trials, and completed preclinical evaluation of new candidate diarrheal and meningitis vaccines. In FY09, examine potential bacterial proteins as new vaccine candidates against major strains of diarrheal disease (E. coli, Campylobacter and Shigella). Manufacture E. coli candidate vaccine and prepare for human testing. Select best Campylobacter vaccine candidate. Prepare for initial human testing of Shigella vaccine. Modify the meningitis bacteria to manufacture and test a multicomponent (to broaden protection) Group B vaccine in preparation for testing in humans. Test new scrub typhus (a debilitating mite-borne disease that is developing resistance to currently available antibiotics) proteins as potential vaccine candidate against multiple strains.		2.739	2.496	.000	
Diagnostics and Disease Transmission Control: In FY08, focused effort to reduce disease threat from insects other than sand flies, tested insect-based pathogen detection assays, down-selected a new insect repellent for final formulation.		1.973	2.152	2.167	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY			<b>PROJECT NUMBER</b> 870	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Continued to improve medical diagnostic capability in the field. Assessed individual and combined components of diagnostic tests for selected naturally occurring infectious disease agents and began design of next-generation diagnostic assays. In FY09, test new intervention methods that prevent or reduce biting by disease-transmitting insects, including use of an improved bed net, and prepare for insect repellent testing to replace Diethylmetatoluamide or DEET (current ingredient in military insect repellent). Design and evaluate five new medical diagnostic tests and surveillance tools for disease-carrying insects (sand flies, mosquitoes) to improve the medical responses in the field. Develop field deployable point-of-care and hospital-based diagnostic devices for infectious diseases. In FY10, will develop passive insect repellent systems that do not require application of chemicals to skin or clothing; will evaluate new tests for detecting infectious organisms within insects that transmit diseases; will validate field deployable point-of-care diagnostic devices to prepare for FDA review; and will develop a repository of standardized critical reagents for producing consistent reproducible results in both laboratory and field-based diagnostic devices.						
Viral Threats Research: In FY08, evaluated new antiviral vaccines against emerging viral threats, and assessed potential of a combined DNA vaccine against several highly lethal viruses including Rift Valley fever, Crimean-Congo hemorrhagic fever, and tick-borne encephalitis. In FY09, assess and evaluate new antiviral vaccines in animals and support the hantaviral vaccine development effort. Examine new vaccine delivery approaches in animals to enhance effectiveness of DNA-based vaccine in humans. Prepare field site for human testing of candidate dengue vaccine. Manufacture proof-of-concept candidate vaccines (Inactivated, molecular and attenuated) to protect against dengue. In FY10, will develop reagents, assays, and animal models to test medical countermeasures for hantaviruses; will develop molecular vaccines and antibody-based countermeasures for flaviviruses (Dengue); and will explore the feasibility of combining inactivated, molecular and attenuated vaccines into a single vaccine that is effective against four dengue strains.			2.313	1.877	3.477	
Vaccines for Prevention of Malaria: In FY08, assessed potential malaria vaccine subcomponents in animal testing. Took into concept exploration new proteins and gene-based vaccines identified from animal malaria models or malaria in humans. Used molecular biological approaches to produce sufficient material to formulate into a vaccine candidate and to test in animal studies. In FY09, manufacture pilot lots of candidate vaccines (both DNA - and protein-based) against a severe form of malaria (Plasmodium falciparum) to maintain a pipeline of new technologies and to mitigate risk if lead technologies fail. Test protein-based candidate vaccines in small animals for proof-of-concept for eventual down selection. In FY10, will manufacture and test in animal models a DNA based P. falciparum vaccine candidates to support			3.117	3.082	3.353	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 870	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
a new vaccine application with the FDA. Will file the application for approval to test these candidates in humans. Will evaluate the safety and effectiveness in animals of DNA-based candidate falciparum vaccines.				
Drugs to Prevent/Treat Parasitic Diseases (harmful effects on host by an infecting organism): In FY08, continued studies to design, assess, and qualify candidate chemical compounds in search of more promising candidate drug classes to maintain pipeline of potential compounds for optimization. In FY09, assess new chemical compounds that have shown the greatest potential for effective in cell-based testing against malaria and/or leishmaniasis (a skin-based disease transmitted by sand flies). Assess in animal models a new formulation of amphotericin B, an FDA-approved drug as an oral treatment against cutaneous Leishmania. Develop bioluminescent (the production and emission of light by a living organism as the result of a chemical reaction) parasite animal model to assess drug effectiveness. Modify the current lead drugs to improve safety, effectiveness in animal models. In FY10, will optimize chemical compounds that have potential to be effective drugs against malaria and/or leishmaniasis, including new candidate(s). will complete optimization of one lead malaria drug to test in animals, and if successful, prepare for initial testing in humans.	4.706	5.858	4.585	
Bacterial Threats (cont'd FY10 and FY11): In FY10, will complete evaluation of E. coli subunit vaccine in monkeys. Will evaluate alternative Shigella constituents, as potential vaccine candidates in animals. Will manufacture lead candidate Campylobacter vaccine. Will transition a multicomponent Group B meningococcal vaccine to next phase of development. Will evaluate scrub typhus for drug resistance, will identify new proteins as candidate vaccine components, and will evaluate vaccine delivery methods in animals. Will evaluate new therapeutic approaches to accelerate wound healing such as vacuum-assisted closure of wounds using binding agents to kill bacteria.	.000	.000	3.608	
<b>Total</b>	<b>14.848</b>	<b>15.465</b>	<b>17.190</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 873	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
873: HIV EXPLORATORY RSCH	10.953	11.351	9.248						Continuing	Continuing

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

This project funds research on the human immunodeficiency virus (HIV), which causes Acquired Immunodeficiency Syndrome (AIDS). Work in this area includes developing improved identification methods to determine genetic diversity of the virus, and evaluating and preparing overseas sites for future vaccine trials. Additional activities include developing candidate vaccines for preventing HIV, 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 US 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed 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 cooperative agreement.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HIV Research Program: Conduct projects assessing new HIV vaccine candidates, vaccine test site development worldwide, HIV disease outbreaks, and genetic attributes of HIV threat. In FY08, continued ongoing long-term candidate vaccine refinement based on studies of globally prevalent Human Immunodeficiency Virus (HIV) viral subtypes, continued to improve methodologies for medical monitoring of Department of Defense (DoD) personnel's viral exposure and infection, and continued to improve and integrate new methods to assess the effectiveness of candidate vaccines in support of clinical research (initial assessment for safety in humans). In FY09, continue long-term efforts to find solutions to the HIV threat to DoD personnel with ongoing studies directed at assessing HIV vaccine candidates, assessing vaccine test sites in Africa and Asia, and identifying changes in global risk and genetic makeup of HIV threat to US forces to help direct future research and intervention programs. In FY10, will define the potential threat posed by HIV to the US military by continuing to identify and characterize different subtypes involved with the global epidemic of HIV-infected populations; will develop new human study test sites in Uganda to expand testing facilities, including production of new	10.953	11.053	9.248	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY			<b>PROJECT NUMBER</b> 873	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
vaccine candidates against selected HIV subtypes found in East Africa; and will control production quality of new vaccine candidates to be used in humans.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.298	.000	
Total			10.953	11.351	9.248	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 874	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
874: CBT CASUALTY CARE TECH	16.139	11.936	17.811						Continuing	Continuing

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

This project funds the development and assessment of 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), tissue repair including transplant technologies, and treatment of burns, Traumatic Brain Injury (TBI), eye injuries and face trauma. Research involves extensive collaboration with multiple academic institutions to develop treatments for combat wounds through the Armed Forces Institute of Regenerative Medicine.

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

- (1) Hemorrhage (bleeding) Control, Blood, and Resuscitative Fluids: Includes materials and systems for minimizing the effects of traumatic blood loss, preserving blood and blood products, and resuscitation following trauma: Beginning in FY10, funding shifts to the Damage Control Resuscitation area.
- (2) Damage Control Resuscitation: Includes knowledge products, materials and systems for control of internal bleeding, minimizing the effects of traumatic blood loss, preserving blood, blood products, and resuscitation following trauma; the research area starts in FY10.
- (3) Combat Trauma Therapies: Includes identification and development of candidate drugs and medical procedures to minimize the effects of combat injuries.
- (4) Far-Forward Medical Systems: Includes diagnostic and therapeutic medical devices and associated algorithms, software, and data-processing systems for resuscitation, stabilization, life support, surgical support, and dental care treatments that can be applied in a pre-hospital, operational field setting. Beginning in FY10, dental efforts move to oral/facial surgery under Combat Trauma Therapies and the remaining efforts shift to the Combat Critical Care Engineering area.
- (5) Combat Casualty Bioinformatics and Simulation: Focuses on a data management system to capture and analyze data (such as heart and respiration rates) over time and the development of casualty simulations and durable, realistic simulators for initial and reinforcement training of medical care providers. Beginning FY10, will discontinue in-house simulation research and leverage Program Executive Office, Simulation, Training, and Instrumentation (PEO-STRI) medical simulation research. Bioinformatics research will be funded with the Combat Critical Care Engineering research area in FY10.
- (6) Combat Critical Care Engineering: Includes development of diagnostic and therapeutic medical devices and 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; this research area starts in FY10.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 874	
<p>(7) Clinical and Rehabilitative Medicine: Includes laboratory and animal studies of regenerating skin, muscle, and bone tissue for the care and treatment of battle-injured casualties; this research area starts in FY10.</p> <p>All drugs, biological products, and medical devices, are developed in accordance with US Food and Drug Administration regulations, which governs testing in animals to assess safety, toxicity, and effectiveness prior to conducting human subject clinical trials.</p> <p>Promising efforts identified in this project are further matured under PE 0603002A, project 840.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work on this project is performed by the US Army Institute of Surgical Research (ISR), Fort Sam Houston, TX; and the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Detrick, MD.</p>					
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>		<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs		.000	.148	.000	
Hemorrhage Control, Blood, and Resuscitative Fluids: In FY08, began preparation for initial safety study of freeze-dried plasma (FDP), identified new strategies to treat the abnormal blood-clotting response that occurs in severely injured patients, established the effects of resuscitation treatments for combined blast-trauma-hemorrhage injuries on the brain and lungs; and determined if stored red blood cells lose efficacy near the end of their shelf life. Also, tested products and methods of using a foam blood clotting agent to stop internal bleeding. In FY09, identify candidate diagnostic and therapeutic interventions for abnormal blood clotting; using a small animal model, continue investigation into use of resuscitative fluids to improve outcomes for combined blast-trauma-hemorrhage on brain and lung. Evaluate freeze-dried fibrinogen (a blood component), for improving blood clotting. In FY10, this work will be funded under the Damage Control Resuscitation area.		8.329	1.689	.000	
Combat Trauma Therapies: In FY08, awarded contracts to Armed Forces Institute of Regenerative Medicine (AFIRM) and began to assess emerging therapeutics (stem cell therapy and growth factors for tissue and bone regeneration) in animal models and new methods to repair areas with major injuries caused by projectiles; developed selective brain cooling and neuroregeneration for early intervention and treatment of traumatic brain injury; established neuroprotection/neuroregeneration methods to reduce death and illness resulting from brain trauma including stem cell therapies, tissue grafts, and a drug to improve new learning and memory; completed initial efficacy studies of FDA-licensed drugs that are candidate anti-seizure therapies for silent brain seizure; and continued biomarker clinical trials and designed		4.568	7.725	3.267	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY			<b>PROJECT NUMBER</b> 874	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
a device for brain injury diagnostics. In FY09, focus AFIRM tissue regeneration activities on most promising clinical treatments for blood vessel grafts, muscle regeneration, regeneration of bones in the head and face, and assessment of long-bone regeneration using an animal model; continue to refine selective brain cooling and neuroregeneration for early intervention and treatment of brain injury; conduct drug combination studies for treatment of acute brain trauma; and expand biomarker clinical feasibility trial to include diagnosis of mild Traumatic Brain Injury. In FY10, will begin several injury studies of Penetrating Ballistic-type Brain Injury (PBBI) in large animals; will conduct animal study of oral surgical dressing; and will begin studies into the nature of eye injuries and evaluate promising repair methods in laboratory and animal models.						
Far-Forward Medical Systems: In FY08, completed preclinical evaluation of algorithms for simultaneous operation of closed-loop control of ventilation, oxygen administration, and fluid administration, and identified a hardware platform for this system: completed toxicity and formulation studies on an antimicrobial, antiplaque compound. In FY09, begin laboratory-based evaluation of fluid resuscitation algorithms in an integrated hardware platform (either the Army's integrated litter or the Navy's lightweight trauma module) for casualty transport; and transition oral protective, antiplaque compound to commercial partner. In FY10, dental efforts will move to oral/facial surgery under Combat Trauma Therapies and the remaining efforts will shift to the Combat Critical Care Engineering area.			1.294	1.174	.000	
Damage Control Resuscitation: In FY08 and FY09, funding was within the Hemorrhage Control, Blood, and Resuscitation Fluids program area. In FY10, will continue animal studies of freeze dried plasma; will develop and evaluate performance of candidate blood substitutes and expanders (e.g. frozen and freeze dried platelets); will test treatment interventions to stop internal bleeding in an animal model; will characterize the body's blood clotting mechanism associated with head injury bleeding and other trauma to identify ways to better control clotting and determine effects on resuscitation; will continue evaluation using animal models of various combinations of plasma, clotting factors, and Complement Inhibitors (CI's) as therapies to stop severe bleeding and treat trauma.			.000	.000	7.754	
Combat Critical Care Engineering: In FY10, will conduct large animal studies evaluating change in electrical signals in the brain as non-invasive resuscitative end-points in shock from blood loss.			.000	.000	1.679	
Clinical and Rehabilitative Medicine: In FY10, will conduct studies of compounds to reduce cellular damage during compartment syndrome (nerve or tendon constriction in an enclosed space) in laboratory and animal models; will test a tissue-engineered functional human facial expression muscle; will evaluate a biodegradable tissue-lined stent; will test			.000	.000	5.111	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 874	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
reconstruction of a facial defect in the skull by using synthetic bone scaffold material; and will test a dressing that mimics the fetal skin structure to prevent wound scarring.				
Combat Casualty Bioinformatics and Simulation: In FY08, completed patient trauma simulations with advances in material sciences that depict realistic skin, flesh, blood, bone, organs, and loss of fluids; and improved sensors that detect and provide feedback on interventions by medics. In FY09, support testing and evaluation of trauma simulation component for training assessments developed jointly with the Research, Development and Engineering Command. Bioinformatics research will merge into the Combat Critical Care Engineering research area in FY10.	1.948	1.200	.000	
<b>Total</b>	<b>16.139</b>	<b>11.936</b>	<b>17.811</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 878	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
878: HLTH HAZ MIL MATERIEL	11.857	14.264	.000						Continuing	Continuing

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

The objective of this project is to support the Medical and Survivability technology areas with a focus on providing Soldier protection from health hazards associated with materiel and operational environments. Emphasis is on identifying health hazards inherent to the engineering design and operational use of equipment, systems, and materiel used in Army combat operations and training. Areas of emphasis include battlefield lasers, ballistic, and mechanical injury (e.g., models of protection by soft body armor), health hazards of operations in environmental extremes, and toxic environments. Hazards addressed include blast overpressure generated by weapons systems, toxic chemical hazards associated with deployment into environments contaminated with industrial and agricultural chemicals (effort complements ongoing Defense Threat Reduction Agency initiatives for chemical/biological threat agent detection), directed energy sources (laser), and environmental stressors (heat, cold, and high altitude). Specific research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness, injury, and performance degradation; establishing biomedical databases to support protection criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection. In FY10, project 878 will be consolidated into project 869.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; the US Army Center for Environmental Health Research, Fort Detrick, MD; and the US Army Aeromedical Research Laboratory, Fort Rucker, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Pulmonary Hazards and Risk Assessment Models: In FY08, developed an integrated model that will predict lung injury and performance outcomes from exposures to combined insults of blast over-pressure and blunt trauma. Collected test data required to expand the scope of the Toxic Gas Assessment Software - Performance Evaluator (TGAS-PE) model to predict the impact of inhaled fire gas exposures on physical performance. In FY09, use new and existing animal injury and performance data to validate the integrated blast overpressure/blunt trauma lung injury and performance model. Use large-animal performance data to validate the TGAS-PE model for performance impacts from exposure to inhaled toxic fire gases and release TGAS-PE1 (performance) to survivability assessors for live-fire vehicle testing.	3.595	4.377	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 878	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10 and FY11, this effort will be realigned to Neurosensory Injury Protection (project 869). Physiological response and blast and blunt trauma models of thoracic and pulmonary injury will be realigned to project FH2.				
Laser Protection Research: In FY08, completed functional assessment of visual acuity recovery in a behavioral model based on emerging laser injury research to determine the best eye injury treatment approach and refine a strategy for combined drug therapies in treatment of laser and trauma-induced eye injuries (blast, fragments). In FY09, utilize animal testing to assess laser eye injury hazards from advanced military systems. Evaluate a combination of drugs for treatment of laser-induced eye injury. In FY10 and FY11, this effort will be realigned to Injury Return to Duty Standards (project 869).	1.824	2.403	.000	
Injury Protection (face/eye): In FY08, validated and transitioned physical model and face/eye injury dose-response models to Army materiel developers. In FY09, design an impact test methodology for assessing face shield performance. In FY10 and FY11, this effort will be realigned to Neurosensory Injury Protection (project 869).	3.061	2.873	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.272	.000	
Biomonitor System and Dehydration Research: In FY08, conducted laboratory testing of the environmental sentinel biomonitor system to demonstrate capability of the integrated platform and sensors to rapidly assess drinking water quality and provide relevant health risk information to decision makers regarding toxic hazards in water. Also, conducted laboratory studies using human subjects data to assess the effects of nutritional countermeasures (such as caffeine) on fluid balance and performance when working in hot environments. In FY09, assess technologies for rapidly identifying chemical contamination by toxic industrial chemicals and that are appropriate for use with field water production equipment. Conduct field test to evaluate on-the-move enhanced fluid and nutrient delivery systems to enhance fluid and electrolyte delivery to Soldiers. Demonstrate efficacy of inducing acquired thermal tolerance (cellular protection) coincident with heat acclimatization in Soldiers. In FY10 and FY11, this effort will be realigned to Physiological Awareness Tools and Warrior Sustainment in Extreme Environments (project 869).	3.377	3.131	.000	
Systems Biology and Network Science:	.000	1.208	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 878	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>In FY09, conduct applied research to investigate whether protein-protein network models, developed for a particular pathogen, are portable to a different pathogen sharing a common set of proteins. Develop mathematical models to predict host-pathogen protein-protein interaction networks, and metabolic network models to predict phenotypical (genetically and environmentally determined physical appearance of an organism) responses induced by external stimuli. In FY10, this effort will be moved to the new project VB4.</p>					
Total			11.857	14.264	.000
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 879	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
879: MED FACT ENH SOLD EFF	9.851	10.282	.000						Continuing	Continuing

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

The objective of this project is to support applied research with a focus on sustaining and enhancing Soldier health and performance during military operations in the full spectrum of military environments. Emphasis is on identification of baseline physiological performance and assessment of degradations produced by operational stressors. The resulting databases and collection of rules and algorithms for performance degradation in multi-stressor environments form the basis for the development of behavioral, training, pharmacological, and nutritional interventions, including psychological debriefing to prevent degradation in Soldier health and sustain Soldier performance. Key stressors include psychological stress from isolation; new operational roles; frequent deployments; inadequate restorative sleep; prolonged physical effort; and inadequate hydration in extreme environments. Will also assess the adverse effect of shifting biological rhythms during deployments across multiple time zones (extreme jet lag), night operations, and thermal and altitude stress. In FY10, project 879 will be consolidated into project 869.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Research Institute of Environmental Medicine, Natick, MD; and the US Army Aeromedical Research Laboratory, Fort Rucker, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Vision and Auditory Research:                      In FY08, conducted evaluations of animal database for the effects of impulse noise/blast waves on hearing; conducted clinical and animal evaluations of a noise immune electronic stethoscope directed toward future Food and Drug Administration approval; developed the concept of solar protection compatible with rapid transition into darkened environments.                      In FY09, conduct comparative analysis of six eye damage risk criteria identified by NATO countries and provide recommendations of optimum health risk assessment criteria; transition a noise immune electronic stethoscope into advanced development with the United States Army Medical Research and Material Command Developmental Activity; conduct assessments of integrated solar protection device eye protection systems.                      In FY10 and FY11, this effort will be realigned to Neurosensory and Musculoskeletal Injury Return to Duty Standards (project 869).</p>	2.546	2.359	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY		<b>PROJECT NUMBER</b> 879	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Mental Health Research: In FY08, assessed individual intervention strategies such as DoD post-deployment health assessment and post-deployment health reassessments; assessed leader development tools such as pre-deployment battlemind training, and Soldier and leader training modules including post-deployment battlemind training and spouse battlemind training. In FY09, develop unit-level intervention tools for military-wide implementation to improve Warfighter resiliency, health, and performance. In FY10 and FY11, this effort will be realigned to Psychological Resilience (project 869).</p>	2.785	3.548	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.083	.000	
<p>High Altitude Research: In FY08, integrated doctrinal and technological components into the prototype Altitude Readiness Management System (ARMS), a personalized digital assistant device designed to use altitude and physiological modeling data to monitor individual susceptibility to adverse health and performance at high altitudes. ARMS provide an enhanced planning and prediction capability. In FY09, examine use of Food and Drug Administration (FDA) approved drug (erythropoietin) to prevent neuropsychological deficits and acute mountain sickness. Provide critical information to the Army Medical Department Combat Developer for the development of new Army doctrine related to high altitude deployments. In FY10 and FY11, this effort will be realigned to Physiological Awareness Tools and Warrior Sustainment in Extreme Environments (project 869).</p>	2.791	2.634	.000	
<p>Fatigue/Sleep Research: In FY08, conducted laboratory studies to assess predictions of performance effectiveness and efficacy of drug interventions for individual Soldiers. In FY09, further integrate components of the next-generation Fatigue Intervention and Recovery Model/Sleep Activity, Fatigue, and Task Effectiveness (FIRM/SAFTE) which will include enhanced capability for prediction of the effects of stimulants, into the Sleep History and Readiness Predictor (SHARP). SHARP is a program that facilitates interpretation and usefulness of the FIRM/SAFTE model by providing summary information on the relative predicted efficacy of each individual Soldier within a unit. In FY10 and FY11, this effort will be realigned to Nutritional Sustainment and Fatigue Interventions (project 869).</p>	1.729	1.658	.000	
<b>Total</b>	<b>9.851</b>	<b>10.282</b>	<b>.000</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY	<b>PROJECT NUMBER</b> 879
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602787A MEDICAL TECHNOLOGY					<b>PROJECT NUMBER</b> 968		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
968: SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	4.831	4.984	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Cancer Detection applied research.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
SBIR/STTR								.000	.139	.000	
Synchrotron-Based Scanning Research Neuroscience and Proton Institute								4.831	4.845	.000	
Total								4.831	4.984	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	65.489	73.352	37.574						Continuing	Continuing
C07: JOINT SERVICE COMBAT FEEDING TECH DEMO	1.780	2.258	2.354						Continuing	Continuing
J50: FUTURE WARRIOR TECHNOLOGY INTEGRATION	35.256	36.333	30.056						Continuing	Continuing
J52: WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	23.134	29.702	.000						Continuing	Continuing
242: AIRDROP EQUIPMENT	4.029	3.788	3.811						Continuing	Continuing
543: AMMUNITION LOGISTICS	1.290	1.271	1.353						Continuing	Continuing

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

This program element (PE) provides Soldiers with the most effective personal clothing, equipment, and rations at the least weight and sustainment burden. This PE supports the maturation and demonstration technologies associated with air delivery of personnel and cargo (project 242), improved weapon systems for munitions availability and survivability (project 543), combat rations and combat feeding equipment (project C07), combat clothing and personal equipment (including protective equipment such as personal armor, helmets, and eye wear) (project J50). Project J52 funds congressional special interest items. The projects in this PE adhere to Tri-Service Agreements on clothing, textiles, and food with oversight and coordination provided by the directors of Service laboratories through the Warrior Systems Technology Base Executive Steering Committee.

Work in this PE is related to, and fully coordinated with, PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603008A (Command, Control, Communications Advanced Technology), and PEs 0602623A and 0603607A (Joint Service Small Arms Program).

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology		
<p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work is performed by the Natick Soldier Research, Development, and Engineering Center (NSRDEC), Natick, MA and the Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ.</p>				
<b><u>B. Program Change Summary (\$ in Millions)</u></b>				
	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>
Previous President's Budget	86.103	46.793	42.611	
Current BES/President's Budget	65.489	73.352	37.574	
Total Adjustments	-20.614	26.559	-5.037	
Congressional Program Reductions	.000	-3.241		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	29.800		
Total Reprogrammings	-18.331	.000		
SBIR/STTR Transfer	-2.283	.000		
<b><u>Change Summary Explanation</u></b>				
FY08 funding was decreased due to transfer of congressional interest items.				
FY09 funding increase is due to congressional special interest items.				
FY10 funding was decreased to support higher priority efforts.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology					<b>PROJECT NUMBER</b> C07	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
C07: JOINT SERVICE COMBAT FEEDING TECH DEMO	1.780	2.258	2.354						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project matures and demonstrates technologies for military combat feeding systems and combat rations to include processing, preservation, packaging, and equipment and energy technologies that reduce the logistics footprint. This project demonstrates combat feeding technology with reduced logistics (in component parts, weight, cube, fuel, and water) and labor requirements, while improving the quality of food service. The project, a Department of Defense (DoD) program for which the Army has Executive Agent responsibility, provides technology development for Joint Service Combat Feeding. The DoD Combat Feeding Research and Engineering Board provides oversight for this project.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed and managed by the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA. This project has collaborative efforts with the US Army Research Institute for Environmental Medicine.</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
<p>Combat Feeding Equipment Technologies: This effort demonstrates technologies for military combat feeding systems to reduce logistics footprint of field feeding.</p> <p>In FY08, integrated and demonstrated a prototype beverage chiller with a standard commercial or military backpack hydration system and transitioned to PM-Clothing and Individual Equipment (CIE) and PM-Individual Combat Equipment (ICE); developed new joint service battlefield kitchen; demonstrated multi-serving self-heating hot water system enhancement to Unitized Group Ration Express (UGR-E); and completed prototype development and demonstration of solar-powered refrigerated container and transitioned to PM-Force Sustainment Systems (PM-FSS).</p> <p>In FY09, demonstrate joint service Battlefield Kitchen based on using state of the art power generation systems (FY08 novel co-generators from PE 0602786A/project H99) and transition to PM-FSS; complete final technology demonstration of Waste to Energy Converter and transition to PM-FSS.</p> <p>In FY10, will integrate and demonstrate an ethylene control system (prolongs freshness) in refrigerated containers to extend the shelf-life of fresh fruits and vegetables.</p>						.640	.863	.900		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology		<b>PROJECT NUMBER</b> C07	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Ration Stabilization, Packaging, and Novel Nutrient Delivery Technologies: This effort demonstrates technologies for enhancing nutrient composition and consumption to maximize cognitive and physical performance. In FY08, downselected novel diagnostics for food pathogen array detection systems. This expanded diagnostic capability, while reducing weight and volume of deployable array system; conducted biodegradable coating trials for prototype compostable fiberboard containers - characterized for biodegradation, water resistance and insect repellency. In FY09, demonstrate effectiveness of providing phytonutrients (organic components of plants, that promote human health) via buccal delivery (mouth tissue) and incorporate into ration components to demonstrate human performance optimization in validated military performance tasks (e.g., victim rescue, 30m combat rushes); conduct final technology demonstration of novel food pathogen diagnostic technologies incorporated into array systems and transition to Veterinary Services Activity/Office of the Surgeon General (VSA/OTSG) for procurement; demonstrate Hybrid Optimal Processing (HOP) technique to reduce processing time and increase food quality and nutrient retention.	1.140	1.388	.000	
Ration Stabilization, Packaging, and Novel Nutrient Delivery Technologies (cont'd): This effort demonstrates technologies for enhancing nutrient composition and consumption to maximize cognitive and physical performance. In FY10, will demonstrate shelf stability of probiotic enhanced ration components and encapsulated oils for ration systems; will prepare field manual on validated assays/surveys for the analysis of food pathogens and biological agents and transition to the VSA/OTSG; will demonstrate the optimal use of analytical food pathogen detection diagnostics and the accompanying procedures for high throughput screening of foods.	.000	.000	1.454	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.007	.000	
<b>Total</b>	<b>1.780</b>	<b>2.258</b>	<b>2.354</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology					<b>PROJECT NUMBER</b> J50	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J50: FUTURE WARRIOR TECHNOLOGY INTEGRATION	35.256	36.333	30.056						Continuing	Continuing

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

This project matures, demonstrates and integrates high-payoff technologies to provide the Soldier with the most effective personal protective clothing, electronics subsystems, and duty position-specific mission equipment at the least weight, sustainment and cognitive burden. Efforts in this project focus on maturation and demonstration of technologies associated with combat clothing and personal equipment including protective equipment such as personal armor, helmets and eyewear; lightweight, ruggedized, durable components for situational awareness and network connectivity; load-bearing/load carrying augmentation systems; and power/power management components/systems for the individual Soldier.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Integrated Soldier Protection: This effort matures and demonstrates technologies to achieve improvements enabled by advanced integrated lightweight Soldier protective headgear and clothing. In FY08, initiated a systems engineering process, in collaboration with the Joint Science and Technology Office (JSTO) Chemical Ensemble project, to develop advanced concepts for integrated chemical, biological, toxic industrial materials (TIM) and network enabled personnel protective systems. A joint technology demonstration is planned in FY10. Developed initial concepts of anthropometrically-based conformal armor plates to enhance fit and armor area of coverage. Designed a robust and streamlined personal area network for future Soldier system concepts. In FY09, select the most promising integrated protection technology solutions designed in FY08, (i.e., networked physiological monitors, eye protection, improved armor) and continue to mature and demonstrate performance; conduct technical tests and structured and freeplay field demonstrations of both technology and systems to obtain relevant user feedback for design improvement, and to ensure technical and operationally-based system performance metrics are developed to support rapid transition of integrated technology solutions.	5.314	5.284	.000	
	5.314	4.850	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology		<b>PROJECT NUMBER</b> J50	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Soldier Ballistic and Blast Protection: This effort matures and demonstrates technologies to achieve Warfighter survivability capability improvements enabled by test devices and protocols to protect against blast and ballistic threats. In FY08, designed and refined test equipment and experimental protocols to generate means of evaluating current and future protective systems against primary blast lung injury (PBLI). Conducted analysis of available blast and ballistic protective systems and component assessment tools, devices and protocols to devise standardized system level assessment protocols. Conducted blast testing to determine changes to devices, and began to develop associated specific standardized personnel blast test protocol.</p> <p>In FY09, finalize test equipment and protocol for PBLI protection system assessment, benchmark protection afforded by currently fielded items and transition equipment protocol; continue effort to develop system level assessment protocols and test devices to address other ballistic and blast-related injury mechanisms (fragments, burns, inhalation of toxic gas, etc.); begin to translate knowledge from FY08 blast testing of injury data, criteria, and blast event characterization efforts into materiel design solutions and evaluate effectiveness of protection systems.</p>				
<p>Soldier Mobility and Enhanced Load Carriage: This effort matures and demonstrates technologies to achieve capability improvements enabled by wearable load-bearing equipment that assist in Warfighter strength and mobility. In FY08, matured and refined components and subsystems transitioned from the Defense Advanced Research Projects Agency (DARPA) Exoskeleton program (full body system) and PE 0602786A/project H98; continued to develop concept for using Exoskeleton to aid Soldiers in loading and delivery operations.</p> <p>In FY09, develop human use protocols to assess effects of wearing Exoskeleton system; continue to mature component technology and integrate safety performance parameters into Soldier loading and delivery systems; conduct technical tests and field demonstrations with Combined Arms Support Command (CASCOM/Ft. Lee) for user feedback to ensure relevant system performance evaluations to enable transition of technology solutions to PEO Soldier.</p>	3.527	3.689	.000	
<p>Small Combat Unit C4 Interfaces: This effort matures and demonstrates technologies to provide more durable Soldier displays and subsystems that provide greater situational awareness with less cognitive stress. In FY08, assessed, selected, and matured ground Soldier components and/or subsystems that required refinement and further maturation to include flexible displays, small form-factor processors, Soldier Radio Waveform-based communicating devices, advanced communication headsets with hearing protection, motion-sensing gloves, integrated trackball/mouse and keypads; cabling and connectors to include micro and nano connectors to enhance Soldier-borne networking between head, body, and weapon systems; continued to mature the software translation tools for converting</p>	6.230	7.997	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology		<b>PROJECT NUMBER</b> J50	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Force XXI Battlefield Command Brigade and Below (FBCB2) software for use in Soldier networking equipment and demonstrated additional modular capabilities (snap connectors and rally point glove). In FY09, continue to exploit Soldier, squad, and platoon network technology maturation efforts (i.e., emerging wireless body receiver, power hub manager, etc); conduct technical tests/field demonstrations of Soldier-borne networking combined with user feedback to ensure system performance evaluations for transition of integrated technology solutions as well as assess cognitive loading effects.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.958	.000	
Small Unit Lethality Integration: This effort matures and demonstrates technologies for capability improvements in lighter weight, more energy efficient Soldier borne computing and communication equipment. In FY08, conducted lethality analyses of Small Combat Unit (SCU) operational concepts and enabling technologies and evaluated promising technologies individually and as integrated systems of systems in relative field environment. Using models and simulations, analyzed combat effectiveness of the capabilities of the SCU such as networked lethality, small-unit weapon systems. Assessed design parameters impacting SCU to include: system size, weight, power, and cost; and Soldier reaction time to direct and indirect fires. Integrated enhancements to small unit cooperative engagement for more accurate firing solutions. In FY09, continue to mature government-owned open system architectures for current and future networks; assess and evaluate latency across Soldier-vehicle networks to enable quicker call for fire and lethal effects and battlefield sensor awareness; conduct laboratory tests and field demonstrations of maturing network architectures, combined with user feedback, to ensure desired performance.	4.735	3.202	.000	
Soldier Power and Energy: This effort matures and demonstrates technologies to achieve capability improvements in lightweight high-energy and density Soldier power and power management components and subsystems. In FY08, integrated innovative Soldier power and energy solutions and matured system solutions for ground and mounted Soldiers and aviators to include: methanol-based Soldier hybrid fuel cell power source designed under PE 0602705A/ project H11, conformal rechargeable battery packs integrated into Soldier tactical gear, solid oxide fuel cells, thin-film rechargeable batteries, platoon-level battery recharging generator, and half-sized BA 5590 Li/CFx batteries (individual Soldier radio battery). In FY09, continue to mature methanol-based Soldier hybrid fuel cell power source, higher energy density conformal rechargeable battery (central integrated Soldier battery), and half-sized BA 5590 Li/CFx batteries; investigate rechargeable battery development based on packaging thin film rechargeable battery technology; integrate nano-technology based	4.855	4.861	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
electro-textiles with photovoltaic energy properties to augment primary system power sources; demonstrate platoon-level generator recharging batteries; conduct technical tests and demonstrations, combined with user feedback to ensure system performance evaluations that enable transition of integrated technology solutions to Army PMs.						
<p>Small Unit Systems Integration and Demonstration: This effort matures and demonstrates technologies that support upgrades to fielded Soldier equipment.</p> <p>In FY08, expanded the Soldier Systems Integration Lab (SSIL) capabilities to include an open architecture lab environment, coupled with a data collection infrastructure; continued to identify means to improve Soldier/Small Combat Unit (SCU) physical, network, software, interoperability, and conducted human integration testing within system of systems platform without impacting the development and integration of concurrent future warrior technologies; completed technical performance evaluation assessment of integrated survivability, lethality, microclimate cooling, physiologic monitoring, and power and energy technologies within current and emerging small unit operational and technical architectures; and conducted virtual and live simulations to evaluate rapidly configured and reconfigured modular network architectures as well as command and control information systems.</p> <p>In FY09, develop and implement transportable assessment and demonstration Soldier subsystem modules to expedite component integration and technology maturation assessments conducted with Soldiers at operationally relevant field environments at FT Dix and FT Benning.</p>			5.281	5.492	.000	
<p>Integrated Soldier Protection (cont'd): This effort matures and demonstrates technologies to achieve improvements enabled by advanced integrated lightweight Soldier protective headgear and clothing.</p> <p>In FY10, will demonstrate Microclimate Cooling (MC) technologies from PE 0602786A/project H98; will conduct joint technical demonstration with JSTO-Chemical and Biological Defense (CBD) for advanced CB protection integrated with future Soldier systems technologies that provide little or no thermal burden to Soldier; will leverage emerging breadboard system from PE 0602786A/project H98 and incorporate advanced materials from PE 0602105A/project H84 to develop next generation Soldier-centric headgear concepts focused on enhanced protection against agile laser, ballistic, impact, and aural threats (battlefield noise), while enhancing integration of head-borne displays, sensors, and battle command applications.</p>			.000	.000	3.463	
<p>Soldier Mobility and Enhanced Load Carriage (cont'd): This effort matures and demonstrates technologies to achieve capability improvements enabled by wearable load-bearing equipment that assist in Warfighter strength and mobility.</p> <p>In FY10, will optimize and mature low power components to provide a lighter, more agile and efficient operation for a lightweight wearable individual load carrying and mobility aid (lower body system); will conduct mobility aid technical</p>			.000	.000	3.841	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
tests and field demonstrations with Director Combat Developments and Soldier Battle Lab, Ft. Benning for user feedback and to demonstrate performance; will develop operation and maintenance manuals to assist with rapid transition of technology solutions; and will conduct field investigations to optimize Soldier use of spatial information to enhance mobility (understand and remember user's movements during tasks for future exoskeleton replication purposes).						
Small Combat Unit C4 Interfaces (cont'd): This effort matures and demonstrates technologies to provide more durable Soldier displays and subsystems that provide greater situational awareness with less cognitive stress. In FY10, will examine interfacing and interference characteristics of targeted wireless protocols with emerging communication devices in relevant field environments; will design Soldier systems interface to enable robotic control and image dissemination across the squad.			.000	.000	6.418	
Soldier Power and Energy (cont'd): This effort matures and demonstrates technologies to achieve capability improvements in lightweight high-energy and density Soldier power and power management components and subsystems. In FY10, will conduct user assessments of multiple hybrid power systems (reformed methanol, direct methanol) in simulated combat settings for 24 and 72 hour missions; will demonstrate integration of micro electrical-mechanical systems based JP-8 burner with a Stirling engine which enables self-contained power capability. Effort is coordinated with PE 0602705/project H11, H94.			.000	.000	3.336	
Soldier Ballistic and Blast Protection (cont'd): This effort matures and demonstrates technologies to achieve capability improvements enabled by test devices and protocols to protect against blast and ballistic threats. In FY10, will mature system level assessment protocol and test devices test for transition to PM Soldier Equipment and industry; will leverage ballistic and blast protective materials from PE 0602786A/project H98 and PE 0602105A/project H84 to demonstrate enhanced ballistic and blast protection system for thorax area. Will mature and demonstrate breadboard enhanced helmet for next generation armor system. This task collaborates with DoD Medical Research Program for Prevention, Mitigation and Treatment of Blast Injuries and leverages and integrates technologies developed in PEs 0602786A/project H98 & 0602787A/project 878.			.000	.000	4.611	
Small Unit Lethality Integration (cont'd): This effort matures and demonstrates technologies for capability improvements in lighter weight, more energy efficient Soldier-borne computing and communication equipment. In FY10, will miniaturize Soldier-borne gunfire detection system; investigate data filtering of information to improve network performance; will fuze air and ground sensor assets with Soldier borne network to detect and identify targets and			.000	.000	3.436	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology			<b>PROJECT NUMBER</b> J50	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
pass information to target identification network; will investigate strategies to minimize time of digital call for fire and lethal effects. Effort is coordinated with PE 0603004/project 232.						
Small Unit Systems Integration and Demonstration (cont'd): This effort matures and demonstrates technologies that support upgrades to fielded Soldier equipment. In FY10, will continue to improve simultaneous constructive, virtual and live simulation toolset to provide enhanced assessment of the integration capability of maturing technologies such as Soldier borne hardware, software, network, lethality, survivability components and systems; will continue to develop and evaluate modular open architecture for dismounted Soldiers to facilitate integration across potential network sources and will assess maturity of Soldier-borne technologies including simulation tools in field relevant environment. Effort is coordinated with PE 0603004A/project 232.			.000	.000	4.951	
Total			35.256	36.333	30.056	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology					<b>PROJECT NUMBER</b> J52	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
J52: WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	23.134	29.702	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Warfighter Advanced Technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Remote Environmental Monitoring and Diagnostics in the Perishables Supply Chain							4.351	.000	.000	
Ration Packaging Materials and Systems for Meals Ready-to-Eat							4.443	3.488	.000	
Multifunctional Protective Packaging Technology							2.898	.000	.000	
High-Pressure/Microwave MRE Processing							1.546	1.550	.000	
Deployment of Affordable Guided Airdrop System							1.546	.000	.000	
Extended Shelf Life Produce for Remotely Deployed Forces							.774	.000	.000	
Flame & Thermal Protection for Individual Soldier							1.546	3.100	.000	
High Pressure Airbeam Shelter Cost Reduction Technology Improvements							1.392	.000	.000	
ChemBio Integrated Material for Tent Structures							1.546	.000	.000	
Joint Precision Airdrop System (JPADS) Program for Payloads up to 30K lbs							3.092	.000	.000	
Technology and Human Systems Integration							.000	2.325	.000	
Multi-layer Coextrusion for High Performance Packaging							.000	2.325	.000	
Ballistic Precision Aerial Delivery System (BPADS)							.000	.969	.000	
Novel Flame Retardant Nylon Fabrics							.000	1.163	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Chemical and Biological Threat Protection Coating			.000	2.325	.000	
Compact, Day and Night CMOS for Mini and Micro UAVs			.000	1.938	.000	
Improved Lightweight Integrated Communication and Hearing Protection Device			.000	.775	.000	
Aerial Firefighting - Precision Container Aerial Delivery System (PCADS)			.000	2.247	.000	
Compact MVCC Soldier Coding System			.000	1.550	.000	
Precision Guided Airdropped Equipment			.000	3.565	.000	
Laser Studied & Enhanced Reactive Materials :Self-Decontaminating Polymers for CBD			.000	1.550	.000	
SBIR/STTR			.000	.832	.000	
Total			23.134	29.702	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology					<b>PROJECT NUMBER</b> 242	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
242: AIRDROP EQUIPMENT	4.029	3.788	3.811						Continuing	Continuing

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

This project matures and demonstrates equipment and innovative techniques for aerial delivery of cargo and personnel. Aerial delivery is a key capability for rapid force projection and global precision delivery and provides a long-range, autonomous airdrop capability with the option to deliver separate and distinctive payloads to multiple locations with improved accuracy; enhancing cargo, crew, and aircraft survivability.

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Medium Precision Airdrop: This effort demonstrates a 30,000 lbs. precision airdrop capability. In FY08, successfully demonstrated full-scale concept for guided, autonomous, precision medium (30,000 pound) airdrop payload for the Joint Precision Airdrop Delivery System (JPADS).	4.029	.000	.000	
Advanced Precision Airdrop Enhancements: This effort demonstrates enhancements required for dropping cargo loads to precise locations and increasing the precision of delivery using components and technical breakthroughs from PE 0602786A/project 283. In FY09, mature, demonstrate and optimize latest Guidance, Navigation & Control (GN&C) airdrop technologies in a precision airdrop concept designed for accurate resupply in complex, mountainous terrain with small, challenging drop zones; provide hardware and software GN&C component upgrades to demonstrate GN&C technology improvements in all weight classes of the Joint Precision Airdrop Delivery System (JPADS) family. In FY10, will mature and demonstrate emerging GN&C component technologies and spiral promising GNC components candidates for transition to PM Force Sustainment Systems (PM-FSS).	.000	3.701	3.811	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.087	.000	
<b>Total</b>	<b>4.029</b>	<b>3.788</b>	<b>3.811</b>	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603001A Warfighter Advanced Technology					<b>PROJECT NUMBER</b> 543	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
543: AMMUNITION LOGISTICS	1.290	1.271	1.353						Continuing	Continuing

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

This project matures and demonstrates technologies for rapid munitions deployability, resupply, and unused ammunition returned from deployment for the Army's Future Force. It enhances force readiness and reduces the logistics footprint through improvements in Materials Handling Equipment (MHE), ammunition and missile packaging/palletization, and asset throughput/management.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Component of the Joint Modular Intermodal Distribution System (JMIDS) Joint Capability Technology Demonstration (JCTD): This effort demonstrates a lightweight modular platform compatible with restraint systems on military cargo planes, and airdrop and slung lift systems. In FY08, conducted residual evaluation of Joint Modular Intermodal Platform (JMIP) with field users as part of the JCTD.	.500	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.028	.000	
Tactical Ammunition Accountability (TAA): This effort demonstrates advanced supply chain procedures coupled with state of the art remote surveillance devices at the weapon system/munition level to provide precise knowledge of ammunition, location and health status through out an Area Of Responsibility (AOR). In FY08, developed low cost environmental sensors, both automated and visual indicators, for munition health monitoring at the point of consumption: conducted industry search of available hand held devices suitable for remote inventory activities. In FY09, develop and validate software interface for tactical ammunition management systems and integrate with health monitoring sensors.	.790	1.243	1.353	

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<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will fabricate an automated expenditure reporting capability prototype mounted on surrogate weapon system; will demonstrate ammunition consumption transactions from weapons system to Army's property recording system.				
Total	1.290	1.271	1.353	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603002A MEDICAL ADVANCED TECHNOLOGY					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	299.436	321.260	72.940						Continuing	Continuing
FH4: FORCE HEALTH PROTECTION - ADV TECH DEV	1.932	2.065	1.963						Continuing	Continuing
MB1: ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	1.545	.000	.000						Continuing	Continuing
MB2: BRAIN, BIOLOGY, AND MACHINE	1.933	1.594	.000						Continuing	Continuing
MB3: CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	7.729	7.975	.000						Continuing	Continuing
MB4: CENTER FOR UNTETHERED HEALTHCARE	.000	.996	.000						Continuing	Continuing
MD1: EMERGENCY TELEMED RESPONSE & ADV TECH	1.933	.000	.000						Continuing	Continuing
MF2: ADVANCED PROTEOMICS (CA)	1.158	.000	.000						Continuing	Continuing
MG5: NATIONAL FUNCTIONAL GENOMICS CENTER (CA)	8.116	5.980	.000						Continuing	Continuing
MG7: ON-LINE MEDICAL TRAINING (CA)	.000	2.791	.000						Continuing	Continuing

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>	
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>				
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603002A MEDICAL ADVANCED TECHNOLOGY				
MH4: RAPID BIO-PATHOGEN DETECTION TECHNOLOGY (CA)	3.865	.000	.000					Continuing	Continuing
MH9: ADVANCE OF NON-INVASIVE GLUCOSE MONITORING (CA)	.773	.000	.000					Continuing	Continuing
MI4: ALLIANCE FOR NANOHEALTH (CA)	3.865	3.190	.000					Continuing	Continuing
MJ2: FIBRINOGEN BANDAGES FOR BATTLEFIELD WOUNDS (CA)	.000	2.990	.000					Continuing	Continuing
MK1: MEDICAL M&S THROUGH SYNTHETIC DIGITAL GENES (CA)	1.545	.996	.000					Continuing	Continuing
MK7: PEDIATRIC BRAIN TUMOR & NEUROLOGICAL DISEASE PRGM	1.545	.000	.000					Continuing	Continuing
MK8: PLASMA STERILIZER (CA)	2.898	.000	.000					Continuing	Continuing
ML3: SOLDIER-MOUNTED EYE-TRACKING & CONTROL SYSTEM (CA)	2.899	4.983	.000					Continuing	Continuing
ML5: SURGICAL WOUND DISINFECTION & BIO AGENT DECON PROJ	1.545	.000	.000					Continuing	Continuing

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Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification							DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603002A MEDICAL ADVANCED TECHNOLOGY					
MM1: WEIGHT MEASUREMENTS & STANDARDS FOR MIL PERSONNEL	.000	1.994	.000						Continuing	Continuing
MM2: MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)	155.757	184.070	.000						Continuing	Continuing
MM3: WARFIGHTER MEDICAL PROTECTION & PERFORMANCE STDS	.000	.000	6.585						Continuing	Continuing
800: TELEMEDICINE TESTBED	5.241	4.079	.000						Continuing	Continuing
804: PROSTATE CANCER RSCH	2.319	2.392	.000						Continuing	Continuing
810: IND BASE ID VACC&DRUG	20.735	22.020	20.397						Continuing	Continuing
814: NEUROFIBROMATOSIS	7.729	9.967	.000						Continuing	Continuing
819: FLD MED PROT/HUM PERF	1.160	1.252	.000						Continuing	Continuing
840: COMBAT INJURY MGMT	22.488	29.433	43.995						Continuing	Continuing
938: Tissue Engineering	1.158	1.196	.000						Continuing	Continuing
945: BREAST CANCER STAMP PROCEEDS	2.082	.000	.000						Continuing	Continuing
954: DIGITAL X-RAY	3.092	.000	.000						Continuing	Continuing
	2.319	2.392	.000						Continuing	Continuing

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>							<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					
955: ASSISTIVE TECHNOLOGY										
97A: BIOSENSOR RESEARCH	1.545	.798	.000						Continuing	Continuing
97B: BLOOD SAFETY	1.933	1.595	.000						Continuing	Continuing
97D: CENTER FOR AGING EYE	1.545	1.595	.000						Continuing	Continuing
97T: NEUROTOXIN EXPOSURE TREATMENT	19.323	24.917	.000						Continuing	Continuing
97X: SYNCHROTRON-BASED SCANNING RESEARCH	7.729	.000	.000						Continuing	Continuing

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

This program element (PE) supports development of advanced medical technologies to mature medical technology (drugs, vaccines, medical devices, and diagnostics) and doctrine to effectively protect and improve the survivability of US Forces across the entire spectrum of military operations. Tri-Service coordination and cooperative efforts are focused in four principal medical areas: Combat Casualty Care, Military Operational Medicine, Militarily Relevant Infectious Diseases, and Clinical and Rehabilitative Medicine.

Activities funded in this PE are externally peer reviewed and, to prevent unnecessary duplication, fully coordinated with the other Services and agencies.

During this phase of development, promising medical technologies are refined and validated through extensive testing, which is closely monitored by the US Food and Drug Administration (FDA), as part of their process for approving new medical products for use in humans. The FDA requires medical products to undergo extensive pre-clinical testing in animals and/or other models to obtain preliminary efficacy and toxicity information, before they can be tested in humans (clinical trials). Clinical trials are conducted in three phases, starting with Phase 1, to prove the safety of a drug, vaccine, or device for the targeted disease or medical condition in a small number of healthy volunteers. Each successive phase includes larger numbers of human subjects and requires FDA approval prior to proceeding. Work conducted in this PE primarily focuses on technology maturation activities required to obtain FDA approval prior to initiating human efficacy (Phase 2) clinical trials. Some high risk technologies may require additional maturation and FDA approval to initiate pivotal human (Phase 3) clinical trials prior to obtaining licensure and transitioning into a formal acquisition program. Activities in the PE may include completion of pre-clinical animal studies and studies involving human volunteers.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b>		<b>R-1 ITEM NOMENCLATURE</b>		
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		PE 0603002A MEDICAL ADVANCED TECHNOLOGY		
<p>The PE contains no duplication with any effort within the Military Departments, and is related to, and fully coordinated with the United States Army Natick Soldier Research, Development and Engineering Center regarding work in blast research that enables improved body armor design and rations for Soldiers. Work funded in this project is fully coordinated with efforts undertaken in PE 0602787A.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this PE is performed by Walter Reed Army Institute of Research, Silver Spring, MD; US Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; US Army Research Institute of Environmental Medicine, Natick, MA; US Army Institute of Surgical Research, Fort Sam Houston, TX; US Army Aeromedical Research Laboratory, Fort Rucker, AL; the Naval Medical Research Center, Silver Spring, MD; US Army Center for Environmental Health Research; and US Army Medical Research Detachment, Brooks City Base, TX, and the Armed Forces Institute of Regenerative Medicine, Fort Detrick, MD.</p>				
<b><u>B. Program Change Summary (\$ in Millions)</u></b>				
	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>
Previous President's Budget	299.676	59.043	57.249	
Current BES/President's Budget	299.436	321.260	72.940	
Total Adjustments	-.240	262.217	15.691	
Congressional Program Reductions	.000	-1.063		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	263.280		
Total Reprogrammings	8.062	.000		
SBIR/STTR Transfer	-8.302	.000		
<b><u>Change Summary Explanation</u></b>				
FY09 funding increase is due to congressional adds.				
FY10 funds were increased to fund Medical Blast Trauma Research.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> FH4	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
FH4: FORCE HEALTH PROTECTION - ADV TECH DEV	1.932	2.065	1.963						Continuing	Continuing

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

This project matures, validates, and supports enhanced Force Health Protection of Soldiers against threats in military operations and training. Health-monitoring tools are matured to rapidly identify deployment stressors that affect the health of Joint Forces. These databases and systems enhance the Department of Defense's (DoD's) ability to monitor and protect against adverse changes in health, especially mental health effects caused by changes in brain function. Force Health Protection work is conducted in close coordination with the Department of Veterans Affairs. The program is maturing the development of global health monitoring (e.g., development of neuropsychological test methodologies), validating clinical signs and symptoms correlating to medical records, diagnosed diseases, and mortality rates. The key databases supporting this program are the Millennium Cohort Study and the Total Army Injury and Health Outcomes Database. These databases allow for the examination of interactions of psychological stress and other deployment and occupational stressors that affect Warfighter health behaviors.

This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services.

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

Work in this project is performed by the US Army Center for Environmental Health Research, Fort Detrick, MD, the US Army Research Institute of Environmental Medicine, Natick, MA, and the Naval Health Research Center, San Diego, CA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.058	.000	
Health Research: Includes validation of interventions developed from the Millennium Cohort study(a prospective health project in military servicemembers designed to evaluate the long-term health effects of military service, including deployments), validation of biomarkers of exposure and methods to detect environmental contamination and toxic exposure, and validation of thoracic injury prediction models of blast exposure.	1.932	2.007	1.963	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> FH4	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, completed enrollment for Millennium Cohort Study and conducted analyses on data validity, reliability, as well as mental and functional health outcomes. In FY09, conduct a systematic validation of prospective data to correlate relationships in chronic health effects and multi-symptomatic illnesses, drawing from disability database analysis to isolate causes, and implement and track results for the most promising interventions to fight chronic disabilities. In FY10, will validate thoracic blunt trauma and performance decrement models by comparing with data obtained from large animal exercise studies; will conduct data analysis to correlate relationships in Post-Traumatic Stress Disorder (PTSD), depression, and anxiety symptoms among Millennium Cohort participants in conjunction with increased mental and physical health problems; will validate prototype Environmental Sentinel Biomonitor (ESB) system for use with field drinking water production systems and transition to advanced development.				
Total	1.932	2.065	1.963	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MB1		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
MB1: ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	1.545	.000	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Advanced Diagnostic and Therapeutic Digital Technologies development.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Diagnostic and Therapeutic Digital Technologies								1.545	.000	.000	
Total								1.545	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MB2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MB2: BRAIN, BIOLOGY, AND MACHINE	1.933	1.594	.000						Continuing	Continuing

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

Congressional Interest Item funding for brain, biology and machine advanced technology development.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Brain, Biology and Machine Applied Research	1.933	1.549	.000	
SBIR/STTR	.000	.045	.000	
Total	1.933	1.594	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MB3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MB3: CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	7.729	7.975	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for the Center for the Integration of Medicine and Innovative Technology.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Center for the Integration of Medicine and Innovative Technology (CIMIT)						7.729	7.752	.000		
SBIR/STTR						.000	.223	.000		
Total						7.729	7.975	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MB4		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
MB4: CENTER FOR UNTETHERED HEALTHCARE	.000	.996	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for the Center for Untethered Health Care.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Center for Untethered Health Care								.000	.968	.000	
SBIR/STTR								.000	.028	.000	
Total								.000	.996	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY	<b>PROJECT NUMBER</b> MD1
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
MD1: EMERGENCY TELEMED RESPONSE & ADV TECH	1.933	.000	.000						Continuing	Continuing

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

Congressional Interest Item funding for the National Bioterrorism Civilian Medical Response Center.

**B. Accomplishments/Planned Program (\$ in Millions)**

	FY 2008	FY 2009	FY 2010	FY 2011
National Bioterrorism Civilian Medical Response Center (CIMERC)	1.933	.000	.000	
<b>Total</b>	<b>1.933</b>	<b>.000</b>	<b>.000</b>	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MF2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MF2: ADVANCED PROTEOMICS (CA)	1.158	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Advanced Proteomics.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Proteomics Program							1.158	.000	.000	
Total							1.158	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MG5	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MG5: NATIONAL FUNCTIONAL GENOMICS CENTER (CA)	8.116	5.980	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Functional Genomics.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
National Functional Genomics Center							5.797	5.812	.000	
National Functional Genomics Study							2.319	.000	.000	
SBIR/STTR							.000	.168	.000	
Total							8.116	5.980	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MG7	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MG7: ON-LINE MEDICAL TRAINING (CA)	.000	2.791	.000						Continuing	Continuing

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

Congressional Interest Item funding for Online Medical Training.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Online Medical Training for Miliatry Personnel	.000	2.713	.000	
SBIR/STTR	.000	.078	.000	
Total	.000	2.791	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MH4: RAPID BIO-PATHOGEN DETECTION TECHNOLOGY (CA)	3.865	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Rapid Bio-pathogen Detection technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Health Science Center Rapid Bio-Pathogen Detection Technology							3.865	.000	.000	
Total							3.865	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MH9	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MH9: ADVANCE OF NON-INVASIVE GLUCOSE MONITORING (CA)	.773	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Advanced Non-Invasive Glucose Monitoring.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Advanced Non-Invasive Glucose Monitoring						.773	.000	.000		
Total						.773	.000	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MI4	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MI4: ALLIANCE FOR NANOHEALTH (CA)	3.865	3.190	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for the Alliance for NanoHealth.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Alliance for NanoHealth							3.865	3.101	.000	
SBIR/STTR							.000	.089	.000	
Total							3.865	3.190	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MJ2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MJ2: FIBRINOGEN BANDAGES FOR BATTLEFIELD WOUNDS (CA)	.000	2.990	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Fibrin Adhesive Stat (FAST) Dressing technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Fibrin Adhesive Stat (FAST) Dressing							.000	2.906	.000	
SBIR/STTR							.000	.084	.000	
Total							.000	2.990	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MK1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MK1: MEDICAL M&S THROUGH SYNTHETIC DIGITAL GENES (CA)	1.545	.996	.000						Continuing	Continuing

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

Congressional Interest Item funding for Medical Modeling and Simulation advanced technology development.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Medical Modeling and Simulation Through Synthetic Digital Genes	1.545	.968	.000	
SBIR/STTR	.000	.028	.000	
Total	1.545	.996	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MK7		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
MK7: PEDIATRIC BRAIN TUMOR & NEUROLOGICAL DISEASE PRGM	1.545	.000	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for the Pediatric Brain Tumor & Neurological Disease Institute.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Pediatric Brain Tumor & Neurological Disease Institute								1.545	.000	.000	
Total								1.545	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MK8	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MK8: PLASMA STERILIZER (CA)	2.898	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Plasma Sterilizer advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Plasma Sterilizer							2.898	.000	.000	
Total							2.898	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> ML3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
ML3: SOLDIER-MOUNTED EYE-TRACKING & CONTROL SYSTEM (CA)	2.899	4.983	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Biosensor Communicator and Controller System advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Biosensor Communicator and Controller System							2.899	4.843	.000	
SBIR/STTR							.000	.140	.000	
Total							2.899	4.983	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> ML5		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
ML5: SURGICAL WOUND DISINFECTION & BIO AGENT DECON PROJ	1.545	.000	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Surgical Wound Disinfection and Biological Agents.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Surgical Wound Disinfection and Biological Agents								1.545	.000	.000	
Total								1.545	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											
<b>E. Performance Metrics</b>											
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MM1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MM1: WEIGHT MEASUREMENTS & STANDARDS FOR MIL PERSONNEL	.000	1.994	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Weight Measurements and Standards for Military Personnel.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Weight Measurements and Standards for Military Personnel						.000	1.939	.000		
SBIR/STTR						.000	.055	.000		
Total						.000	1.994	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MM2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MM2: MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)	155.757	184.070	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Medical Advanced Technology Initiatives.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Regenerative Medicine Development							1.932	.000	.000	
ALS Therapy Development for Gulf War Illness Research							1.160	.000	.000	
Cooperative International Neuromuscular Research Group (CINRG)							5.023	.000	.000	
Electronic Medical Records Technology Infrastructure							1.160	.000	.000	
COG/USOC Pediatric Cancer Center							1.546	.000	.000	
Obesity and Cancer in the Military Medical Research Program at WRAMC							1.546	.000	.000	
PBRC Four Tasks to Address Personnel Readiness and Warfighter Performance							1.933	.000	.000	
Prader-Willi Syndrome (PWS) Research							1.450	1.550	.000	
Remote Bio-Medical Detector							.967	1.938	.000	
Robotic Telesurgery Research							3.382	.000	.000	
Peoria Robotics							.967	.000	.000	
Gulf War Illness Peer Reviewed Research							9.660	7.750	.000	
Military Biomaterials Institute for Acute and Regenerative Care							.773	.000	.000	
Advanced Regenerative Medicine Therapies for Combat Injuries							.000	2.906	.000	
Portable Autonomous Fluid-less Near-infrared Non-Invasive Alcohol Testing Devices							.000	.484	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY			<b>PROJECT NUMBER</b> MM2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Controlled Release of Anti-Inflammatory & Tissue Repair Agents f/Prosthetic Devices & Burn Treatment			.000	5.813	.000	
Corneal Wound Repair			.000	5.328	.000	
Center of Cardiac Surgery Robotic Computerized Telemanipulation			.000	1.550	.000	
Chronic Tinnitus Treatment Program			.000	.969	.000	
Infectious and Inflammatory Disease Center at the Burham Institute for Medical Research			.000	2.325	.000	
Institute of Surgical and Interventional Simulation (ISIS)			.000	4.262	.000	
Bioelectrics Research for Casualty Care and Management			.000	1.550	.000	
Advanced Medical Multi-Missions and CASEVAC Roles			.000	.775	.000	
Automated and Portable Field System for the Rapid Detection and Diagnosis of Diseases			.000	1.550	.000	
Brain Interventional-Surgical Hybrid Initiative			.000	1.550	.000	
101st Airborne Injury Prevention & Performance Enhancement Research Initiative			.000	1.938	.000	
Blood, Medical & Food Safety Via Eco-Friendly Wireless Sensing			.000	.969	.000	
International Heart Institute/U.S. Army Vascular Graft Research Project			.000	.969	.000	
Military Burn Trauma Research Program			.000	3.875	.000	
Military Nutrition Research: Personnel Readiness and Warfighter Performance			.000	1.550	.000	
Modular Stethoscope For Harsh Environments			.000	1.163	.000	
Novel Approaches to Reduce the Severity of Battlefield Combined Tissue Injury			.000	1.550	.000	
Safe Airway Access in Combat			.000	1.938	.000	
Smart Prosthetic Hand Technology			.000	1.550	.000	
Solutions for Infection Control in Military Hospitals			.000	1.938	.000	
Staph Vaccine			.000	3.875	.000	
Biodefense Tech Transfer Initiative			.000	1.453	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE: May 2009</b>			
<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>	<b>PROJECT NUMBER</b>			
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	PE 0603002A MEDICAL ADVANCED TECHNOLOGY	MM2			
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Extremity War Injury Research Foundation	.000	.775	.000		
Limb Regeneration Through Biometrics Technology	.000	.775	.000		
Linear Accelerator Cancer Research	.000	.775	.000		
Mary Bird Perkins Cancer Center	.000	2.325	.000		
Mass Scale Biosensor Threat Diagnostic for In-Theater Defense Utilization (FIU)	.000	1.550	.000		
Midwest Traumatic Injury Rehabilitation Center	.000	1.414	.000		
MUSC Cancer Genomics Research Collaborative	.000	.775	.000		
Oncology Group Pediatric Cancer Research (CH)	.000	1.550	.000		
Prostate and Ovarian Cancer Biomarkers	.000	1.163	.000		
Proteomics Project (CH-LA)	.000	1.163	.000		
Rehabilitation and Assistive Technologies to Enhance the Life of Individuals with Disabilities	.000	.775	.000		
Strattice Dermal Matrix Research	.000	2.325	.000		
Trauma Hemostat	.000	.775	.000		
Returning Soldier Adjustment Assessment Remote Monitoring System	.000	3.023	.000		
Green Environmentally Sustainable Laboratories and Clean Rooms (USAMRMC)	.000	.775	.000		
Battlefield Nursing Program	.000	1.550	.000		
Intensive Care Unit to Intensive Care Hospital	.000	2.325	.000		
Total Quality System for FDA Regulated Activities Database	.000	1.395	.000		
Accelerating Treatment for Trauma Wounds	.000	1.163	.000		
Military Adult Stem Cell Collection and Storage Project	.000	.775	.000		
Medical Errors Reduction Initiative	.000	.387	.000		
Joint Collaborative Medical Information System (JCMIS)	.000	3.100	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE: May 2009</b>			
<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>	<b>PROJECT NUMBER</b>				
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	PE 0603002A MEDICAL ADVANCED TECHNOLOGY	MM2				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>		
Southeast Nebraska Cancer Center-National Functional Genomics Center	.000	1.163	.000			
Personal Status Monitor (Nightengale)	.000	1.938	.000			
Smart Prosthetics Research	.000	1.550	.000			
Anti-Terror Medical Technology Program	.000	2.713	.000			
Hibernation Genomics	.000	1.938	.000			
SBIR/STTR	.000	5.155	.000			
Advanced Regenerative Medicine (ARM) Skin Cell Therapies, Limb and Digit Treatment	1.837	.000	.000			
Battlefield Exercise and Combat Related Spinal Cord Injury Research	2.898	.775	.000			
Bioceramic Bones for Battlefield Trauma	1.546	.000	.000			
Cartledge Infuser	.966	.000	.000			
Cellular Therapy for Battlefield Medical Care	.773	1.550	.000			
Center for Genetic Origins of Cancer	2.319	2.325	.000			
Christian Sarkine Autism Treatment Center	1.932	.000	.000			
Combat Wound Initiative at Walter Reed Army Medical Center	1.932	1.550	.000			
Composite Tissue Allotransplantation Research and Clinical Program	1.932	1.550	.000			
Dangerous Pathogens DNA Forensics Center	1.932	.000	.000			
Feeding Tube for Trauma and Burn Patients	.483	1.550	.000			
Host Pathogen Interaction Study	.966	3.100	.000			
Human Genomics, Molecular Epidemiology and Clinical Diagnostics for Infectious Diseases	1.159	1.124	.000			
Immersive Medical Environment for Distributed Intuitive Consultation (iMedic)	1.449	.000	.000			
Indiana-Ohio Traumatic Amputation Rehabilitation Research	.966	.000	.000			
Medical Surveillance Initiative-Clinical Looking Glass	.773	.775	.000			

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE: May 2009</b>			
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2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	PE 0603002A MEDICAL ADVANCED TECHNOLOGY	MM2			
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Military Molecular Medicine Initiative	11.590	.000	.000		
Mobile Integrated Diagnostic and Data Analysis System (MIDDAS)	.773	.000	.000		
National Eye Evaluation and Research Network - Clinical Trial of Orphan Retinal Degenerative Disease	2.318	.000	.000		
National Oncogenomics and Molecular Imaging Center	2.897	3.100	.000		
National Warfighter Health Sustainment Study	.773	.775	.000		
Neural Control of External Devices	.966	.000	.000		
Neuroimaging & Neuropsychiatric Trauma in US Warfighters	3.863	4.844	.000		
Norfolk State University Center for Systems and Modeling & Simulation	2.395	.000	.000		
Nursing Clinical Simulation Lab	.966	.000	.000		
Personalized Orthopedic Implants for Combat Trauma Induced Orthopedic Surgery	.483	.000	.000		
Portable Burn Debridement Laser Demonstration	2.318	.000	.000		
Severe Battlefield Injury Treatment	1.546	.000	.000		
Telepharmacy Robotic Medicine Device Unit	1.546	1.356	.000		
The Institute for the Advancement of Bloodless Medicine	1.546	1.550	.000		
Three Dimensional Projection Environment for Molecular Design and Surgical Simulation	.966	.000	.000		
Tracking of Health of Soldiers with Advanced Implantable Nanosensors	1.546	.000	.000		
Advanced Medical Training Platform: Madigan Army Medical Center	.386	.000	.000		
Battlefield Tracheal Intubation for Wounded Soldiers	1.546	4.069	.000		
BEAR (Battlefield Extraction-Assist Robot)	1.546	.000	.000		
Burns Outcomes Infrastructure Project-Only for Dual Military/Civilian Application	2.319	.000	.000		
Integrated Patient Quality Program	1.546	1.550	.000		
Limb Tissue Regeneration after Battlefield Injuries Using Bone Marrow Stem Cells	3.866	2.906	.000		

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2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	PE 0603002A MEDICAL ADVANCED TECHNOLOGY	MM2			
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
National Biodefense Training	1.691	4.844	.000		
Post-IED Craniofacial Injury Reconstruction	1.546	.000	.000		
Rugged Electronic Textile Vital Signs Monitoring	1.546	2.906	.000		
Control of Inflammation and Tissue Repair (CITR)	1.546	3.100	.000		
Trauma Care, Research and Training	1.932	2.325	.000		
U.S. Approved Drugs for Malaria and Leshmaniasis for Military and Civilian Personnel	3.286	.000	.000		
Walter Reed Preventive Medicine Pilot Program	5.315	.000	.000		
Maine Institute for Human Genetics	.484	1.550	.000		
University of Kentucky Robotic Surgery Research	1.932	.000	.000		
University of Kentucky Tissue Repair Research	.967	.000	.000		
Joint Medical Simulation Technology Research & Development Center	1.237	.000	.000		
Pneumothorax Detection Device	1.160	.000	.000		
Targeted Radiation Therapy for Cancer Initiative	.967	.000	.000		
Telehealth Access and Infrastructure Expansion	1.546	.000	.000		
Ultra High-Speed MEMS Electromagnetic Cell Sorter	2.319	2.325	.000		
Warfighter Cancer Care Engineering	1.160	2.325	.000		
Institute for Regenerative Medicine	2.319	2.906	.000		
Wireless Electronic Patient Records, WPIC-Personal Information Center	1.932	3.100	.000		
Integrated Functional Materials Initiative	.967	.775	.000		
Medical Information Network Decision Support (MINDS) Tool Development	.967	.000	.000		
National Center of Ophthalmology Training and Educational Wills Eye Health System	1.933	.969	.000		
Rural Health - CERMUSA	1.546	2.325	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY			<b>PROJECT NUMBER</b> MM2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Spinal Muscular Atrophy (SMA) Research Program			3.092	3.100	.000	
Ultra-High Resolution Display for Army Medicine			3.478	3.875	.000	
Veterinary Research Manpower Development for Defense			.484	.000	.000	
Acellular Matrix Constructs for Military Casualties			1.932	.000	.000	
Advanced Lower Limb Prosthesis for Battlefield Amputees			2.898	1.550	.000	
Advanced Restoration Therapies in Spinal Cord Injuries			.966	1.938	.000	
Advanced Surface Technologies for Prosthetic Development			1.546	1.550	.000	
Total			155.757	184.070	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> MM3	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
MM3: WARFIGHTER MEDICAL PROTECTION & PERFORMANCE STDS	.000	.000	6.585						Continuing	Continuing

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

This project supports the Medical and Survivability technology areas of the future force with laboratory validation studies and field demonstrations of biomedical products designed to protect, sustain, and enhance Soldier performance in the face of a myriad of environmental, physiological stressors, and materiel hazards encountered in training and operational environments. This effort focuses on demonstrating and transitioning technologies and validated tools associated with biomechanical-based health risks, injury assessment and prediction, Soldier survivability, and performance during continuous operations. The three main thrust areas are (1) Physiological Health and Environmental Protection, (2) Injury Prevention and Reduction, and (3) Psychological Health and Resilience. This project contains no duplication with any effort within the Military Departments, and includes direct participation by other Services. Beginning in FY10, projects 800 and 819 will be consolidated into project MM3.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, and the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Injury Prevention and Reduction (transferred from project 819 (Physical Performance Enhancement)): Validation of injury prediction tools for brain, spine, and thoracic injury from blast, blunt, and ballistic impact. In FY10, will field test loading assessment system for the prediction of spinal injury; will validate thoracic blunt trauma and performance decrement models by comparing with data obtained from large animal exercise studies; will validate a battery of Soldier performance tests based on common Soldiering tasks.	.000	.000	3.356	
Psychological Health and Resilience: Validation of neuro-cognitive assessment and brain injury detection methods. Validate tools and pre-clinical methods to treat Post-Traumatic Stress Disorder in a military population. In FY10, will conduct field study to determine the extent to which baseline psychological and neurological functioning impacts resilience and sensitivity to concussion.	.000	.000	.869	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> MM3	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Physiological Health and Environmental Protection (transferred from project 800 (Sleep Research/Environmental Monitoring): Validation of physiological awareness and prediction tools for Soldier performance in extreme environments. In FY10, will transition heat strain decision aid to US Army Ranger School; will refine hydration sensor technologies and conduct early prototype evaluations.	.000	.000	2.360	
Total	.000	.000	6.585	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 800	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
800: TELEMEDICINE TESTBED	5.241	4.079	.000						Continuing	Continuing

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

This project funds the advancement and validation of prototype advanced concepts and enabling technology pertaining to Force Health Protection. Major efforts include collaborative tools for mission planning and rehearsal that enable deployment of optimally tailored medical support for a deployed force; medical command and control; and forward echelon telemedicine presence. The current focus provides increased situational awareness of the operational and health risks of fatigue, exposure to environmental toxins (toxic industrial chemicals and materials), and enabling technologies for reducing these risks. Beginning FY10, project 800 will be consolidated into project MM3.

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

Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Sleep Research/Environmental Monitoring: Efforts focus on the evaluation of fatigue countermeasures to validate methods used to mitigate the effects of fatigue and sleep loss that adversely affects the Soldier's ability to sustain both health and performance during prolonged military operations. In FY08, conducted laboratory clinical studies of the efficacy of nontraditional fatigue countermeasures (drug interventions) for restoring cognitive performance during extended periods of sleep loss (i.e., cognitive enhancers). The cognitive test capacities include decision making, situational awareness, and judgment. In FY09, conduct studies to validate whether cognitive enhancers are effective fatigue countermeasures (mobile health monitoring system) in an operational environment. Demonstrate validity of near real-time wireless squad and personal area networks (Spartan Sensor Network) to improve situational awareness of Soldiers during training by modeling hydration and heat strain using physiological and weather data. Demonstrate value of network-enabled predictive biomedical modeling in training mission planning and real-time mission support. Beginning FY10, this effort will be transferred to project MM3 (Physiological Health and Environmental Protection).	5.241	3.965	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.114	.000	
<b>Total</b>	<b>5.241</b>	<b>4.079</b>	<b>.000</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY	<b>PROJECT NUMBER</b> 800
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 804	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
804: PROSTATE CANCER RSCH	2.319	2.392	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item for Prostate Cancer research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
UMDNJ Cancer Initiative							2.319	2.325	.000	
SBIR/STTR							.000	.067	.000	
Total							2.319	2.392	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 810	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
810: IND BASE ID VACC&DRUG	20.735	22.020	20.397						Continuing	Continuing

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

This project demonstrates and matures US Food and Drug Administration (FDA) regulated medical countermeasures such as drugs, vaccines, and diagnostic systems to naturally occurring infectious diseases that are threats to US military deployed forces. The focus of the program is on prevention, diagnosis, and treatment of diseases that can adversely impact military mobilization, deployment, and operational effectiveness. Prior to licensure of a new drug or vaccine to treat or prevent disease, the FDA requires testing in human subjects. Studies are conducted stepwise: first to prove the product is safe in humans, second to demonstrate the desired effectiveness and optimal dosage in a small study, and third to demonstrate effectiveness in large, diverse human populations. All test results are submitted to FDA for evaluation to ultimately obtain approval (licensure) for medical use. This project supports studies for safety and effectiveness testing on small study groups after which they transition to the next phase of development for completion of studies in larger populations. The project also supports testing of personal protective measures that can reduce disease transmission from biting insects and other vectors to include products such as repellents and insecticides which are regulated by the U. S. Environmental Protection Agency (EPA).

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

- (1) **Drugs to Prevent/Treat Parasitic (symbiotic relationship between two organisms) Diseases:** Select promising malaria and leishmaniasis (a skin-based disease transmitted by sand flies) drug candidates for testing in human subjects, and prepare data packages required for FDA approval of testing in humans and conduct testing. Studies have shown that the malaria parasite can become resistant to existing drugs, which makes it necessary to continually research new and more effective treatments.
- (2) **Vaccines for Preventing Malaria:** Select candidate vaccines; prepare data packages required for FDA approval of testing in humans, and conduct testing of promising malaria vaccine candidates in human subjects. A malaria vaccine against the severe form of malaria (plasmodium falciparum) and the less severe but relapsing form (plasmodium vivax) would be another means of protection against malaria. A malaria vaccine could also minimize the progression of drug resistance and poor Warfighter compliance with taking preventive anti-malarial drugs.
- (3) **Bacterial Threats:** Select promising candidate vaccines against each of the three bacterial causes of diarrhea (a significant threat during initial deployments) and meningococcal vaccine candidates (a threat to trainee and deployed troops and military families) for testing in human subjects, prepare data packages required for FDA approval and conduct testing in human subjects.
- (4) **Viral Threats:** Select most promising vaccine candidates for testing in human subjects against dengue fever (a severe debilitating disease caused by a virus and transmitted by a mosquito) and hantavirus (severe viral infection that causes internal bleeding and is contracted from close contact with rodents). Conduct FDA-required nonclinical safety and protection testing (laboratory-based) in animals, prepare FDA-investigational new drug data packages to allow clinical testing of candidate vaccines in humans to proceed.
- (5) **Diagnostics and Disease Transmission Control:** Conduct human subject testing of FDA-regulated field medical diagnostic devices and EPA-approved insect control measures.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 810	
<p>Research is conducted in compliance with FDA regulations for medical products for human use and EPA-regulations for insect control products that impact humans or the environment (e.g., repellents and insecticides). Work is managed by the US Army Medical Research and Materiel Command. The Army is responsible for programming and funding infectious disease research within the Department of Defense.</p> <p>Promising medical countermeasures identified in this project are further matured under PE 0603807A, project 808.</p> <p>Work is managed by the US Army Medical Research and Materiel Command. 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.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, MD, and its overseas laboratories; the US Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; and the Naval Medical Research Center, Silver Spring, MD, and its overseas laboratories.</p>				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Drugs to Prevent/Treat Parasitic Diseases: In FY08, conducted safety testing in humans (30 volunteers, 8-month trial) of one antimalarial drug and assessed two existing drugs for effectiveness in treating leishmaniasis (a skin-based disease transmitted by sand flies). In FY09, down select between two candidate drugs for leishmaniasis treatment (Amphotericin B and Nitric Oxide). Conduct proof-of-concept study to demonstrate whether current antimalarial drug (Malarone) dosing schedule can be extended to reduce drug cost while maintaining effective protection from infection. Test in humans (20 volunteers) a Chloroquine-tinidazole combination drug at overseas locations to assess effectiveness against the liver (relapsing) form of vivax malaria. In FY10, if results support, will expand Malarone testing in an increased number of humans, and continue studies with a Chloroquine-tinidazole combination drug.	3.704	3.328	3.891	
Vaccines for Prevention of Malaria: In FY08, finalized a multicomponent candidate malaria vaccine for larger scale testing in human volunteers. Began preclinical testing of a new vivax malaria vaccine. In FY09, proceed with first-in-human testing of protein-based candidate vivax malaria vaccine upon approval by FDA of study application. Refine the formulation of the falciparum malaria vaccine. Conduct initial testing in humans to demonstrate effectiveness of candidate vaccines. Vaccines found safe and effective will transition into advanced development. In FY10, will partner with industry to conduct initial safety and small-scale effectiveness testing in humans of a new falciparum malaria vaccine candidate; will forward promising candidate vaccines for further testing in larger populations where malaria occurs naturally, such as Africa; will initiate vivax malaria candidate vaccine testing in humans pending FDA approval.	4.925	4.428	4.812	
	6.506	7.320	6.659	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 810	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Bacterial Threats: In FY08, continued with ongoing testing in humans of candidate vaccines (100 volunteers, 12-month trial), including a second-generation oral dysentery vaccine if the current candidate fails in testing. Performed clinical trials (20-40 volunteers, 6-12 month trial) of two additional diarrheal vaccines. In FY09, conduct larger scale testing in humans for effectiveness of Shigella component (Invaplex) diarrheal vaccine candidate (200 volunteers) to determine effectiveness and optimal dosing. Conduct human volunteer testing (20-40 volunteers) of a genetically modified single component meningitis vaccine. In FY10, will conduct larger scale testing of Shigella component (Invaplex) candidate vaccine; will begin safety and effectiveness trial of live attenuated Shigella vaccine; will begin E. coli vaccine candidate safety and effectiveness testing in humans; in conjunction with partners, will prepare the meningococcal Group B multicomponent vaccine for testing in humans.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.509	.000	
Viral Threats Research: In FY08, continued ongoing human volunteer testing of multiple hemorrhagic virus vaccines including testing of broad-spectrum hantavirus (200 volunteers, 18-month trial) and dengue vaccines (70 volunteers, 6-month trial). In FY09, conduct human volunteer testing of hemorrhagic Hanta virus. Test several dengue candidate vaccines in humans (70 volunteers) to select most promising technologies. In FY10, will conduct larger scale testing in humans of the hantavirus vaccine; will down-select to most safe and effective dengue vaccine candidate based on larger scale studies (120 volunteers).	3.903	4.035	2.505	
Diagnostics and Disease Transmission Control: In FY08, continued to conduct clinical testing of medical diagnostic device for dengue, and field testing of insect control measures with potential completion of several components of the sand fly control tools for Preventive Medicine Units (PMUs). Conducted human subject trials in collaboration with commercial partners to support development of an FDA-approved, field-deployable point-of-care (for clinical use) diagnostic device for cutaneous leishmaniasis (a skin-based disease transmitted by sand flies) and an FDA-approved diagnostic test for latent infection (without signs of clinical disease) with Leishmania parasites. In FY09, work with commercial partner on an improved bed net. Complete testing and transition of selected components of sand fly control tools, such as screening tests to PMUs. Refine and test insect repellent to replace Diethylmetatoluamide or DEET (current ingredient in military insect repellent) in collaboration with commercial partners. Conduct testing of hospital-based leishmaniasis diagnostic device and field-deployable point-of-care diagnostic device for leishmaniasis, dengue and rickettsia diseases. In FY10, will test a new repellent and begin evaluation of field deployable tests to detect infectious organisms within insects that cause sand fly fever, Q-fever, and dengue fever. For diagnostics, will validate results of testing for leishmaniasis, dengue and Rickettsial disease devices. Will modify the Leishmania infection hospital-based	1.697	2.400	2.530	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 810	
<b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
diagnostic test technology to be compatible with Joint Biological Agent Identification Diagnostic System (JBAIDS) platform.				
Total	20.735	22.020	20.397	
<b><u>C. Other Program Funding Summary (\$ in Millions)</u></b> N/A				
<b><u>D. Acquisition Strategy</u></b> N/A				
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 814	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
814: NEUROFIBROMATOSIS	7.729	9.967	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Neurofibromatosis research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Neurofibromatosis (NF) Research						7.729	9.688	.000		
SBIR/STTR						.000	.279	.000		
Total						7.729	9.967	.000		
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 819	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
819: FLD MED PROT/HUM PERF	1.160	1.252	.000						Continuing	Continuing

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

The objective of this project is to support the Medical and Survivability technology areas of the Future Force with laboratory validation studies and field demonstrations of biomedical products designed to protect, sustain, and enhance Soldier performance in the face of a myriad of environmental, physiological stressors, and materiel hazards encountered in training and operational environments. This effort focuses on identifying stressors and validating methods for assessing risk to the Soldier due to both physical and operational stressors. Effort matures and demonstrates methodologies and tools associated with biomechanical-based health risks, injury assessment/prediction, Soldier survivability, and performance during continuous operations. In FY10, project 819 will be consolidated into project MM3.

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

Work in this project is performed by the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Physical Performance Enhancement: In FY08, validated a method to evaluate pre- and post-deployment physical status (i.e., body composition, performance, and muscle strength). In FY09, validate an integrated longitudinal model for predicting individual Soldier and unit musculoskeletal injury and adverse physical performance outcomes. Beginning in FY10, this effort will be transferred to the Injury Prevention and Reduction research area of project MM3.	1.160	1.216	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.036	.000	
<b>Total</b>	<b>1.160</b>	<b>1.252</b>	<b>.000</b>	

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

N/A

**D. Acquisition Strategy**

N/A

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY	<b>PROJECT NUMBER</b> 819

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 840	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
840: COMBAT INJURY MGMT	22.488	29.433	43.995						Continuing	Continuing

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

This project matures, demonstrates, and validates promising medical technologies and methods to include control of severe bleeding, treatment for traumatic brain injury (TBI), revival and stabilization of trauma patients, and prognostics and diagnostics for life support systems. Post-evacuation medical research focuses on continued care and rehabilitative medicine leveraging recent innovations in regenerative medicine and tissue engineering techniques for extremity (arms and legs), facial/maxillary (jaw bone), and ocular (eye) trauma.

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

- (1) Hemorrhage (bleeding) Control, Blood, and Resuscitative Fluids: Includes work required to validate safety and effectiveness of drugs and medical procedures to maintain metabolism, minimize inflammation (swelling), including blocking Complement activation (a series of disease fighting proteins and reactions) from damaging healthy cells of the body, and prevent or minimize secondary organ failure (including brain and spinal cord injury) after major trauma. Beginning in FY10, funding shifts to the Damage Control Resuscitation research area below.
- (2) Damage Control Resuscitation: Includes work required to validate safety and effectiveness of drugs and medical procedures to maintain metabolism, minimize harmful inflammation, including blocking Complement activation (a series of disease fighting proteins and reactions) from damaging healthy cells of the body and prevent or minimize secondary organ failure (including brain and spinal cord injury) after major trauma; this research area starts in FY10.
- (3) Combat Trauma Therapies: Includes work required to validate safety and effectiveness of drugs, biologics (products derived from living organisms), and medical procedures intended to minimize immediate and long-term effects from battlefield injuries.
- (4) Far-Forward Medical Systems: Includes diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation, stabilization, life support, and dental care. Beginning in FY10, dental care moves to Combat Trauma Therapies and the remaining research in this area will be captured under Combat Critical Care Engineering.
- (5) Combat Casualty Bioinformatics and Simulation: Includes testing and validation of a data management system to capture and analyze data, such as heart and respiration rates. Bioinformatics research will merge into the Combat Critical Care Engineering research area in FY10.
- (6) Combat Critical Care Engineering: Includes diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation, stabilization, and life support; this research area starts in FY10.
- (7) Clinical and Rehabilitative Medicine: Includes clinical studies of restoration of function and appearance by regenerating skin, muscle, and bone tissue in battle-injured casualties. Areas of interest include healing without scarring, repair of compartment syndrome (nerve or tendon constriction in an enclosed space), replacement skin, and facial reconstruction; this research area starts in FY10.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 840	
<p>All research is conducted in compliance with US Food and Drug Administration (FDA) requirements for licensure of medical products for human use.</p> <p>Promising efforts identified through applied research conducted under PE 0602787A, project 874, are further matured under this project. Promising results identified under this project 840 are further matured under PE 0603807A, project 836.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the US Army Institute of Surgical Research, Fort Sam Houston, TX; the Walter Reed Army Institute of Research, Silver Spring, MD; and the Armed Forces Institute of Regenerative Medicine, Fort Detrick, MD.</p>				
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.821	.000	
Combat Critical Care Engineering: In FY10, will complete FDA safety study of fluid resuscitation algorithms; will submit FDA data package for the fully integrated automated fluid resuscitation system; will collaborate with manufacturers to integrate oxygen and ventilation systems; will transition stroke volume algorithm to advanced development for integration with new monitors for triage decision support; and will conduct studies for development of a model (algorithm) for early indication of circulatory collapse from severe blood loss.	.000	.000	3.091	
Combat Trauma Therapies: In FY08, conducted expanded FDA safety/efficacy/dosing studies of neuroprotectant drugs in humans, completed clinical validation of brain trauma biomarkers, and identified potential, mature tissue regeneration methods through the Armed Forces Institute of Regenerative Medicine (AFIRM). In FY09, upon approval by FDA, begin an initial FDA safety study in 200 humans of neuroprotectants (brain trauma research is coordinated with related efforts in PE 0602787A, project 878); begin extensive, multicenter, clinical validation of the most promising tissue regeneration treatment regimens through AFIRM; and conduct evaluation of new and existing antibacterial compounds for use in controlling infection. In FY10, will complete initial FDA safety studies in humans of neuroprotectants and a diagnostic device for brain trauma; will refocus dental disease research to facial restorative surgery; will begin research in eye trauma to evaluate current repair treatment for improvement and evaluate new alternatives as they are identified; and will expand existing in-house capability for human safety and effectiveness testing on newly identified treatments and therapies for battlefield trauma for human use of medical products.	3.666	10.318	16.991	
Far-Forward Medical Systems: In FY08, completed clinical testing of the automated ventilation algorithm for operating room and intensive care settings and began initial, FDA-approved safety study in humans for an antimicrobial, antiplaque	5.076	7.849	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 840	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
chewing gum. In FY09, establish relationships with industry developing oxygen and ventilation systems for future validation; initiate a human subject safety study of fluid resuscitation algorithms; begin building interfaces for use with either the Army's integrated litter or the Navy's lightweight trauma module for casualty transport; and complete prototype and data analysis of a field medic diagnostic device to enhance casualty treatment on the battlefield. Beginning in FY10, dental care moves to Combat Trauma Therapies and the remaining research in this area will be captured under Combat Critical Care Engineering.				
Damage Control Resuscitation: In FY08 and FY09, funding was within the Hemorrhage Control, Blood, and Resuscitation Fluids program area. In FY10, will begin safety and effectiveness testing in humans of freeze-dried plasma and platelet products to control severe bleeding; will conduct additional studies in larger animals to identify optimal timing, dose and mechanisms of action of plasma, clotting factors and CIs in combination.	.000	.000	14.688	
Hemorrhage Control, Blood, and Resuscitative Fluids: In FY08, continued animal studies using combinations of products (freeze-dried plasma, synthetic red blood cells, activated Factor VII, and fibrinogen) and treatment strategies to determine which combinations best control all forms of bleeding; and continued Platelet Derived Hemostatic Agent (PDHA) clinical studies to determine potential to increase survival; determined best transfusion and storage practices for blood products, and began safety and effectiveness clinical trial of complement inhibitor (CI) in trauma patients with severe hemorrhage. In FY09, continue to evaluate combinations of products and treatment strategies to best control all forms of bleeding; evaluate safety and effectiveness of freeze dried plasma in an animal model; analyze PDHA data from safety and effectiveness test in human subjects. Beginning in FY10 the work will be funded under Damage Control Resuscitation.	13.204	9.600	.000	
Combat Casualty Bioinformatics and Simulation: In FY08, completed revisions of algorithms intended to enhance recovery of usable physiological data and validated use of high-frequency features of electrophysiological signals (electrical measurements of body function) to predict the need for a lifesaving intervention (LSI). In FY09, complete prototype development and test validity of an algorithm that incorporates low- and high-frequency signals for an automated decision assist tool used by medical personnel to identify a need for a specific LSI. Bioinformatics research will merge into the Combat Critical Care Engineering research area in FY10.	.542	.845	.000	
Clinical and Rehabilitative Medicine: In FY10, will conduct regenerative medicine studies using human subjects to demonstrate stable engraftment and restoration of sensory-motor function of transplanted limbs and facial skin, fat transfer	.000	.000	9.225	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
therapy to manage burn scarring, implantation of engineered cartilage ear transplants, and use of a strain-reducing dressing to reduce wound scarring.				
Total	22.488	29.433	43.995	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 938	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
938: Tissue Engineering	1.158	1.196	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Tissue Engineering research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Angiogenesis and Tissue Engineering Research							1.158	1.163	.000	
SBIR/STTR							.000	.033	.000	
Total							1.158	1.196	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 954		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
954: DIGITAL X-RAY	3.092	.000	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Digital X-ray advanced technology development.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Portable Digital X-Ray								3.092	.000	.000	
Total								3.092	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A											
<b>D. Acquisition Strategy</b> N/A											
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 955	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
955: ASSISTIVE TECHNOLOGY	2.319	2.392	.000						Continuing	Continuing

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

Congressional Interest Item funding for Assistive Technology.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Assistive Technology Research Center at the National Rehabilitative Hospital	2.319	2.325	.000	
SBIR/STTR	.000	.067	.000	
Total	2.319	2.392	.000	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 97A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
97A: BIOSENSOR RESEARCH	1.545	.798	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Biosensor research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Technologies for Metabolic Monitoring (TMM)							1.545	.775	.000	
SBIR/STTR							.000	.023	.000	
Total							1.545	.798	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 97B	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
97B: BLOOD SAFETY	1.933	1.595	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Blood Safety advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Blood Safety and Decontamination Technology							1.933	1.550	.000	
SBIR/STTR							.000	.045	.000	
Total							1.933	1.595	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 97D	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
97D: CENTER FOR AGING EYE	1.545	1.595	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Low Vision research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Military Low Vision Research							1.545	1.552	.000	
SBIR/STTR							.000	.043	.000	
Total							1.545	1.595	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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**Exhibit R-2a, PB 2010 Army RDT&E Project Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603002A MEDICAL ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 97T	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
97T: NEUROTOXIN EXPOSURE TREATMENT	19.323	24.917	.000						Continuing	Continuing

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

Congressional Interest Item funding for Neurotoxin Exposure Treatment.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Neurotoxin Exposure Treatment Parkinsons Research Program	19.323	24.219	.000	
SBIR/STTR	.000	.698	.000	
<b>Total</b>	<b>19.323</b>	<b>24.917</b>	<b>.000</b>	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
97X: SYNCHROTRON-BASED SCANNING RESEARCH	7.729	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Synchrotron-based scanning research.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Proton Beam Therapy							7.729	.000	.000	
Total							7.729	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	99.457	106.285	60.097						Continuing	Continuing
BA7: AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	47.287	44.214	.000						Continuing	Continuing
BA8: VECTORED THRUST DUCTED PROPELLER (CA)	.000	4.983	.000						Continuing	Continuing
313: ADV ROTARYWING VEH TECH	39.254	45.797	39.458						Continuing	Continuing
435: AIRCRAFT WEAPONS	2.323	2.679	2.704						Continuing	Continuing
447: ACFT DEMO ENGINES	10.593	8.612	17.935						Continuing	Continuing

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

This program element (PE) matures and demonstrates manned and unmanned rotary wing vehicle (RWV) technologies to enable Army transformation. Within this PE, aviation technologies are matured and integrated into realistic and robust demonstrations. The PE supports the maturation and demonstration of enabling component and subsystems for rotorcraft in the following areas: rotors, drive trains, structures and survivability (project 313), weapons integration (project 435), mission equipment packages to enable control of unmanned systems (project 436) and affordable and efficient engines (project 447). Projects BA7 and BA8 fund congressional special interest items.

Work in this PE is related to and fully coordinated with PE 0602211A (Aviation Technology), PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603270A (Electronic Warfare Technology). Efforts under this PE transition to programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development), and PE 0604270A (Electronic Warfare Development).

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.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY
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Work in this PE is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) with facilities located at Redstone Arsenal, AL; Fort Eustis, VA; and Moffett Field, CA.

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	98.899	57.277	69.597	
Current BES/President's Budget	99.457	106.285	60.097	
Total Adjustments	.558	49.008	-9.500	
Congressional Program Reductions	.000	-.352		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	49.360		
Total Reprogrammings	3.221	.000		
SBIR/STTR Transfer	-2.663	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.  
Multiple task reductions in FY10 to reduce growth.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> BA7	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
BA7: AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	47.287	44.214	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Aviation advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
UAV-Resupply (BURRO)							1.931	1.163	.000	
Excalibur							2.318	.000	.000	
Technologies for Military Equipment Replenishment							3.864	3.488	.000	
Joint Technical Data Integration-Wide Intelligent Content Enhancements							3.864	.000	.000	
Cutting Tools for Aerospace Materials							1.158	.775	.000	
Fuel Cells for Mobile Robotic Systems Project							2.319	.775	.000	
Improved VAROC/UAV Compression System Development							2.319	.000	.000	
Universal Control Full Authority Digital Engine Control (FADEC)							2.898	3.100	.000	
Alternate Payload Bomb Live Unit Munition							2.165	.000	.000	
Drive System Composite Structural Component Risk - Reduction Program							2.319	2.325	.000	
Helmet Mounted Display/Visor Projection for Army Helicopters							1.546	.000	.000	
Integrated Aircraft Test Bed							1.546	.000	.000	
Quick-MEDS Automated Release Pod							1.546	.775	.000	
Autonomous Cargo Acquisition for Rotorcraft Unmanned Aerial Vehicles							2.319	2.325	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY			<b>PROJECT NUMBER</b> BA7	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Inter Turbine Burner for Turbo Shaft Engines			3.864	3.100	.000	
Night Vision Goggle Compatible Electrostatically Conductive Windscreen Laminates for use on Acrylic/			1.160	.000	.000	
Power Dense Transmissions			.774	1.240	.000	
Enhanced Rapid Tactical Integration and Fielding of Systems			1.546	1.550	.000	
Parts-on-Demand for CONUS Operations			3.478	4.843	.000	
Next Generation Ice Protection Technologies for UAVs			1.937	1.550	.000	
FC3, FCS Reconnaissance (UAV) Platforms			2.416	.000	.000	
Heavy Fuel Burning Engines for UAVs			.000	1.938	.000	
Reconfiguration Tooling System			.000	1.550	.000	
Mission Execution Technology Impementation			.000	3.100	.000	
Defense Helicopter Power Dense Transmission			.000	1.240	.000	
Non-Hazardous Infrared Anti-Reflective Coatings for Army Aircraft Sensors			.000	1.163	.000	
Helicopter Vulnerability Reduction			.000	2.325	.000	
Brownout Sensor Visualization and Hazard Avoidance System			.000	.775	.000	
Improved Black Hawk De-Icing			.000	.775	.000	
Army Aviation Weapon Technology			.000	.775	.000	
UAS Sense and Avoid Concept Evaluation for Airspace Integration			.000	2.325	.000	
SBIR/STTR			.000	1.239	.000	
Total			47.287	44.214	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY	<b>PROJECT NUMBER</b> BA7
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> BA8	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
BA8: VECTORED THRUST DUCTED PROPELLER (CA)	.000	4.983	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Vectored Thrust Ducted Propeller Compound Helicopter.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Vectored Thrust Ducted Propeller Compound Helicopter (pending transfer to 0643801)							.000	4.844	.000	
SBIR/STTR							.000	.139	.000	
Total							.000	4.983	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 313	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
313: ADV ROTARYWING VEH TECH	39.254	45.797	39.458						Continuing	Continuing

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

This project matures and demonstrates systems/subsystems for manned/unmanned rotorcraft that provide, improved survivability, greater performance or lessen the operational costs and required maintenance. Systems demonstrated include rotors, drivetrains, robust airframe structures and integrated threat protection systems.

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

Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Fort Eustis, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Affordable Turbine Engine (AATE): In FY09 complete detailed design activities for several engine components (e.g. compressor, turbine, combustor and mechanical systems). Related work is also being conducted in project 447	.000	2.781	.000	
Rotor Design and Capabilities: This program determines the performance benefits of advanced rotors through the evaluation of alternative designs aimed to satisfy future force capability needs for increased system durability, speed, range and payload. In FY08, matured and demonstrated passive and active control methods for improving rotorcraft performance in a heavy vibration environment. Investigated benefit, design implications and limitations of the Optimum Speed Rotor (OSR) technology when applied to rotorcraft of different classes and mission types. Evaluated high lift technologies that provide rotor systems with improved aero performance, while enhancing damage tolerance. Characterized advanced main rotor hub concepts compatible with on-blade rotor control systems, leading to increased rotorcraft performance. Evaluated the applicability of candidate technologies to current airframes. In FY09, demonstrate high lift technologies that provide rotor systems with improved aero performance, reduced vibrations and noise. Utilize impact models and component tests to select rotor durability solutions for demonstration and fielding. Design and demonstrate a rotor system for reliable transfer of data and power across the rotating and nonrotating interface for applications such as de-icing, on-blade controls and health and usage monitoring systems. Characterize Optimum Speed	12.969	16.035	14.554	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY			<b>PROJECT NUMBER</b> 313	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Rotor system performance through rigorous flight testing. In FY10, will begin to characterize acoustic properties of Optimum Speed Rotor (OSR) through flight testing and demonstrate full flight envelope. Will conduct component testing for rotor durability technologies. Will conduct whirl stand and wind tunnel testing on full-scale rotor blades to demonstrate high performance rotor technologies that improve aeromechanical performance, reduce acoustic detection and reduce vibration.						
Integrated Aircraft and Crew Protection: This effort demonstrates combined rotorcraft platform durability and survivability improvements through a fully optimized and integrated structure, vehicle management system (VMS), and rotors/subsystems technology integration program. In FY10, will conduct a series of platform system trade studies to identify the sensitivities of technology contributions to battlefield and operational survivability from structures, rotors, subsystems, and vehicle management systems areas.			.000	.000	1.954	
Real-time Airspace Collision-Avoidance and Teaming (REACT): This program evaluates, integrates, demonstrates, and flight tests real-time airspace deconfliction and collision avoidance technologies. In FY10, will mature the Army tactical airspace model for systems engineering analysis of potential airspace deconfliction and collision avoidance methods and will demonstrate and evaluate improved airborne and ground control station based real-time situational awareness displays.			.000	.000	1.480	
High Altitude Long Endurance (HALE) Platforms: This effort represents the Army's contribution to an Air Force managed Joint Capabilities Technology Demonstration (JCTD) to demonstrate an unmanned, high altitude, long endurance surveillance system. In FY08, conducted first flight and began expansion of envelope to demonstrate endurance, durability, maintainability and structural life. Evaluated manning schemes to determine optimum ground personnel support requirements. In FY09, refine flight characteristics and demonstrate air vehicle endurance, foot-print, and turn time (time to prepare vehicle for next mission). Demonstrate payload performance and data assimilation and storage. Validate military utility of air vehicle in concert with ground control station and military operators. Work on this effort is performed in coordination with PE's 1160401BB, 1160428BB, 0604857F, 0603160BR, and 0207434F during execution of the Global Observer JCTD.			7.500	7.500	.000	
Enhanced Rotorcraft Drive System (ERDS): This program demonstrates advanced rotorcraft drive technologies that will increase the horsepower-to-weight ratio, reduce drive system noise, reduce production, operating and support costs and provide automatic component impending failure detection. In FY08, fabricated helical face gears, gears for the enhanced power density tail rotor gearbox, and composite shafts. Conducted demonstration testing of the composite gearbox			3.947	4.765	3.596	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 313	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
housing. In FY09, complete fabrication of helical face gear components. Conduct demonstration testing of the helical face gear design. Begin demonstration tests of the composite shaft/coupling, composite main rotor drive shaft and tail rotor enhanced power density gears. Validate diagnostic algorithms as part of the demonstration tests. In FY10, will conduct over-torque fatigue testing of the tail rotor enhanced power density gears. Will complete endurance and over-torque testing of the helical face gears. Will complete demonstration testing of the composite housings and composite shaft/coupling.				
Capability-Based Operations and Sustainment Technologies (COST): Mature and demonstrate technologies that improve the operational availability of rotorcraft while reducing operating and support (maintenance) costs. In FY08, expanded the existing engine diagnostic models to include continuous on-board power availability calculations, prognostic models, and advanced control models to allow the pilot to continuously know the engine power available, allow calculation of engine component efficiencies during flight to predict the remaining life of components and scheduling of maintenance and enable the modification of the engine control laws to optimize engine performance. Developed and validated diagnostic/prognostic algorithms for electrical subsystems. In FY09, mature and refine engine algorithms by testing a turboshaft engine in a controlled, instrumented test cell. Perform full-scale testing, on a rotor test stand, of rotor head, flight controls and bearings to verify/validate the newly developed algorithms. Initiate regression testing of software (evaluating the algorithms' functionality and interoperability with other software and sensor inputs using simulated flight test data) in preparation for system integration and flight testing. Demonstrate prognostication of remaining service life of damage tolerant airframe components. In FY10, will integrate engine, flight control, electrical and rotor technologies to demonstrate the feasibility of implementing the technologies as a single solution. System level data fusion techniques will be applied to increase accuracy and reduce false alarms. A system integration demonstration will be conducted in an avionics systems integration laboratory.	5.678	6.993	6.912	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	1.212	.000	
Adaptive Vehicle Management System (AVMS): The AVMS integrates advanced flight controls with real time aircraft state information to enable safe and low-effort maneuvering and real time adaptation to aircraft state changes (degradations, damage, mission, etc.). The AVMS will demonstrate technology to enable Level 1 (most acceptable) handling qualities in the entire flight envelope, reduce flight control line replaceable unit counts by over 20% and reduce flight control system weight. In FY10, will compile and identify technologies, including emerging 6.2 results and analyze the technology status and risk assessment of each for inclusion in the AVMS flight demonstration. Will generate a preliminary design of a baseline AVMS system for flight demonstration.	.000	.000	1.221	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 313	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Rotorcraft Survivability: These efforts increase rotorcraft survivability by reducing platform signatures as well as providing the means to jam enemy detection systems. This effort also enhances situational awareness allowing manned/ unmanned aircraft to avoid enemy air threats. In FY08, integrated a suite of candidate survivability technologies on a Black Hawk helicopter and performed flight tests to quantify the increase in threat detection range, as well as the reduction in the threats' lock-on range and targeting accuracy. Developed a fully-integrated aircraft self-protection suite for defeating current Man-Portable Air Defense System (MANPADS) threats, small arms and rocket propelled grenades (RPG), anti-tank guided missiles and laser designated threats, utilizing multi-function threat detection and threat countermeasures for reduced system weight and cost. In FY09 will develop a modular pod-based system for housing the laser jammer turret and hostile fire indication (HFI) sensors to collectively provide a universal B-kit for rotary wing platforms. In FY10, will complete development of lightweight, multi-function laser to counter MANPADS, small arms, RPG and laser designated threats through multi-band, infra-red and eye-safe visual energy. Work on this effort is also being accomplished under PE 0602270A, project 442 and PE 0603270A, project K16.	9.160	6.511	9.741	
Total	39.254	45.797	39.458	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 435	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
435: AIRCRAFT WEAPONS	2.323	2.679	2.704						Continuing	Continuing

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

This project matures, demonstrates and integrates manned and unmanned sensor and weaponization technologies such as advanced missiles, guns, fire controls, advanced target acquisition and pilotage sensors into Army aviation platforms. Efforts are directed toward reducing the integrated weight of weapons, increasing engagement ranges, providing selectable effects on a variety of threats, and enabling cost effective integration across multiple aviation platforms.

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

Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Redstone Arsenal, AL and Fort Eustis, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.059	.000	
Aviation Multi-Platform Munition (AMPM): Aircraft weapons efforts were consolidated in this project to focus technologies toward integrating a new lightweight weapon for use with both manned and unmanned rotorcraft systems. In FY08, conducted a Capabilities Based Assessment (CBA) in concert with the user community to identify technologies (such as launcher interface, weapon seeker and weapon motor) and approaches for improving sensor to shooter synergies across Army aviation operations. Matured the requirements definition for a new, lightweight weapon system for both manned and unmanned aviation platforms. Coordinated with the Naval Air Warfare Center, China Lake, to integrate the Navy's 5-lb SPIKE missile with the test-bed rotary wing Vigilante UAV. Issued a Request For Information (RFI) to industry and other military services to identify potential sources of new weapon systems suitable for integration on Army Aviation platforms. Received and reviewed 31 weapon concepts of which at least 7 are sufficiently mature for aircraft integration and live-fire testing. In FY09, develop and fabricate a Universal Test Pod (UTP) to support flight test evaluation of industry weapon systems. The UTP will integrate weapons using the Universal Armaments Interface (UAI) standard and will enable flight test and integration analysis of weapon concepts. Also conduct flight testing of the most promising industry candidate weapon systems in conjunction with scheduled Kiowa Warrior weapons pylon testing. In FY10, will develop and publish interface control documentation of weapons for multi-platform integration (based on CBA	2.323	2.620	2.704	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
results). Will develop weapon system engineering concept. Will solicit industry technical solutions and will develop key technologies.				
Total	2.323	2.679	2.704	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> 447	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
447: ACFT DEMO ENGINES	10.593	8.612	17.935						Continuing	Continuing

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

This project matures and demonstrates power system technologies through design, fabrication, and testing of advanced engine components in order to improve the performance of turbine engines. This project supports Army transformation by demonstrating mature technologies for lighter turbine engines that provide increased power, increased fuel efficiency, improved sustainability and reduced maintenance. The advanced engine will significantly improve the overall aircraft performance characteristics and reduce the logistical footprint of rotary wing aircraft.

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

Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), at Fort Eustis, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Affordable Turbine Engine (AATE) Tech (cont'd FY10): In FY10, will integrate core engine (compressor, combustor and gas generator turbine) components into a gas generator configuration and complete initial testing, verifying mechanical integrity of the core design. Will integrate power turbine and conduct first full engine test, establishing initial engine performance capability. Will validate component design modifications required for improved performance. Will complete final design iterations, based on analysis of test results, on identified components to support demonstration testing. Will refine an interim production and maintenance cost goal status assessment.	.000	.000	17.935	
Advanced Affordable Turbine Engine (AATE) Tech: Demonstrate a 3000 horsepower gas turbine engine for improved operational capability for Blackhawk, Apache, and other future rotorcraft. AATE includes two competitive engine demonstrator efforts (General Electric and Advanced Turbine Engine Company (ATEC), (Honeywell and Pratt & Whitney Joint Venture)). The AATE effort includes funding from project 313 to support competitive demonstrations. In FY08, completed preliminary design and executed detailed design and component fabrication tasks, building on knowledge gained in the DoD Versatile Affordable Advanced Turbine Engine effort. Design activity included 2-D and 3-D mechanical and aerothermal efforts to evaluate engine subcomponents. In FY09, complete initial rig-tests for several	10.593	8.397	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603003A AVIATION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> 447	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
engine components (e.g. compressor, turbine, combustor and mechanical systems) of the competing designs. Validate the design's aerodynamic performance and mechanical integrity, prior to an integrated, full-engine test. Analyze component rig-test results to support redesign efforts as required for future engine builds.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.215	.000	
Total	10.593	8.612	17.935	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	84.679	109.074	66.410						Continuing	Continuing
L94: ELECTRIC GUN SYS DEMO	9.298	11.539	11.731						Continuing	Continuing
L96: HIGH ENERGY LASER TECHNOLOGY DEMO	14.857	20.442	23.312						Continuing	Continuing
L97: SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	.991	1.022	1.012						Continuing	Continuing
232: ADVANCED MUNITIONS DEM	30.605	37.958	30.355						Continuing	Continuing
43A: ADV WEAPONRY TECH DEMO	28.928	38.113	.000						Continuing	Continuing

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

The objective of this program element (PE) is to mature and demonstrate advanced lethal and non-lethal weapons and munitions technologies to increase battlefield lethality. This PE supports the maturation and demonstration of enabling component and subsystems that provide: scalable lethal and non-lethal effects (project 232); key subsystems that enable an electromagnetic (EM) gun weapon system demonstrator (project L94); a tactical high energy laser weapon system demonstrator (project L96); and smoke and obscurant technologies to enhance platform and personnel survivability (project L97). Project 43A funds congressional special interest items.

Work in this PE is related to, and fully coordinated with, PE 0602624A (Weapons and Munitions Technology), PE 0602618A (Ballistics Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0602307A (Advanced Weapons Technology), PE 0602120A (Sensors and Electronic Survivability), and PE 0602622A (Chemical, Smoke, and Equipment Defeating 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.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology			
Work in this PE is performed by the Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey; Edgewood Chemical and Biological Center (ECBC), Edgewood, MD; and the Space and Missile Defense Command (SMDC), Huntsville, AL.					
<b><u>B. Program Change Summary (\$ in Millions)</u></b>					
	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>	
Previous President's Budget	85.981	73.697	76.273		
Current BES/President's Budget	84.679	109.074	66.410		
Total Adjustments	-1.302	35.377	-9.863		
Congressional Program Reductions	.000	-.363			
Congressional Rescissions	.000	.000			
Total Congressional Increases	.000	35.740			
Total Reprogrammings	.800	.000			
SBIR/STTR Transfer	-2.102	.000			
<b><u>Change Summary Explanation</u></b>					
All FY 2009 increases are due to congressional adds.					
FY10 funding was decreased due to transfers of Multi-mode High Power Microwave (HPM) and Laser Induced Plasma Channel (LIPC).					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology					<b>PROJECT NUMBER</b> L94	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
L94: ELECTRIC GUN SYS DEMO	9.298	11.539	11.731						Continuing	Continuing

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

This project matures and demonstrates electromagnetic (EM) armament subsystems and the enabling technologies for tactically relevant EM gun systems. This work complements and is fully coordinated with efforts in PE 0602618A/project H75 and PE 0601104A/project H56.

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

Work in this project is performed by the Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ, in cooperation with the Army Research Laboratory (ARL), Adelphi, MD, and The University of Texas at Austin, TX (a University Affiliated Research Center).

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>EM Gun System Demonstration: The primary objective of this effort is to reduce technical risk associated with EM Gun technology by demonstrating meaningful technical progress at the subsystem level. In FY08, built a lightweight cantilevered high fidelity (4 meter) railgun with integrated breech and muzzle shunt and demonstrated threshold performance at hypervelocity; completed ballistic test of a live fuzed launch package demonstrating functionality in an EM gun environment; confronted technical issue posed by cracks within composite banding of one pulsed alternator rotor, implementing analytical modeling to resolve the pulsed power supply (PPS) path forward. In FY09, conduct composite material analyses and structural validation tests of the rotor banding process and reassess PPS performance; complete manufacture and verification testing of the major rotating machine components and assemble the pulsed alternators and switch converters; test fire an integrated launch package with a high explosive, fuzed warhead from a laboratory EM gun. In FY10, will assemble and integrate the compact, twin counter-rotating pulsed alternator power supply, will conduct subsystem functional tests and will accomplish high fidelity breadboard PPS demonstrations that establish and validate requisite performance criteria; will prepare threshold/goal performance specifications and investigate long lead/alternative</p>	9.298	11.272	11.731	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology		<b>PROJECT NUMBER</b> L94	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
technologies to support evolutionary concepts for an integrated EM armament system prototype selected on best balance of technical achievability and military utility.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.267	.000	
Total	9.298	11.539	11.731	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology					<b>PROJECT NUMBER</b> L96	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
L96: HIGH ENERGY LASER TECHNOLOGY DEMO	14.857	20.442	23.312						Continuing	Continuing

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

This project matures and demonstrates advanced technologies for future force High Energy Laser (HEL) weapons technology. The major effort under this project is the development of a mobile one-hundred kilowatt (kW) class Solid State High Energy Laser Technology Demonstrator (HEL TD) that is traceable to the form, fit, and function requirements of the future force. At weapon system power levels of around 100 kW, Solid State Laser (SSL) technology has the potential to engage and defeat rockets, artillery and mortars, surface mines, anti-tank guided missiles (ATGMs), sensors, and optics. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems and without the need to strategically, operationally, or tactically stockpile ordnance. The HEL TD effort utilizes a modular building block approach with open systems architecture to ensure growth and interoperability. This modular approach ensures opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power, and Battle Management Command, Control, and Computers (BMC3). The SSL technology effort in PE 0602307A addresses technical issues such as high average power output from compact and more efficient lasers; precision optical pointing and tracking; laser effects degradation due to atmospheric effects; lethality against a variety of targets; and effectiveness against low-cost laser countermeasures.

Work in this project is related to, and fully coordinated with, efforts in PE 0602307A (Advanced Weapons Technology), PE 0602890D8Z (High Energy Laser Research), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), and PE 0603924D8Z (High Energy Laser Advanced Technology Program), PE 0605605A (DOD High Energy Laser Systems Test Facility), PE 0603005A/441 (Combat Vehicle and Automotive Advanced Technology), and PE 0603313A (Missile and Rocket Advanced Technology).

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

Work is performed by the US Army Space and Missile Defense Command Technical Center, Huntsville, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
High Energy Laser Technology Demonstrator (HEL TD): This effort matures and integrates solid state laser components and subsystems on a mobile platform to demonstrate a mobile 100kW class solid state High Energy Laser Technology Demonstrator.	14.857	19.870	23.312	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology			<b>PROJECT NUMBER</b> L96	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, completed the preliminary design of the HEL TD ruggedized Beam Control System (BCS), incorporating technologies that improve pointing accuracy and minimize jitter. These designs include structural and vibration support platform, beam steering and focusing mechanisms with on-board target acquisition, and functional software; purchased some long lead item procurements for mirror substrates, mirror assemblies, and other optics; and began HEL TD systems engineering efforts to enable the integration of technologies into a mobile and tactically relevant weapon system capability, including development of detailed system specifications and interface requirements. Developed detailed system requirements for power, thermal management, and BMC3 (includes Fire Control) and analyzed, assessed, and selected appropriate tactical vehicle platform.</p> <p>In FY09, continue HEL TD system engineering efforts; complete the BCS design and begin the fabrication, assembly, and functional testing.</p> <p>In FY10, will complete the fabrication, assembly, and testing of the BCS; will initiate effort to conduct low power HEL testing utilizing the BCS to begin dynamic shoot down test planning activities; and will continue the system-level preliminary design of the integrated HEL mobile demonstrator.</p>						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.572	.000	
<b>Total</b>			<b>14.857</b>	<b>20.442</b>	<b>23.312</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology					<b>PROJECT NUMBER</b> L97	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
L97: SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	.991	1.022	1.012						Continuing	Continuing

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

The project matures and demonstrates obscurant technologies that enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved advanced infra-red (IR) obscurants are developed with the goal of providing efficient and safe screening of deployed forces.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Obscurant Enabling Technologies: This effort demonstrates the dissemination of advanced infra-red (IR) obscurants. In FY08, matured, fabricated, and tested the single-mode grenade concept to meet TRL-6 requirements. In FY09, evaluate dissemination methods and conduct modeling and analysis of advanced IR obscurants for artillery and mortar applications. In FY10, will design bi-spectral obscurant prototypes for initial dissemination evaluations.	.991	.993	1.012	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.029	.000	
<b>Total</b>	<b>.991</b>	<b>1.022</b>	<b>1.012</b>	

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

N/A

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology	<b>PROJECT NUMBER</b> L97
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology					<b>PROJECT NUMBER</b> 232	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
232: ADVANCED MUNITIONS DEM	30.605	37.958	30.355						Continuing	Continuing

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

This project matures and demonstrates lethal and non-lethal enabling technologies for weapons and munitions such as advanced energetic materials, insensitive munitions, novel fuze designs, scalable warhead designs, pulsed laser sources and high power microwave systems. This project focuses on technologies that enable precision delivery of effects and increased affordability.

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

Work in this project is performed by the Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ, in cooperation with the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Ground Based Networked Munitions Technologies: This effort provides follow on increments of ground based munitions systems currently being developed with improved capabilities, including a non-lethal response. In FY09, conduct initial design for a delivery system capable of deploying existing and future ground based munition systems to a precise location once released from the primary delivery mechanism such as MLRS, UAS, Fixed and Rotary wing platforms, etc. The effort is working approaches to guide sensors, communication nodes and effects devices to the ground once released from the carrier, in a pattern that allows optimal interaction among the components, eliminates communications degradation and provides an optimal engagement pattern. Develop a concept that integrates technologies which allow precision emplacement of Intelligent Munitions Systems (IMS) from a standoff distance that is as effective as hand emplaced IMS (PE 654808/D016). Conduct a trade study to evaluate different approaches for low collateral self destruct. In FY10, will mature non-lethal layered response concept, focusing on a delivery methodology for COTS munitions; will demonstrate initial prototype capability for low collateral self destruct in the laboratory environment; will demonstrate a passive communications repeater approach in the laboratory while maturing a 40mm flare-based deployment concept. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624A/H19.	.000	3.113	2.933	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology		<b>PROJECT NUMBER</b> 232	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Fuze and Power for Advanced Munitions: This effort demonstrates technologies that reduce munition sizes while adding tailorable effects and improving advanced on-board munition power systems. In FY08, integrated electronic safe and arm devices (ESAD) subsystem. Conducted demonstration of gun launched multipoint warhead initiation. Conducted performance testing of micro electromechanical systems safe and arm (MEMS) (S&amp;A) device and MEMS impact switch performance in 155 mm projectile. For sensors: demonstrated gun launch RADAR proximity fuze capability in direct fire application, validated stand-off improvements and size reduction. Achieved mortar configuration for laser detection and ranging (LADAR) sensor using advanced laser and detector. For power: demonstrated prototype organic chemistry based liquid reserve batteries and thermal management battery improvements with flight tests in a gun-launched munition. In FY09, conduct instrumented ballistic and guided flight tests; demonstrate pre-programmed maneuver and guide-to-hit capabilities in a ten mature prototypes of precision guided 105mm projectile; and optimize tactical design of sensors and fuze technologies Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H18.</p>	4.750	3.543	.000	
<p>Dual Use Composites (DUC): This effort demonstrates the application of carbon/thermoplastic materials in a UAV shaped munition. In FY08, mature design of fuze to be integrated in composite material projectile. In FY09, integrate fuze into projectile; demonstrate projectile lethality in a lab environment. In FY09, integrate fuze with the DUC for the design and development of the first tube/rail launch miniature lethal UAV; demonstrate DUC UAV structural integrity; test demo of the miniature lethal UAV (perform reconnaissance of objective, loiter and engage target).</p>	.200	.600	.000	
<p>Kinetic Energy Active Protection System (KEAPS): This effort matures and demonstrates warhead and fuze safe and arming technology to support KEAPS which enhances the survivability of lightly armored vehicles. In FY09, mature warhead and fuze safe and arm (S&amp;A) device; demonstrate and validate their performance against primary class of threats and validate their performance against remaining classes of threats. Efforts described here are coordinated and complimentary to related efforts in PE 0602624/Project H28 and are developed and collaborated with efforts in PE 0603005A/project 221 and PE 0603313A/project 550.</p>	.000	4.393	.000	
Reliability for the Future Force:	.812	.995	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology		<b>PROJECT NUMBER</b> 232	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>This effort matures advanced physics-based stochastic methods to enhance the reliability of critical micro electromechanical systems (MEMS) and devices.</p> <p>In FY08, matured physics-based models of the MEMS critical components for both the MEMS inertial measurement unit and MEMS safe and arm (S&amp;A); matured design by determining the optimal initiation train formulation of S&amp;A (i.e., 1 or 2 pressed charges and their exact formulation and process).</p> <p>In FY09, define critical failure mechanisms through probabilistic physics-based modeling; create explicit and implicit physics-based failure modes; identify the uncertainties for each variable, developed probability models; perform sensitivity analysis and optimized design and process.; Develop probabilistic models for MEMS failure physics and develop reliability models for each failure mode building from sub-component and material levels up through component subassembly to integrated S&amp;A levels.</p>				
<p><b>Weaponization of Pulsed Laser Technologies:</b></p> <p>This effort matures and miniaturizes key directed energy (DE) technologies and subsystems to support DE weaponization with the potential to field leap-ahead capabilities in effectiveness and suitability. Laser Induced Plasma Channel (LIPC) uses a low energy femtosecond laser pulses with the unique capability to facilitate transmitting high voltage and/or radio frequency energy downrange to a target with tailored effects.</p> <p>In FY08, matured Laser Guided Energy (LGE) technology using femtosecond lasers to demonstrate feasibility at militarily relevant ranges. In addition, matured and demonstrated advanced solid state High Power Microwave (HPM) device designed to reduce the size and weight over that of existing solid state power HPM devices; and demonstrated HPM stackable, modular, and higher power density modules.</p> <p>In FY09, will model interaction between various directed energy sources and identify most mature LGE technology and will begin design to integrate compact solid state HPM and high voltage sources to obtain LGE in a directed energy weapon system demonstrator; Efforts described here are coordinated and complimentary to related efforts in PE/Projects: 0602624A/H18 and H19.</p>	6.225	5.172	.000	
<p><b>Common Smart Submunition (CSS):</b></p> <p>This effort pursues critical subsystem evaluations leading to system demonstrations of a submunition that offers increased operational efficiency through multiple kills per munition.</p> <p>In FY08, demonstrated full up functional CSS prototype submunitions at the suspended cable facility at Sandia; demonstrated sensor and algorithm technical maturity by carrying the sensor in an airborne platform for instrumented testing; verified laser radar and ranging/infrared (LADAR/IR) sensor and automatic target recognition (ATR)</p>	8.703	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology		<b>PROJECT NUMBER</b> 232	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
discrimination algorithms in a dynamic flight test; verified all ATR performance sub-sets such as registration, target detection, key feature extraction, and target recognition during the flight test; conducted evaluations of integrated systems in relevant environments; conducted demonstrations of warhead effectiveness when integrated with multiple systems; finalized interface design for warhead to support integration of warhead with the CSS submunition; conducted final demonstration of CSS with live warhead and self-destruct capabilities. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H18.				
<p><b>Tunable Pyrotechnics:</b> This effort demonstrates reactive energetic technologies that enable the Warfighter to have pyrotechnic munitions for countermeasure missions.</p> <p>In FY08, evaluated the efficacy of tunable pyrotechnic formulations by integrating and combining ignitable reactive materials, nanotechnology and pyrotechnic chemistry. Evaluated the key processes, products, and physical parameters.</p> <p>In FY09, use the successful candidate formulations and conduct energetic characterization, sensitivity studies, and initial prototype application for countermeasures and battlefield effects simulators; develop and test low visibility infrared (IR) decoy flare compositions to protect aircraft from IR guided missiles without revealing aircraft position during night operations; and conduct signature and performance measurements on new nano pyrophoric and pyrotechnic formulations.</p> <p>In FY10, will test enhanced primer and tracer compositions; will mature countermeasure formulation; will integrate formulation into prototype decoys to demonstrate effectiveness against specific threat systems; will demonstrate battlefield effects by testing prototype battlefield effects simulators; will demonstrate feasibility of tunable compositions in battlefield effects.</p>	1.032	2.571	2.959	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.776	.000	
<p><b>Extended Area Protection and Survivability (EAPS):</b> This effort demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery and mortar rounds.</p> <p>In FY08, integrated projectile design based on results of comparison and demonstration firings between a course correcting projectile (round A) and an in-flight forward detonating projectile (round B).</p> <p>In FY09, demonstrate separately EAPS components: course correction, warhead, and auto gun subsystems; evaluate command operated course correction and warhead detonation through the air traffic service (ATS) radar as radio frequency (RF) linked communication; and fire ballistic simulators with auto gun.</p>	2.688	2.779	3.911	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology		<b>PROJECT NUMBER</b> 232	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will fabricate an integrated system including a course correction round and respective warhead subsystems; will investigate command of a projectile maneuver and a warhead detonation simultaneously through an RF link from the ATS radar ground station; will model and simulate the fire of a group of rounds, track them through the radar, and implement a course correction in flight to increase the intercept probability. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H28.				
<b>Military Operations in Urban Terrain (MOUT)/Urban Lethal Technologies:</b> This effort demonstrates the next generation of explosive wall breaching and shoulder launched weapon warhead technologies. In FY08, conducted modeling and validation testing of multi-mode warhead design concepts and fuze requirements which enabled demonstration and refinement of the precursor charge for shoulder launched munitions; for the light weight wall breaching system, demonstrated mature linear shaped charge liner and multipoint initiation. In FY09, evaluate advanced fuzing options of multimodal warheads and mature the bash-through warhead on shoulder launched munitions; for the light weight wall breaching system, refine liner and initiation concepts for system integration and demonstrate a one-shot, on-target tandem wall breaching system against appropriate targets; demonstrate multi-purpose capability (multiple targets) from a single shoulder launched munition; and demonstrate a single shot demolition device for the purpose of creating Soldier-sized entry holes in double rebar reinforced concrete walls in a single step. In FY10, will optimize precursor and bash-through warhead for reduced weight; will demonstrate warhead performance against target set for shoulder launched munitions; will demonstrate remote emplacement of a single step breaching system.	3.100	3.494	4.328	
<b>Scalable Effect Weapons and Munitions System:</b> This effort matures scalable warhead technology and materials and demonstrates them in weapon and munition concepts that can be gun or missile launched to deliver a broad spectrum of effects, ranging from non-lethal to lethal, against threat personnel and other targets. In FY08, established baseline, initiated modeling of hardware and conducted experiments to evaluate next generation explosives, reactive materials, and advanced warhead liners. In FY09, define and evaluate system selectability requirements to enable controlled lethality against targets and reduce collateral damage; evaluate warhead tailoring methodologies to control munition energy output and verify modeled scalability effects in reduced munition sizes for man-portable systems; and fabricate and test hardware for evaluation of multipurpose capabilities.	3.095	7.535	13.272	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology			<b>PROJECT NUMBER</b> 232	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY10, will model detailed designs and simulate performance of components and system assemblies; will integrate technologies developed under PE 060624/Project H28 into a demonstrator to test advanced technology functions for medium and large caliber scalable and adaptive lethality munitions; will conduct static demonstrations of medium and large caliber munitions in a lab environment to verify component level performance against selectable and scalable lethality requirements using a combination of empirical data and modeling and simulation (M&amp;S) analyses. Efforts described here are coordinated and complimentary to related efforts in PE 0602624A/project H18 and H28 and PE 0602303A/Project 214.</p>						
<p><b>Soldier and Small Unit Lethality Integration:</b> This effort leverages the soldier radio waveform (SRW) to enable network lethality at the small combat unit (SCU) level. In FY09, demonstrate mission tasking, acoustic-based target geo-location (gun-fire detection), de-confliction and automated target hand-off from a small unmanned ground vehicle (UGV)/Soldier platform to a small unit effects network; and mature and validate algorithms that support target geo-location, de-confliction, hand-off, and weapon-target pairing for future soldier systems. In FY10, will integrate mission tasking, target geo-location and hand-off from a small UAV platform to a small unit effects network; and will participate and demonstrate small unit effects network at C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) On-The-Move (OTM) test bed. Efforts described here are coordinated and complimentary to related efforts in PE 0603001A/project J50.</p>			.000	2.987	2.952	
<b>Total</b>			30.605	37.958	30.355	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology					<b>PROJECT NUMBER</b> 43A	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
43A: ADV WEAPONRY TECH DEMO	28.928	38.113	.000						Continuing	Continuing

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

Congressional Interest Item funding for Advanced Weaponry Technology development.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Rapid Prototyping for Special Projects	4.829	.000	.000	
Disruptive Technology Acceleration	1.545	.000	.000	
RAMAN Chemical Identification System	1.545	1.550	.000	
Rapid Insertion of Developmental Technology	2.319	2.325	.000	
Electromagnetic Gun Initiative	1.932	.000	.000	
Reactive Nanocomposite Materials	.967	.000	.000	
Lightweight Cannon Recoil Reduction	.774	1.860	.000	
Common Smart Submunition (CSS)	.967	.000	.000	
Knowledge Driven Manufacturing System (KDMS)	.967	.000	.000	
Lightweight Munitions and Surveillance System (LMSS) for Unmanned Air & Ground Vehicles	3.865	2.713	.000	
Micro Electrical Mechanical Systems (MEMS) Application for Armor and Munitions	2.415	1.550	.000	
Nanotechnology Fuze-on-a-Chip	3.478	2.713	.000	
Development of Truck-Deployed Explosive Containment Vessel	1.392	1.550	.000	
Northern Ohio Integrated Command Operations Program	1.933	.000	.000	
Advanced Prototyping with Non-Traditional Suppliers	.000	3.100	.000	
Nanotechnology Manufacturing Center	.000	1.937	.000	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603004A Weapons and Munitions Advanced Technology			<b>PROJECT NUMBER</b> 43A	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Precision Molding Manufacturing Technology for Infrared Aspheric Optics			.000	2.247	.000	
Lens-Less Micro Seeker System for Small Steerable Projectiles			.000	1.550	.000	
Advanced Lightweight Gunner Protection Kit			.000	1.163	.000	
Enhanced Jamming Resistant Technology for INS/GPS Precision Guided Munitions			.000	1.550	.000	
Advanced Medium Caliber Tungsten Penetrators			.000	1.550	.000	
Titanium Powder Advanced Forged Parts Program			.000	1.550	.000	
Advanced Fuzing Technologies			.000	3.488	.000	
Hybrid Luminescent Ammunition (pending transfer to 62623)			.000	.775	.000	
Novel Guidance Kit - Phase 2 (NGK2) for M864 Projectile			.000	3.875	.000	
SBIR/STTR			.000	1.067	.000	
Total			28.928	38.113	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						
<b>E. Performance Metrics</b>						
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	242.286	263.879	89.586						Continuing	Continuing
C66: DC66	5.157	.672	2.444						Continuing	Continuing
221: COMBAT VEH SURVIVABLTY	44.207	37.401	22.437						Continuing	Continuing
441: COMBAT VEHICLE MOBILTY	42.452	40.027	47.041						Continuing	Continuing
497: COMBAT VEHICLE ELECTRO	12.686	7.435	7.513						Continuing	Continuing
515: ROBOTIC GROUND SYSTEMS	9.164	10.149	10.151						Continuing	Continuing
53D: NAC Demonstration Initiatives (CA)	37.873	52.227	.000						Continuing	Continuing
53G: FUTURE COMBAT SYSTEMS (FCS)	5.509	11.952	.000						Continuing	Continuing
533: Ground Vehicle Demonstrations	85.238	104.016	.000						Continuing	Continuing

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

The objective of this Program Element (PE) is to develop components and subsystems for ground combat and tactical vehicles in the areas of survivability (project C05), advanced automotive technology (project H77), and tank and automotive technology (project H91). Projects T26 and T31 fund congressional special interest items.

Work in this PE is related to, and fully coordinated with, PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0602618A (Ballistics Technology), PE 06020105A (Materials), and PE 0602705A (Electronics and Electronic Devices). 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology
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Work in this PE is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

**B. Program Change Summary (\$ in Millions)**

	<u><b>FY 2008</b></u>	<u><b>FY 2009</b></u>	<u><b>FY 2010</b></u>	<u><b>FY 2011</b></u>
Previous President's Budget	245.629	107.992	87.947	
Current BES/President's Budget	242.286	263.879	89.586	
Total Adjustments	-3.343	155.887	1.639	
Congressional Program Reductions	.000	-.873		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	156.760		
Total Reprogrammings	3.119	.000		
SBIR/STTR Transfer	-6.462	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology					<b>PROJECT NUMBER</b> C66	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
C66: DC66	5.157	.672	2.444						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
The purpose of this project is to conduct resesarch on classified efforts. The details of these efforts may be provided to appropriately cleared individuals upon request.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Classified efforts							5.157	.672	2.444	
Total							5.157	.672	2.444	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology					<b>PROJECT NUMBER</b> 221	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
221: COMBAT VEH SURVIVABLT Y	44.207	37.401	22.437						Continuing	Continuing

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

This project matures and demonstrates survivability technologies such as advanced armors, active protection systems (APS), and safety devices. Armors are currently being developed to meet program thresholds and move towards ground combat/tactical vehicle objectives. Additionally, this project focuses on integrating and demonstrating active protection technologies and vision protection to defeat optical attacks. This project looks at the combination of survivability technologies that enable entire protection suites to provide greater survivability than armor alone.

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

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan; Army Research Laboratory (ARL), Aberdeen Proving Ground, Maryland; Armaments Research, Development, and Engineering Center (ARDEC), Picatinny, New Jersey; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Vision Protection:</b> This effort matures and demonstrates treatments to optical systems that provide protection from frequency-agile laser weapons. In FY08, completed construction of breadboard targeting system and conducted tests of the fire control camera breadboard for optical and laser protection performance and fabricated protection system for navigation camera. In FY09, complete and validate performance of agile laser protection in future force combat vehicle-type navigation camera and optical fire control breadboards. In FY10, will integrate agile laser protection into a prototype medium range EO/IR sensor; will integrate agile laser protection into a combat vehicle driver's camera. Related work is also being performed in program elements 0602120A, 0602705A, 0602786A and 0602712A.	5.556	3.737	2.499	
<b>Active Protection Systems (APS) against Kinetic Energy (KE):</b> This effort conducts essential trade studies, technical evaluations, and demonstrations of APS components/subsystems designed for protection against KE penetrators. In FY08, integrated matured components into Future Force combat vehicle architecture and hardware for the KE AP system; integrated ARDEC's warhead and fuse package with a missile interceptor being developed at AMRDEC; updated the	17.240	9.652	3.748	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 221	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
System Engineering Plan (SEP), Test & Evaluation Master Plan (TEMP), systems architecture, system and component specifications and interfaces; managed and conducted KE APS component testing of warhead, fuse, and interceptor. In FY09, update component and system design specifications and finalize all system interfaces; complete integration support of ARDEC's warhead and fuse package and AMRDEC's interceptor; and test warheads in support of KE APS final demonstration. In FY10, will support final KE APS demonstration with interceptor/system testing, demonstration, and analysis; and will complete component and system design specifications and finalize all system interfaces. Related work is also being conducted under program elements 0602624A, 0603004A, and 0603313A.				
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.678	.000	
<b>Armor/Mine Protection:</b> This effort integrates and tests advanced ballistic protection including smart and ceramic armors, advanced composite and laminate structures, and advanced transparent armor formulations. In FY08, matured near-term opaque and transparent armors that defeat RPGs and developed design guidance for future Medium Tactical and Combat Vehicle mine protection; demonstrated initial mine kit designs; developed and demonstrated spin-out armor/transparent armor/RPG protection; and furthered the development of vehicle-level mine response modeling and simulation (M&S) to include vehicle kinematics (motion) response. In FY09, accelerate maturation and demonstration of combat and tactical wheeled vehicle armor recipes and improved mine kit designs against objective threats while reducing armor weights; and further the development of vehicle-level mine response M&S tools to include crew/occupant response to support system level analysis.	9.469	12.590	.000	
<b>High Performance Lightweight Track(Blast Mitigation):</b> This effort improves lightweight track durability and survivability. In FY10, will use M&S to perform blast event analysis on two high performance lightweight track prototypes; and will incorporate analysis results to optimize track design for mine blast/IED survivability. This effort done in coordination with related efforts in PE 0603005A projects 441 and 497.	.000	.000	2.022	
<b>TWV Survivability:</b> This effort focuses on maturing and demonstrating viable integrated survivability suites that can be tailored to meet current and future threats for light, medium, and heavy tactical wheeled vehicles. In FY08, finalized component maturation and initial designs for demonstration vehicle(s); continued to integrate suite designs and conducted studies to determine the impact of various survivability suites on vehicle weight, volume, and power. In FY09, conduct extensive tests on an expanded set of integrated survivability suites on demonstration vehicle(s) to verify and validate	11.942	10.744	10.619	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 221	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
the level of protection achieved, system durability and the impact of the added weight, volume, and power on vehicle performance; complete analysis tool to simulate the effects of mine blast impacts on vehicle and crew; and develop, fabricate, and integrate advanced armors. In FY10, will begin tactical platform active protection prototype system fabrication; will conduct live fire blast and ballistic testing; mobility/durability tests on demonstration vehicles will also be conducted; will assess emerging technologies against current and emerging threats to update optimal suites of integrated survivability technologies; will integrate suite options and deliver test report, lessons learned, and recommendations to ground combat and tactical vehicle developers. Related work is also being performed under program elements 0602601A, 0602618A, and 0602105A.				
<b>Armor Integration:</b> This effort integrates and demonstrates passive, reactive, and electromagnetic technologies for use in active protection armor applications to defeat objective and emerging KE and CE threats. In FY10, will mature passive and reactive armor solutions from PE 0602601/Project C05 and PE 0602618A that defeat objective and emerging threats.	.000	.000	1.215	
<b>Vehicle Integration Laboratory:</b> This effort provides for continuous improvements to ground vehicles to include technology trades, integration, concepts and configuration management designs. In FY10, will develop M&S framework to assess system integration impacts for emerging technologies (i.e. advanced engines, suspensions, survivability technologies) for ground combat and tactical vehicle platforms; will begin lifetime environmental and stability studies of laser protection systems for tactical and ground combat vehicles.	.000	.000	2.334	
<b>Total</b>	44.207	37.401	22.437	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology					<b>PROJECT NUMBER</b> 441	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
441: COMBAT VEHICLE MOBILTY	42.452	40.027	47.041						Continuing	Continuing

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

This project matures and demonstrates advanced mobility and electric technologies for propulsion, power, and electrical components and subsystems. Mobility technologies are being developed to meet program thresholds and move towards ground combat/tactical vehicle objectives. Additionally this program looks at the integration of mobility technologies to enable lightweight, agile, deployable, fuel efficient, and survivable ground vehicles.

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

Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in conjunction with Army Research Laboratory (ARL), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	1.057	.000	
Power and Thermal Management: This effort demonstrates power and thermal management components and control strategies to meet objective tactical and combat vehicle power requirements. In FY09, mature and demonstrate intelligent power management components and control strategies on system/demo platform. In FY10, will mature and demonstrate advanced intelligent (learn and adaptive) power management components and control strategies on a system platform; and will test, evaluate and demonstrate power and thermal management systems in a relevant laboratory environment. This effort is done in coordination with efforts in 0602601A.	.000	2.706	5.010	
Fuel Cell Power: This effort develops a fuel cell technology as an auxiliary power unit for providing electrical power to combat vehicles. In FY10, identifies ground vehicle system power requirements and space available for fuel cell applications; will create system layout map and perform modeling and simulation; and will begin identifying and testing of fuel cell system components.	.000	.000	4.606	
JP-8 Reformation for Alternative Power Sources:	3.739	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 441	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
This effort matures JP-8 reformer and desulphurization technologies so that JP-8 can utilized as a fuel source for fuel cells used in future military vehicle power applications. In FY08, integrated JP-8 reformer to transportable system and interfaced with fuel cell; optimized key components to make system transportable.				
<b>Advanced Lightweight Track:</b> This effort improves and optimizes lightweight segmented band track technology through utilization of high performance elastomers and component design with the goal of improving track durability and survivability. In FY08, integrated and evaluated performance of the new segmented band track and hybrid steel track on demonstrator vehicles under field conditions with focus on durability and mobility. In FY09, fabricate Hybrid Lightweight Track and conduct vehicle test for durability, mobility, and survivability capabilities to demonstrate a sufficient technology maturity for transition to Future Force manned ground vehicles. In FY10, will mature, fabricate and conduct preliminary vehicle testing of competing advanced lightweight track systems; and will continue development, and testing of an advanced track tensioner. This effort done in coordination with related efforts in PE 0603005A, projects 221 and 497.	3.849	.976	1.968	
<b>Pulse Power:</b> This effort matures and demonstrates compact components and subsystems that enable significantly improved survivability and lethality applications. In FY08, completed development of vehicle-ready version of the 100kW power supply for the Solid State Laser (SSL) to include development, integration and test of high power-density batteries with the Pulse Forming Networks (PFN)/Battery box; improved Electromagnetic (EM) Gun Switch with Silicon Carbide (SiC) based devices; increased High Energy Density (HED) capacitor's life by 25 percent; and increased energy density of HED capacitors to 2.0 J/cc. In FY09, develop active cooling for the High Energy Laser (HEL) pulse power supply allowing greater operational time and increase power/weight efficiency by 40 percent; and develop high voltage-reversal capacitors with extended durability and increased capacity. In FY10, will demonstrate Second Generation SiC based technology at threshold metrics defined by Future Force concepts; will refine the Programmable Pulse Power Supply for field testing at threshold metrics; and will refine designs for active cooling Programmable Pulse Power Supply for HEL.	4.422	3.932	5.047	
<b>Advanced Hybrid Electric Vehicle Components:</b>	3.457	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 441	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
This effort advances HEV component technology for increased combat and tactical vehicle mobility, efficiency and mission capability without increasing vehicle weight or volume. In FY08, demonstrated advanced HEV-based modular drive train systems consisting of power sources and energy storage devices under different architectures in the propulsion lab, with focus on developing effective thermal management system architectures and power management control strategies that can be applied to next generation tactical vehicles; and matured and demonstrated system architecture designs for improving reliability, safety, and power consumption strategies.				
Hybrid Electric Vehicle Demonstration and Assessment: This effort refines and demonstrates the maturity of HEVs for military applications, and develops modeling and simulation tools to predict fuel economy and performance characteristics. In FY08, continued analysis and testing of HEVs and modeling and simulation (M&S) excursions to expand lessons learned from military utility assessment and conducted additional experiments and performance tests. The demos also helped update HEV designs and applications to TWVs. In FY09, continue analysis and demonstration of HEVs to focus on M&S excursions with actual demonstrations to validate models and expand lessons learned to quantify fuel economy and performance of Hybrid Demonstrator Vehicles; conduct additional testing on HEVs designed with various architectures.	4.683	4.159	.000	
Ground Systems Power Evaluation: This effort matures and demonstrates power and energy components for propulsion, control systems, communications, life support, electric weapons, and protection systems. In FY10, will demonstrate high temperature power electronics, advanced motors and generator systems; will mature advanced diesel engines for JP8 compatibility and increased thermal efficiency; and will mature and demonstrate components, including traction motor inverters, energy converters and motor generator concepts in integrated hybrid electric (HE) systems for wheeled vehicles.	.000	.000	2.936	
Hybrid Electric Vehicle (HEV) Propulsion and P&E System Integration Lab (SIL): This effort matures and demonstrates power and energy component technologies and assesses HEV performance benefits and burdens. In FY08 completed integration of advanced traction drive into the prototype combat vehicle chassis; optimized architecture for best thermal management; continued reducing electromagnetic interference (EMI) through filtering, shielding, and grounding; and continued to update power and energy mission profiles. In FY09, upgrade electronic architecture and thermal management system on the prototype combat vehicle chassis for continued evaluation in a space constrained vehicle environment; and utilize user-developed scenarios to establish baseline performance of prototype combat vehicle chassis and integrated hybrid electric propulsion system.	4.355	7.046	4.431	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will support testing of HEV components and hybrid electric system for combat platforms; will perform thermal management tests of components that increase heat the transfer capabilities of onboard power electronics, and perform evaluation of high temperature power electronics.				
<p>JP-8 Fuel Cell Reformer System: This effort identifies and demonstrates fuel cell technology, that when integrated with a JP-8 reformer, creates an APU. In FY10, will update JP-8 reformer system layout map and mature system process models; will identify all JP-8 reformer components and technologies that will be used; and will begin reformer component characterization to ensure operational parameters will be met. This effort is done in coordination with efforts in 0602601A.</p>	.000	.000	4.281	
<p>Fuel Efficiency ground vehicle Demonstrator (FED): This effort focuses on demonstrating the viability of achieving significant decreases in fuel consumption without sacrificing tactical vehicle performance or capability. In FY08, used modeling and simulation that exploits advanced materials and construction techniques to design a tactical wheeled vehicle significantly lighter and more fuel efficient than the HMMWV with comparable or improved mobility and survivability; identified potential high pay-off lightweight/fuel efficient designs and components (such as electric/hybrid electric propulsion systems, high energy density-high efficiency engines, advanced power units, fuel cells, advanced batteries, lightweight armors, electric motors, lightweight/durable suspensions, and energy efficient tires); and select the best design. In FY09, perform extensive model and simulation to identify opportunities to implement technologies. Begin detail design of demonstrator(s) using the identified technologies. In FY10, will complete design of demonstrator(s); and will begin fabrication/integration of the demonstrator(s), and if necessary conduct subsystem testing.</p>	9.295	9.191	4.898	
<p>Propulsion-Prime Power: This effort provides propulsion and power technologies for tactical wheeled vehicles. In FY08, completed and verified system level models of the suspension and propulsion systems; designed TWV engine and fuel injection system for JP-8 operation; and mature Magneto-Rheological (MR) Suspension on Stryker Mobile Gun System (MGS).</p>	8.652	7.782	8.010	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, test and evaluate hybrid electric components for tactical wheeled vehicle application; modify, optimize, and evaluate performance of commercially available engines to enable JP-8 fuel usage; demonstrate, and refine Magneto-Rheological Suspension on Stryker MGS; and perform suspension proof-of-principle (POP) test on Stryker. In FY10 will complete performance and durability testing of modified commercial diesel engines; will integrate and evaluate compact advanced high power density, high operating temperature, components on vehicle platforms; will ruggedize MR suspension hardware and software for endurance testing on Stryker; and will perform vehicle Endurance Testing.				
Non-primary Power Sources (NPS): This effort demonstrates component technologies for energy storage and generation. In FY09, perform laboratory assessment of several advanced high energy/power density battery systems to gauge their suitability for final NPS hardware; and demonstrate advanced power generation technologies to meet NPS requirements. In FY10, will integrate power generation and energy storage system into advanced power and energy vehicle architecture system; and will demonstrate improved engine-off vehicle performance on system demonstrator for silent watch. This effort is done in coordination with efforts in PE 0602601A.	.000	3.178	5.854	
<b>Total</b>	42.452	40.027	47.041	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
497: COMBAT VEHICLE ELECTRO	12.686	7.435	7.513						Continuing	Continuing

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

This project matures, integrates, and demonstrates vehicle electronics hardware (displays, sensors, communications systems, and vehicle command/control/driving mechanisms) and software that result in increased crew efficiencies, performance, and/or reduced crew size, and reductions in vehicle maintenance costs. The project advances open system architectures for ground combat vehicles that allow more efficient crew stations to be adapted for a variety of ground platforms. Technical challenges include: increased levels of automation for both manned and unmanned systems, advanced user interfaces that support improved/increased span of control for robotic operations, and collaborative vehicle operations, workload management, reliability of driving aids and commander's decision aids, and embedded simulation for battlefield visualization and fully integrated virtual test/evaluation. Additionally this project matures and demonstrates mobility technologies that reduce the weight as well as the operation and sustainment of ground vehicles.

This work is performed in conjunction with Robotics Collaboration effort described in project 515. The Robotics Collaboration and Intelligent Secure Mobility Work (ISM) work is performed in close cooperation with the Army Soldier Battle Lab.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP).

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in conjunction with Army Research Laboratory - Human Resources Engineering Directorate (ARL-HRED), Aberdeen, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Robotics Collaboration: This effort matures and demonstrates common scalable user interface software for crew stations, operator control units, and small Soldier portable devices. In FY08, refined task timelines and models in the Intelligent Systems Behavior Simulator (ISBS) environment based on Soldier evaluations and experimental data; finalized design and integration of scalable interface software and intelligent agents into mounted and dismounted system hardware and performed capstone Soldier operational field demonstrations in militarily significant combat scenarios in urban environments capturing all relevant performance data.	12.686	.000	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.186	.000	
Improved Mobility and Operations Performance through Autonomous Technologies: This effort matures indirect vision technologies to provide the Soldier with full hemispherical situational awareness in closed hatched vehicle operations. In FY09, define the mobility & situational awareness performance/limitations of current indirect vision systems; conduct task and workflow analysis for the mobility and local situational awareness tasks of a vehicle crew; identify key cueing technologies for Soldiers that are dismounting to provide local situational awareness; analyze existing crewstations and software for a baseline mobility and situational awareness task workload experiment; and support design and analysis of two experiments on eye-tracking technologies for operational environments. In FY10, will design and develop enhanced crewstations and software based on mobility and local situational awareness tasks and workload; will design local situational awareness warfighter machine interface for dismounting Soldiers and conduct experiment to assess impact of dismount information tools on local situational awareness; will integrate enhanced crewstation 360/90 Day/Night local situational awareness, assisted mobility, and soldier monitoring/state classification technologies with surrogate platform; and will analyze experiments to capture physiological and physical data from mounted soldiers in operational environments.	.000	6.277	6.524	
Enhanced Vehicle Technologies to Improve Lightweight Track Reliability: This effort will improve/optimize lightweight segmented band track technology through utilization of high performance elastomers and design with the goal of improving track durability. In FY09, analyze data of Failure Mode and Effects Criticality Analysis (FMECA) for High Performance Light-weight Track and a representative current force or baseline legacy counterpart. Analyze data gaps to identify possible sensors and/or indicators that assist in determining the state of health of components/subsystems that are primary cost drivers of track systems. In FY10, will validate a track system diagnostic model to verify dynamic loads and effects of changes in the system; will collect track system vehicle test data and investigate features and conditions in the data that correlate to failure modes; and will perform a limited correlation exercise between diagnostic model, bench test, and track system test data to assess ability to predict system behaviors and / or failures. This effort done in coordination with related efforts in PE 0603005A projects 221 and 441.	.000	.972	.989	
<b>Total</b>	<b>12.686</b>	<b>7.435</b>	<b>7.513</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
515: ROBOTIC GROUND SYSTEMS	9.164	10.149	10.151						Continuing	Continuing

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

This project matures and demonstrates unmanned ground vehicle technologies. The main focus is on integrating and demonstrating in relevant environments sensor technologies, perception hardware and software, and robotic control technologies that enable Unmanned Ground Vehicle (UGV) systems to maneuver on- and off-road at militarily significant speeds with minimal human intervention, thereby enabling the Soldier to perform other mission tasks. Challenges addressed include: obstacle avoidance, overcoming perception limitations, intelligent situational behaviors, command and control by Soldier operators, frequency of human intervention, operations in adverse weather, and robots protecting themselves and their surroundings from intruders. Mature technologies are incorporated in UGV technology demonstrators so that performance can be evaluated for tactical maneuver and sustainment applications.

Work done in this project is complementary to the Robotics Collaboration effort described in project 497 and the Robotic Vehicle Control Architecture effort described in 53G.

The approach builds upon, complements, and does not duplicate previous and ongoing investments conducted under the Joint Robotics Program Office and the Defense Advanced Research Projects Agency, in program element (PE) 0602601A, project H91 (Ground Vehicle Technology) and by the Army Research Laboratory (ARL) PE 0602618A (Ballistics 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 in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Ground, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Near Autonomous Unmanned Systems: This effort matures automated tactical behaviors and self security systems that allow unmanned vehicles to perform intelligent tactical maneuvers. In FY08, completed integration and evaluation of tactical behavior algorithms; completed entire suite of tactical behaviors and vehicle self-security system and conducted capstone Soldier-in-the-loop field experiments in a militarily relevant environment and scenarios.	4.717	.000	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Robotics Collaboration: This effort develops the tools, techniques, and autonomy to maximize mounted and dismounted control of ground and air unmanned systems. In FY08, integrated Soldier-robot teaming and safe-operations algorithms into hardware, conducted Soldier-field demonstration in relevant environment and provided engineering support to the Robotic Vehicle Control Architecture technologies program technical efforts.	4.447	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.285	.000	
Robotic Vehicle Control Architecture (RVCA) Technology: This effort develops UGV end to end control architecture to reduce future technology integration risk and demonstrates the viability of autonomous operations in a relevant environment. In FY09, integrate a prototype Autonomous Navigation System (ANS) onto the UGV platform to test and measure system capabilities; conduct a soldier operational experiment; and finalize platform system development and update with latest software interfaces. In FY10, will finalize RVCA hardware/software designs and interfaces and complete all updates to the Autonomous Platform Demonstrator and will perform engineering evaluations and Soldier operational exercises on the Autonomous Platform Demonstrator to test/measure system capabilities.	.000	4.400	5.266	
Safe Operations of Unmanned systems for Reconnaissance: This effort demonstrates perception, control and tactical behavior technologies to safely conduct urban operations. In FY09, evaluate baseline behaviors that enable Unmanned Ground Vehicles (UGVs) to safely navigate around people and other vehicles in a realistic military testing environment; evaluate specialized classification algorithms for sensor and algorithm fusion; evaluate machine learning and adaptive tactical behaviors; investigate situational awareness and operational procedures to assure safe UGV employment across anticipated missions; assist in the development of UGV safety and testing procedures; and investigate and evaluate modeling and simulation (M&S) tools to evaluate perception/control algorithms and human-robot interaction. In FY10, will provide quantitative performance data based on demonstrations that enable development of Techniques, Tactics and Procedures; will develop mission focused tactical behaviors; and will develop and conduct initial warfighter assessment and engineering evaluations including evaluation of combined mobility/mission workload for UGVs and Unmanned Air Vehicles (UAVs).	.000	5.464	4.885	
<b>Total</b>	<b>9.164</b>	<b>10.149</b>	<b>10.151</b>	

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<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
53D: NAC Demonstration Initiatives (CA)	37.873	52.227	.000						Continuing	Continuing

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

These are Congressional Interest Items

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Thermal Management System	3.092	2.326	.000	
Advanced Thermal and Oil Management Controls	1.545	.000	.000	
High Strength, Powder Metal Gears for Vehicle Transmissions	2.511	.000	.000	
Next Generation Non-Tactical Vehicle Propulsion	1.545	.000	.000	
Hydraulic Hybrid Vehicles (HHV) for the Tactical Wheeled Fleet	.966	.776	.000	
Advanced Composites Development for Light Weight, Low Cost Transportation Systems Using 3+ Extruder	3.092	2.326	.000	
Improved HMMWV Tactical Shelter Project	.967	.000	.000	
Special Operations Vehicle - Lightweight, Armored, Hybrid, Power Generating, Tactical Vehicle	1.546	1.939	.000	
Novel Onboard Hydrogen Storage System Development	2.319	.776	.000	
Next Generation Manufacturing Technologies for Defense Supply Chain	3.092	.000	.000	
Military and Interstate Commercial Truck Component Weight Reduction Program	2.319	.000	.000	
Tactical Wheeled Vehicle Structures for Improved Survivability and Performance	3.864	7.745	.000	
Tactical Wheeled Vehicle Composite Component Weight Reduction Program	2.319	.000	.000	
Armor Ready Composite Cab Transition	2.899	.000	.000	
Diesel Hybrid-Electric Utility Vehicles	1.932	.000	.000	
Field Deployable Fleet Hydrogen Fueling	2.319	.000	.000	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Fuel Cell Cost Reduction Research			1.546	.000	.000
Wireless Analysis and Visualization Engines for Sensors (WAVES)			.000	.775	.000
Enhanced Military Vehicle Maintenance System Demo Project with Anniston Army Depot and Auburn Univ			.000	1.550	.000
Base Security Systems			.000	1.163	.000
Joint Combat Support Trailer			.000	3.100	.000
Alternative Energy Research			.000	19.376	.000
N-STEP-Enabled Manufacturing Cell for Future Combat Systems			.000	2.325	.000
Next Generation Non-Tactical Vehicle Propulsion			.000	1.550	.000
Advanced Drivetrains for Enhanced Mobility and Safety			.000	1.550	.000
Advanced Digital Hydraulic Hybrid Drive System			.000	1.938	.000
C4ISR Auxiliary Power Unit (APU) for Soldier Tactical Applications			.000	1.550	.000
SBIR/STTR			.000	1.462	.000
Total			37.873	52.227	.000
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					
<b>E. Performance Metrics</b>					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
53G: FUTURE COMBAT SYSTEMS (FCS)	5.509	11.952	.000						Continuing	Continuing

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

This project funds FCS technologies. When mature, technologies such as armor, active protection system components, power and energy components, and unmanned systems, developed under this project are transitioned into the FCS acquisition program to enable objective capabilities. Current efforts are to demonstrate an Autonomous Platform Demonstrator (APD). The APD effort will develop a large scale, greater than 9 tons, hybrid electric Unmanned Ground Vehicle (UGV). This large sized UGV will integrate, and demonstrate advanced mobility technologies such as: hybrid electric drive systems, suspension systems, and lightweight chassis technologies. This effort supports and collaborates with the Robotic Vehicle Control Architecture program (Project 515) and is critical to effectively evaluate large scale high speed UGVs in a mobile tactical network. This project ends in FY09. Continuing efforts will transition to Project 515. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, designed the software architecture for the control of UGVs by Soldier operators, designed and developed the mission execution, computer operating environment, and vehicle management hardware and software as well as sensor management and fusion software for platform and payload control. This work was performed in coordination with efforts in project 515.	5.509	.000	.000	
In FY09, finalize control architecture designs for the control of UGVs by Soldier operators; finalize designs and finish development of the mission execution, computer operating environment, vehicle management, sensor management and fusion hardware and software for UGV control and integrate components onto the vehicle platform in preparation for engineering evaluations. Related work is also being conducted in the Robotic Vehicle Control Architecture Technology effort in project 515.	.000	11.617	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs.	.000	.335	.000	
<b>Total</b>	<b>5.509</b>	<b>11.952</b>	<b>.000</b>	

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

N/A

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology	<b>PROJECT NUMBER</b> 53G
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology					<b>PROJECT NUMBER</b> 533			
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>		
533: Ground Vehicle Demonstrations	85.238	104.016	.000						Continuing	Continuing		
<b>A. Mission Description and Budget Item Justification</b>												
These are Congressional Interest Items												
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>												
									<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Administrative Database Error									3.219	.000	.000	
Hybrid Electric (Heavy Truck) Vehicle									.000	2.325	.000	
Michigan Technological University's Project for Diverse Sensing for Synergistic Force Protection in Urban Threat Environments									.000	.775	.000	
Ground Vehicle Integration Technologies									.000	2.325	.000	
Advanced Hybrid Electric Vehicle Technologies for Fuel Efficient Blast Protected Vehicle									.000	1.163	.000	
Fire Shield									.000	3.100	.000	
Power and Energy Research Equipment Upgrades									.000	5.812	.000	
Advanced Performance Transparent Armor for Tactical Wheeled Vehicles									.000	1.163	.000	
Model-Based Engineering Environment									.000	.775	.000	
Lithium Ion Battery Exchange Program									.000	2.325	.000	
Medium Sized Unmanned Ground Vehicles Platform									.000	1.938	.000	
MRAP Supportability System (MSS)									.000	3.875	.000	
Light Weight Medical Evacuation Unit									.000	1.550	.000	
End-to-End Vehicle Survivability Technology									.000	1.550	.000	
FCV Advanced Suspension System									.000	1.550	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 533	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Hull Humvee Protection Program	.000	1.938	.000	
Implementation of an Advanced Tactical Wheeled Armored Vehicle System	.000	2.907	.000	
Light Tactical Vehicle Ambulance Shelter	.000	2.325	.000	
Advanced Lightweight Multi-Functional Multi-Threat Composite Armor Technology	.000	2.325	.000	
Payload and Advanced Development for Next Generation Robot Platform	.000	1.938	.000	
Robotics Vehicle Secure Communications	.000	1.938	.000	
Advanced Corrosion Protection for Military Vehicles	.000	2.325	.000	
Lightweight Partial Hybrid Electric Military Transport Vehicle	.000	1.550	.000	
Applied Power Management Control and Integration	.000	.775	.000	
Stryker Second Source Tire Research	.000	.775	.000	
Plug-in Hybrid Vehicle Electrification Program	.000	3.100	.000	
Magneto-Rheological (MR) Suspensions for Tactical Wheeled Vehicles	.000	2.325	.000	
Next Generation Diesel Engine for Ground Vehicles	.000	3.876	.000	
Dynamometer Facility Upgrade Program at TARDEC	.000	3.100	.000	
SBIR/STTR	.000	2.912	.000	
Ground Vehicle Fastening and Joining Research	.773	.000	.000	
Vehicle Maintenance and Prognostics System	2.473	.000	.000	
Robotics Manipulators for Ordnance Disposal	.463	.000	.000	
Universal Diagnostic Data Management System	1.545	.000	.000	
Full Spectrum Close-In Layered Shield (FCLAS) for Thin Skinned Vehicles	1.545	.000	.000	
Lightweight Structural Composite Armor for Blast and Ballistic Protection	1.932	1.550	.000	
3-D Advanced Battery Technology	3.091	3.875	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE: May 2009</b>			
<b>APPROPRIATION/BUDGET ACTIVITY</b>	<b>R-1 ITEM NOMENCLATURE</b>			<b>PROJECT NUMBER</b>		
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	PE 0603005A Combat Vehicle and Automotive Advanced Technology			533		
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>		
Advanced Lightweight Composite Armor	1.545	.000	.000			
Antiballistic Windshield Armor (AWA)	3.863	3.488	.000			
Combat Vehicle and Automotive Advanced Technology for the Antiballistic Windshield	1.990	.000	.000			
High Speed Diesel Combustion	3.091	.000	.000			
LEAN Digital Product Development	1.931	.000	.000			
Unmanned Ground Vehicle Initiative (UGVI)	11.590	11.624	.000			
Liquid Desiccant-Based Atmospheric Water Generation without Reverse Osmosis	.869	.000	.000			
Vehicle Armor Structure Development & Testing for Future Combat Systems & JT Light Tactical Vehicle	.966	.775	.000			
No Idle System (NIS)	.966	.000	.000			
Hybrid Engine Development Program for Tactical Wheeled Vehicle Fleet	7.727	.000	.000			
Battlefield Requirements Management Support System	.966	.000	.000			
On-Board Vehicle Power Management	1.545	.000	.000			
Networked Reliability and Safety Early Evaluation System (NRSEES)	1.545	.000	.000			
Vehicle Information Manager Display for Drivers (VMID)	.773	.000	.000			
Crosshairs Hostile Fire Indicating System	2.898	1.938	.000			
Active Protection Systems Initiative for the Joint Light Tactical Vehicle	2.936	.000	.000			
Center for Military Vehicle Technologies	3.941	.000	.000			
Defect-Free Commercially Viable Si/C Semiconductor Using Superlattice Technology	3.091	2.480	.000			
Rotary Multi-Fuel Auxiliary Power Unit M1A1 Abrams Tank	1.932	2.325	.000			
Tactical Rocket Propelled Grenade Airbag Protection System (TRAPS) Enhancement	1.545	.775	.000			
Development of Logistical Fuel Processors to Meet Army/TARDEC/TACOM Needs	2.704	2.713	.000			
Enhanced Directed Armor RPG Vehicle Protection System	.773	.000	.000			

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603005A Combat Vehicle and Automotive Advanced Technology		<b>PROJECT NUMBER</b> 533	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Secure On-the-Move Information Analysis and Control for Advanced Combat Vehicles	1.545	.000	.000	
Ground Forces Readiness Enabler for Advanced Tactical Vehicles (GREAT-V)	1.545	.775	.000	
Adv Lithium Iron Phosphate Battery Sys for Army Combat Hybrid HMMW V & Other Army Vehicle Platforms	1.545	1.938	.000	
No-Idle Climate Control for Military Vehicles	1.931	1.550	.000	
Diminishing Manufacturing Sources and Material Shortages (DMSMS) Case Resolution Program	1.932	2.325	.000	
High Performance Aluminum Structures and Components	1.545	.000	.000	
Passive Walking Beam Tracked Platform UGV	.967	.000	.000	
Combat Vehicle Electrical Power-21st Century (CVEP-21)	.000	.775	.000	
Ceramic and Metal Matrix Composite (MMC) Armor Development Using Ring Extruder Technology	.000	.775	.000	
<b>Total</b>	<b>85.238</b>	<b>104.016</b>	<b>.000</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	11.781	11.544	8.667						Continuing	Continuing
DF7: DF7	2.973	4.349	5.080						Continuing	Continuing
257: DIGITAL BATTLEFLD COMM	.000	2.392	.000						Continuing	Continuing
592: SPACE APPLICATION TECH	8.808	4.803	3.587						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
<p>This program element (PE) matures and demonstrates advanced space technology applications that support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, DoD, and Army space policies. This PE provides applications for enhanced intelligence, reconnaissance, surveillance, target acquisition, position/navigation, missile warning, ground-to-space surveillance, and command and control capabilities. Project 592 supports the maturation and demonstration of Space Applications Technology efforts that provide technology options for networked and integrated surveillance and command and control capabilities to enable information superiority, enhanced situational awareness, and support for distributed operations. Project 592 also matures and demonstrates high altitude and space sensor and communications payloads for Army applications and provides technology risk reduction capability for ground-to-space surveillance system development. Project DF7 supports classified activities. Properly accessed individuals can obtain further information from the Assistant Secretary of the Army for Acquisition Logistics &amp; Technology (ASAALT) Special Programs Office.</p> <p>Work in this PE is coordinated with PE 0602120A (Sensors and Electronic Survivability) and PE 0603008 (Electronic Warfare Advanced Technology).</p> <p>The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this PE is performed by the US Army Space and Missile Defense Technical Center in Huntsville, AL. This program is designated as a DoD Space Program.</p>										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	14.082	9.183	8.787	
Current BES/President's Budget	11.781	11.544	8.667	
Total Adjustments	-2.301	2.361	-.120	
Congressional Program Reductions	.000	-.039		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	2.400		
Total Reprogrammings	-1.927	.000		
SBIR/STTR Transfer	-.374	.000		

**Change Summary Explanation**

FY08 funding decrease is due to transfer out of congressional interest items.  
 FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology					<b>PROJECT NUMBER</b> DF7		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
DF7: DF7	2.973	4.349	5.080						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b> The purpose of the project is to conduct classified research efforts. The details of the efforts may be provided upon request to appropriately cleared individuals.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Classified efforts								2.973	4.349	5.080	
Total								2.973	4.349	5.080	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A											
<b>D. Acquisition Strategy</b> N/A											
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology					<b>PROJECT NUMBER</b> 257	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
257: DIGITAL BATTLEFLD COMM	.000	2.392	.000						Continuing	Continuing

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

Congressional Interest Item funding for Digital Battlefield advanced technology development.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Vertical/Horizontal Integration of Space Technologies and Applications (VISTA)	.000	2.325	.000	
SBIR/STTR	.000	.067	.000	
<b>Total</b>	<b>.000</b>	<b>2.392</b>	<b>.000</b>	

**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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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology					<b>PROJECT NUMBER</b> 592	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
592: SPACE APPLICATION TECH	8.808	4.803	3.587						Continuing	Continuing

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

This project matures and demonstrates advanced space technology applications that support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, DoD, and Army space policies. This project matures and demonstrates advanced technologies in the areas of light weight materials, miniaturization, reduced power consumption, and advanced data collection, processing, and dissemination. This project also develops algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems. It matures and demonstrates payloads for tactically responsive space and high altitude platforms, sensors, and data down link systems. This project provides space advanced technology risk reduction capability for ground-to-space surveillance and systems development.

Work in this Project is coordinated with PE 0602120A (Sensors and Electronic Survivability) and PE 0603008 (Electronic Warfare Advanced Technology).

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

Work in this PE is performed by the US Army Space and Missile Defense Technical Center in Huntsville, AL. This program is designated as a DoD Space Program.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
All Weather Radio Frequency (RF) Launch Detection: This effort is maturing and demonstrating a passive radio frequency sensor / receiver system to detect, locate, and classify weapons ordnance events in all weather conditions. In FY08, designed, fabricated, and tested a Multiple Antenna Radiometer Sensor (MARS) that successfully detected RF emissions during launch of tactical rocket systems; collected data on rockets, artillery, and missile projectiles during weapons systems field testing; matured detection and classification algorithms using data collection results; demonstrated the enhanced MARS application for Counter-Rockets, Artillery, and Mortars (CRAM) Project Office applications.	2.214	.000	.000	
Payload Technology Development: This effort is maturing technologies for smaller, Warfighter-responsive sensor and communication payloads for use in both space and high altitude environments.	.000	1.397	1.124	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology		<b>PROJECT NUMBER</b> 592	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, mature tactical radio relay payloads, to include Single Channel Ground to Air Radio System (SINCGARS) radio and antenna subsystems, to improve survivability, range, and bandwidth in high altitude and space environments; and demonstrate tactical radio relay payload performance at high altitude. In FY10, will mature EO/IR imaging space sensor; using prior year demonstration data, will mature the tactical radio relay payload to improve bandwidth and support more users; will demonstrate improved tactical radio relay payload performance at high altitude.				
Distributed Imaging Radar Technology (DIRT): This effort is demonstrating software algorithms for multi-perspective synthetic aperture radars to provide precision tracking and targeting based on an enhanced radar image. In FY08, integrated DIRT algorithms and demonstrated Inverted Synthetic Aperture Radar (ISAR) and Volumetric Synthetic Aperture Radar (VSAR) imaging of targets with real radars; and integrated DIRT algorithms into a fixed site Distributed Common Ground Station - Army (DCGS-A version 2) facility, demonstrated and validated software, and refined DIRT algorithms for tactical aerial platforms.	3.045	.000	.000	
Vertical Integration of Space Technology and Applications (VISTA): This effort is maturing and demonstrating algorithms and intelligent agent based software applications to provide missile threat warning for Warfighters on-the-move. In FY08, designed and demonstrated Intelligent Agent components that process missile warning messages; developed agent reference models and VISTA architecture; and completed initial build of VISTA's Multi-Agent Knowledge Online (MAKO) software. In FY09, mature and demonstrate vertical and horizontal integration of missile threat warning, collaborative planning, and tailored data, and information distribution to verify compatibility of intelligent agent and knowledge management technologies. In coordination with the US Army Communications - Electronics Research, Development, and Engineering Center (CERDEC), integrate and demonstrate VISTA with Army networks and within battle command applications. In FY10, will mature the intelligent agent software technology including automated and seamless distribution of relevant space and strategic system-developed situational awareness information to specific Brigade and below tactical units in a format that can be directly integrated into their applicable Battle Command System, including Force XXI Battle Command Brigade and Below (FBCB2) and Command and Control Personal Computer (C2PC); and will demonstrate the automated network-centric VISTA capability in the Army Training and Doctrine Command (TRADOC) Battle Laboratory Collaborative Simulation Environment.	1.112	3.290	2.463	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.116	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603006A Command, Control, Communications Advanced Technology		<b>PROJECT NUMBER</b> 592	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Ground Based Space Surveillance: This effort is leveraging existing missile defense sensor capabilities to demonstrate space surveillance of satellites over the theater of operations to determine their operational intent and assess impact on ground forces. In FY08, completed and validated algorithm and netted sensor hardware/software development; demonstrated mobile data processor with ground sensor in netted ground architecture; and began integration of the ground based space surveillance technology into the Extended Space Sensors Architecture (ESSA) Advanced Concept Technology Demonstration scheduled for a March 2009 demonstration.	2.437	.000	.000	
Total	8.808	4.803	3.587	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603007A Manpower, Personnel and Training Advanced Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	6.632	6.830	7.410						Continuing	Continuing
792: Personnel Performance & Training	6.632	6.830	7.410						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project matures and demonstrates advanced behavioral and social science technologies that enhance performance to ensure that the Warfighter keeps pace with the transformations in systems, weapons, equipment, and mission requirements to meet the goals of the future force. These technologies provide key capabilities through training methods and techniques that prepare Soldiers and leaders to effectively operate in complex digitized, networked environments, enable the use of embedded training technologies envisioned for future command and control (C2) systems, and foster cognitive, behavioral, and psychological flexibility, adaptability, and mission readiness.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work is performed and managed by the US Army Research Institute (ARI) for the Behavioral and Social Sciences in Arlington, VA.</p>										
<b>B. Program Change Summary (\$ in Millions)</b>										
		<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>					
Previous President's Budget		6.740	6.853	6.883						
Current BES/President's Budget		6.632	6.830	7.410						
Total Adjustments		-.108	-.023	.527						
Congressional Program Reductions		.000	-.023							
Congressional Rescissions		.000	.000							
Total Congressional Increases		.000	.000							
Total Reprogrammings		.002	.000							
SBIR/STTR Transfer		-.110	.000							
<b><u>Change Summary Explanation</u></b>										
FY10 funds were increased to support Human Dimension Applications.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603007A Manpower, Personnel and Training Advanced Technology					<b>PROJECT NUMBER</b> 792	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
792: Personnel Performance & Training	6.632	6.830	7.410						Continuing	Continuing

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

This project matures and demonstrates advanced behavioral and social science technologies that enhance performance to ensure that the Warfighter keeps pace with the transformations in systems, weapons, equipment, and mission requirements to meet the goals of the future force. These technologies provide key capabilities through training methods and techniques that prepare Soldiers and leaders to effectively operate in complex digitized, networked environments, enable the use of embedded training technologies envisioned for future command and control (C2) systems, and foster cognitive, behavioral, and psychological flexibility, adaptability, and mission readiness.

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 performed and managed by the US Army Research Institute (ARI) for the Behavioral and Social Sciences in Arlington, VA.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Personnel Technology: This effort develops technologies to assess how Soldiers and units are impacted by Army mission, policy, or program changes. In FY08, collected and analyzed survey data and provided lessons learned on unit stabilization; increased complexity and improved aviation Selection Test Battery and investigated its validity as a tool to assign aviators to specific aircraft. In FY09, continue attitude and opinion research on factors that influence Soldier and Family satisfaction, retention, and readiness through design and analysis of surveys. In FY10, will exploit various methods and technologies to more rapidly assess attitudes and opinions across the Army to be more responsive to the fast-paced operational demands of the Global War on Terror (GWOT) and improve understanding of assessment methods of Soldiers' attitudes and opinions to quantify factors influencing Soldiers' career plans.	1.330	1.352	1.387	
Small Business Innovation Research/Small Business Technology Transfer Programs	.000	.106	.000	
Training Technology and Leader Development:	5.302	5.372	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603007A Manpower, Personnel and Training Advanced Technology		<b>PROJECT NUMBER</b> 792	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>This effort provides training techniques that enable Soldiers to take full advantage of advances in technology and systems as they evolve and helps the Army attain its goals of embedded training in future force systems.</p> <p>In FY08, refined and demonstrated methods for more rapid development of training support packages that meet future technology and system spin out requirements; validated assessment methods of single-user immersive training technologies; developed preliminary guidelines for designing effective single user, interactive, distributed training using game-engine-based immersion; and developed techniques such as the use of scenario-based, interactive lessons to train leaders to be more adaptable in persuading others with differing goals.</p> <p>In FY09, mature prototype training support packages that enable improved commander/staff performance in network-enabled environments; validate and refine assessment measures and metrics used in single-user immersive training technologies; exploit training tools/techniques to improve drill sergeant skills as trainers and improve initial entry training so first-term Soldiers are better prepared for operational deployments; and evaluate techniques leaders need as basic elements for leadership in changing, complex environments.</p>				
<p>Training Technology and Leader Development (cont'd):</p> <p>In FY10, will provide guidelines for optimizing the use of blended learning environments for Army training (e.g., TRADOC schools); will assess the level of preparedness and performance through behavioral evaluation tools following graduation from training programs to develop improved training strategies; and will demonstrate two Web-based training tools (one to predict skill retention and one to develop training, tactics, and procedures to improve training outcomes). Will exploit and improve emerging development and measurement methods that can facilitate the Army's capability to produce leaders who can more easily adapt to change and complexity.</p>	.000	.000	6.023	
<b>Total</b>	6.632	6.830	7.410	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603008A Electronic Warfare Advanced Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	55.257	62.353	50.458						Continuing	Continuing
TR1: TAC C4 TECHNOLOGY INT	34.729	37.377	37.540						Continuing	Continuing
TR2: Secure Tactical Information Integration	12.895	13.415	12.918						Continuing	Continuing
TR8: C3 DEMONSTRATIONS (CA)	7.633	11.561	.000						Continuing	Continuing

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

Efforts in this program element (PE) mature and demonstrate technologies for secure, mobile, wireless networks that will operate reliably in diverse and complex terrain, in all environments. Technologies are matured and demonstrated to address this challenge with distributed, mobile, secure, self-organizing communications networks. A key objective is to demonstrate seamlessly integrated communications technologies across all network tiers, ranging from unattended networks and sensors through maneuver elements and airborne and space assets. To accomplish the goal, this PE investigates and leverages external communication technologies and combines technology options in a series of Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-The-Move (OTM) demonstrations to measure the battlefield effectiveness (project TR1). This PE also provides: protection technologies for tactical wireless networks against modern network attacks; and supports collaborative technologies for information sharing between battlefield functional communities (project TR2). Several tasks are conducted in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other Services. Project TR8 funds congressional special interest items.

Work in this PE is fully coordinated with PE 0602782A (Command, Control, Communications Technology), PE 0603772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602120A (Sensors and Electronic Survivability) and 0602270A (EW 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 performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	56.591	50.961	51.967	
Current BES/President's Budget	55.257	62.353	50.458	
Total Adjustments	-1.334	11.392	-1.509	
Congressional Program Reductions	.000	-.208		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	11.600		
Total Reprogrammings	.017	.000		
SBIR/STTR Transfer	-1.351	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology					<b>PROJECT NUMBER</b> TR1	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TR1: TAC C4 TECHNOLOGY INT	34.729	37.377	37.540						Continuing	Continuing

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

Efforts in this project mature and demonstrate key communications, mobile networking technologies to enable commanders and individual Soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. The efforts here concentrate on three major goals: provide a series of technology demonstrations of Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) capabilities to significantly reduce the risk associated with the networks of networks concept; provide critical links in the ability to communicate and move large amounts of information across the force structure in a seamless, integrated manner conducive to a highly mobile manned and unmanned force structure; and assess the Technology Readiness Level (TRL) of emerging network technologies in an operationally relevant environment.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Proactive Integrated Link Selection for Network Robustness: This effort demonstrates proactive link selection algorithms to optimize use of all available networked communications link types, maximizes network throughput and simplifies network planning and maintenance. In FY08, continued modeling and simulation and design of enhanced implementation of deployed mode link selection algorithms; implemented first level integration among link selection algorithms; collaborated with the Naval Research Lab (NRL) on an implementation of data dissemination filtering between heterogeneous multicast routing architectures; conducted functional, performance characterization and scalability testing of mature link selection algorithms within laboratory and relevant field environments. In FY09, complete implementation of deployed mode link selection algorithms; conduct final architecture, design maturation, and integration of planning and deployed mode link selection algorithms; conduct performance testing in a relevant field environment of all planning and deployed mode link selection technologies with representative hardware and transition to PM WIN-T.	7.848	8.811	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology		<b>PROJECT NUMBER</b> TR1	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Cognitive Networking: This effort matures and demonstrates technologies enabling wireless networks to sense network and spectrum conditions and automatically adapt for more efficient use. In FY10, will mature cognitive radio policy software by standardizing Dynamic Spectrum Access (DSA) policy language to allow interoperability of disparate Next Generation (XG) radio communications platforms; will mature spectrum sensors interoperable with cognitive antennas to increase spectrum efficiency and allow opportunity for use of spectrum gray spaces leading to more efficient use of current spectral resources; will mature wafer antenna technology and superconducting microelectronics based all digital transceiver and digital signal processing (DSP) components to provide an increase in SATCOM channel and throughput capacity; will mature cooperative SATCOM network routing technology to provide for SATCOM signal blockage mitigation. Work related to this effort is also being accomplished under PE 0602782A/project H92.</p>	.000	.000	3.065	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.942	.000	
<p>Antenna Technologies: This effort matures and demonstrates low cost, power efficient, antenna technologies for terrestrial and tactical satellite ground. In FY08, completed demonstration of Ku and Ka band power amplifiers for integration into SATCOM antenna assemblies; completed investigation on phased array technologies applicable to very low profile SATCOM on the move (OTM) antennas; developed and demonstrated affordable terrestrial directional antenna for PM WIN-T; completed development and ruggedization of survivable 2 port low profile and triband antenna prototypes and transitioned to JTRS and FCS programs; developed and demonstrated broadband low cost low profile directional antenna prototypes for application to PM Signal Warfare requirements for reduced cosite interference; developed low cost C-band terrestrial directional antenna; designed phase II distributed antenna array prototypes; conducted platform antenna study testing of algorithm for optimized antenna placement of tactical vehicles. In FY09, mature and demonstrate a low profile Ku/Ka single beam SATCOM antenna; mature single beam low profile hybrid Ka/Q band SATCOM OTM antenna. In FY10, will complete development of low profile Ka/Ku single beam SATCOM OTM antenna and conduct field demonstration; will integrate Ka/Q band power amplifiers into a single prototype and conduct lab testing; will mature and evaluate single beam low profile hybrid Ka/Q band SATCOM OTM antenna; will mature small aperture Blue Force</p>	7.598	3.943	5.992	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology		<b>PROJECT NUMBER</b> TR1	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Tracking (BFT) SATCOM terminal to enable accurate position location dissemination using military satellite to replace costly commercial satellite services. Work related to this effort is also being accomplished under PE 0602782A/project H9				
<b>Communications Planner for Operational and Simulation Effects with Realism (COMPOSER):</b> This effort matures technologies to observe and predict the performance of wireless tactical networks at faster than real time. In FY08, integrated and tested the communications effects simulator, network visualizer, and spectrum management software modules to support the baseline architecture for Coalition Joint Spectrum Management Planning Tool effort.	2.628	.000	.000	
<b>Wireless Information Assurance (IA):</b> This effort matures and demonstrates technologies to protect wireless tactical networks against computer network attacks with an emphasis on defending against attack methods not previously seen. In FY09, mature and demonstrate IA technologies enabling information exchange across activity domains ensuring survivability of tactical networks and critical information against information warfare attacks; mature and demonstrate network management/information assurance fault correlation engine that reduces the software footprint by creating an integrated suite of network operations tools. In FY10, will mature and demonstrate a Mobile Ad Hoc Networking (MANET) malicious code detection service to thwart zero day attacks; will demonstrate a response system that receives the root cause analysis from the correlation engine then develops and recommends a response plan to address the security problem; will mature autonomous adaptive middleware and evaluate in a lab environment. Work related to this effort is also being accomplished under PE 0602782A/project H92.	.000	3.736	9.895	
<b>Applied Communications and Information Networking (ACIN):</b> This effort adapts and matures emerging commercial wireless, networked communications technologies for military use. In FY09, mature and demonstrate commercial networking and communications technology in intelligent agents and mobile networking; provide rapid adaptation of commercial communications equipment for military use through the development of new architectures combining commercial and military unique technologies; provide modeling and simulation and planning tools for communications/network planning. In FY10, will adapt and mature emerging commercial 802.16e, 802.22 and 802.11n wireless networking technology for military use by adapting the technology for use in military frequency bands and assessing security vulnerabilities;	.000	1.346	1.970	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology		<b>PROJECT NUMBER</b> TR1	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
will mature radio frequency propagation modeling and simulation and planning tools for use in urban environments and complex terrain; will assess and adapt commercial software defined radios with cognitive radio technology.				
<p><b>C4ISR On-The-Move (OTM):</b>                      In FY08, assessed the capability, functionality, and performance of current and emerging radio waveforms from the JTRS Joint Program Office on JTRS Handheld, Manpack, Small Form Fit (HMS) and Ground Mobile Radio representative hardware; conducted relevant technical demonstrations in support of PM FCS BCT focused on the interaction of FCS software applications and the transport layer as well as evaluating Spin Out 2 designs; assessed the Technical Readiness Level (TRL) of Army Science and Technology (S&amp;T) efforts maturing in the FY08 timeframe in an operationally relevant field environment; assessed the performance of the baseline and alternative C4ISR on-the-move architectures and various network configurations to inform the current and future forces; utilized high performance computing (HPC) and non-HPC tools and techniques using the FCS baseline architecture as the starting point to stimulate the live demonstration environment with modeling and simulation (M&amp;S) via distributed connectivity; and employed data collection, reduction and analysis techniques facilitating early assessment of emerging C4ISR technologies in a system of systems construct. In FY09, assess the capability, functionality, and performance of the FY09 programmed increments of JTRS HMS for dismount Soldiers, unmanned ground sensors, non-line of sight launch system and intelligent munitions systems; assess WIN-T increment 2 and 3 functionality including enhanced quality of service architecture, information assurance solutions to enable network security across a wide area network using multiple encryption devices with minimal loss of data, and selected network operations management functions; assess the TRL of Army S&amp;T efforts maturing in the FY09 timeframe in an operationally relevant field environment; continue to support FCS technical evaluations to explore FY09 programmed increments of Army Battle Command.</p>	12.586	10.848	.000	
<p><b>C4ISR Network Mining:</b>                      Large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining consists of five major elements: extract, transform, and load transaction data onto the data warehouse system; storing, and managing the data in a multidimensional database system; providing data access; analyzing the data by application software; and presenting the data in a useful format. In FY08, performed vulnerability assessments on commercial wireless solutions and transitioned reports to PEO C3T; matured data mining software, and performed a voice architecture analysis which was transitioned to PM FCS; performed analysis to understand the types and patterns of data being passed between coalition networks; performed an examination on battle command systems and their impact on logistics which was transitioned to the logistics community.</p>	4.069	5.304	5.405	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology			<b>PROJECT NUMBER</b> TR1	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, mature network data mining software to analyze security concerns and systems vulnerability via (1) vulnerability analysis at the waveform and networking layers and (2) development of software and/or hardware to secure systems for deployment; analyze spectrum availability and utilization; investigate cognitive networking technologies and its impacts on current and future force networks.</p> <p>In FY10, will conduct analysis and perform modeling and simulation (M&amp;S) of various fidelity of ISR performance over restricted bandwidth networks; will examine and represent in models and simulations varying fidelity carrier to noise radio and voice over Internet protocol (IP) solutions for future force networks.</p>						
<p><b>C4ISR On-The-Move (OTM):</b> In FY10, will assess increments of JTRS HMS and Ground Mobile Radio (GMR) for mounted &amp; dismounted Soldiers, unmanned ground and aerial sensors, non-line of sight launch systems and intelligent munitions systems: will continue to assess WIN-T functionality including quality of service architecture, information assurance solutions to enable network security with minimal data loss, selected network operations management functions, and associated networks; will assess the TRL of S&amp;T efforts in an operationally relevant environment; will continue to support tech evaluations to explore programmed increments of Battle Command and Unified Battle Command.</p>			.000	.000	9.248	
<p><b>Dismounted Communications in Urban Terrain:</b> This effort matures and demonstrates technologies that enable dismounted soldier wireless networked communications in complex terrain such as urban environments and inside buildings. In FY09, mature communications capabilities for dismounted Soldier operating in highly complex communications environments through the use of adaptive processing, networking algorithms, and network security features such as employing random noise waveforms and policy based network management, fault correlation low probability of intercept, low probability of detection technologies to reduce communications systems vulnerability and improve reliability. In FY10, will adapt and mature space time adaptive processing for use on dismounted Soldiers radio equipment.</p>			.000	2.447	1.965	
<b>Total</b>			34.729	37.377	37.540	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology	<b>PROJECT NUMBER</b> TR1

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology					<b>PROJECT NUMBER</b> TR2	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TR2: Secure Tactical Information Integration	12.895	13.415	12.918						Continuing	Continuing

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

Efforts in this project mature and demonstrate technologies with enhanced capabilities to analyze, plan, execute, and assess operations, at tactical and strategic operational levels, by integrating decision support and intelligence based software to provide a more comprehensive understanding of a given adversary and the environment. Efforts mature and demonstrate technologies to improve mission execution success by providing software to more tightly couple operations and intelligence and to better facilitate collaboration between individuals and teams. Efforts in tactical cross domain solutions demonstrate software based technologies enabling information sharing across operations and intelligence security domains that replace current application specific hardware solutions.

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

Work in this project is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research Development and Engineering Center (CERDEC), Fort Monmouth, NJ, and the Army Research Laboratory (ARL), Adelphi, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Collaborative Battle Management:</b> This effort matures and demonstrates technologies to improve sharing and understanding of data between the intelligence and operations communities. In FY10, will leverage existing net-centric data strategies and extend by adding concept-based data meta-tagging; will mature portability framework and develop implementations for the Force XXI Battle Command, Brigade and Below (FBCB2), and Distributed Common Ground Station-Army (DCGS-A) environments; will mature a universal collaboration bridge permitting disparate collaboration schemes such as mIRC, Jabber, and SameTime to interoperate; will mature a digital mission representation and its data, information and decision requirements to enable the ability to share and understand data between communities of interest (Intel/Ops/Geospatial); will mature software to associate Intel requirements, geospatial data needs and collection opportunities with operational mission tasks for Intel and Battle Command (BC) communities; will mature integrated Intel/Ops decision support tools to include planning and execution software support services, priority information requests management, and collection/sensor management.	.000	.000	6.472	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology		<b>PROJECT NUMBER</b> TR2	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Work related to this effort is also being accomplished under PE 0603772A/project 101, PE 0602120A/project H15, PE 0602270A/project 442.				
Theater Effects Based Operations (TEBO) Advanced Concept Technology Demonstration (ACTD): The TEBO ACTD demonstrates an Effects-based Operations (EBO) process and provides United States Forces Korea with enhanced capabilities to analyze, plan, execute, and assess effects-based operations at the strategic-theater and operational levels by integrating a framework of processes, tools, and tactics, techniques and procedures. In FY08, matured TEBO software to spiral V configuration; matured and solidified capabilities demonstrated in spirals I-IV to provide full spectrum support for effects-based operations including semi-automated knowledge acquisition and operational modeling and simulations; matured human interfaces and scalability of the TEBO toolset, demonstrated TEBO capabilities in Joint Forces Command (JFCOM) exercises in coordination with United States Forces Korea. In FY09, initiate the sixth and final developmental spiral; participate in the two annual Korean exercises - Key Resolve (2QFY09) and Ulchi Forward Guardian (4QFY09) as well as participate in Pacific Command's (PACOM) Terminal Fury exercise; transition activities from the TEBO toolset to Defense Information Systems Agency (DISA) and Net-Centric Enterprise Services (NCES).	12.895	13.195	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.220	.000	
Tactical Cross Domain Solutions: This effort matures and demonstrates Service Oriented Architecture (SOA) Cross Domain Solution (CDS) to enable assured sharing of information across multiple security domains. In FY10, will mature and demonstrate cross domain web services on high assurance operating systems (e.g., Green Hills Integrity, Lynux Works Lynx OS) that provide trusted labeling service (applies security labeling classification and releasability labels to data), data regarding service (used to sanitize security labeled messages before they cross security domain boundaries), and domain boundary service (ensures that cross security domain requirements are fulfilled before information is released from one security domain to another).	.000	.000	6.446	
<b>Total</b>	<b>12.895</b>	<b>13.415</b>	<b>12.918</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology	<b>PROJECT NUMBER</b> TR2
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603008A Electronic Warfare Advanced Technology					<b>PROJECT NUMBER</b> TR8	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
TR8: C3 DEMONSTRATIONS (CA)	7.633	11.561	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for C3 Demonstrations.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Portable Mobile Emergency Broadband Systems (PMEBS)							3.285	3.875	.000	
Advanced Wireless Technologies							.483	1.163	.000	
Applied Communications and Information Networking (ACIN)							3.865	3.100	.000	
Maritime C4ISR System							.000	.775	.000	
Networked Dynamic Spectrum Access Investigation Enhanced MBITR							.000	2.325	.000	
SBIR/STTR							.000	.323	.000	
Total							7.633	11.561	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE: May 2009</b>		
<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603015A Next Generation Training & Simulation Systems					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	23.292	25.298	19.415						Continuing	Continuing
HB5: IMMERSIVE ENVIRONMENTS DEMONSTRATIONS (CA)	1.932	1.994	.000						Continuing	Continuing
S28: Immersive Learning Environments	4.670	4.864	3.017						Continuing	Continuing
S29: MODELING & SIMULATION - Adv Tech Dev	3.646	3.878	5.883						Continuing	Continuing
S31: Modeling and Simulation Infrastructure Technology	9.759	10.077	10.515						Continuing	Continuing
S33: TRAINING AND SIMULATION SYSTEMS INITIATIVES (CA)	3.285	4.485	.000						Continuing	Continuing

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

This program element (PE) matures and demonstrates tools to enable effective training capability for the Warfighter. The PE supports the maturation and demonstration of simulation technologies developed by the Institute for Creative Technology (project S28); incorporates advanced modeling and simulation (M&S), training, and leader development technology into immersive training demonstrations as well as demonstrates a framework for future embedded training and simulation systems for future force combat and tactical vehicles and dismounted Soldier systems (project S29); develops, integrates and demonstrates an overarching M&S architecture that incorporates multi-resolution entity-based models, simulations, and tools to enable Network-Centric Warfare (NCW) M&S capability (project S31). Immersive Environments Demonstrations (project HB5) and Training and Simulation Initiatives (project S33) fund congressional special interest items.

Work in this PE is related, to and fully coordinated with efforts in PE 0601104A (University and Industry Research Centers), PE 0602308A (Advanced Concepts and Simulation), and PE 0603007A (Manpower, Personnel and Training Advance Technology).

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems
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The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this PE is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	22.365	18.881	20.231	
Current BES/President's Budget	23.292	25.298	19.415	
Total Adjustments	.927	6.417	-.816	
Congressional Program Reductions	.000	-.083		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	6.500		
Total Reprogrammings	1.553	.000		
SBIR/STTR Transfer	-.626	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems					<b>PROJECT NUMBER</b> HB5	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
HB5: IMMERSIVE ENVIRONMENTS DEMONSTRATIONS (CA)	1.932	1.994	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Immersive Environments advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Joint Fires and Effects Training System (JFETS)							1.932	1.938	.000	
SBIR/STTR							.000	.056	.000	
Total							1.932	1.994	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems					<b>PROJECT NUMBER</b> S28	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S28: Immersive Learning Environments	4.670	4.864	3.017						Continuing	Continuing

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

This project matures and demonstrates immersive technologies that include the application of photo-realistic synthetic environments, multi-sensory interfaces, virtual humans, and training applications on low-cost game platforms. This project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies that are created at the Institute of Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California to formulate training demonstrations with an emphasis on urban operations and asymmetric warfare. The ICT's collaboration with its entertainment partners, the Research, Development, and Engineering Command, and the Army Training and Doctrine Command creates a true synthesis of creativity and technology that harnesses the capabilities of industry and the research and development community to advance the Army's ability to train and practice military skills across the full spectrum of conflict.

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

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.136	.000	
Immersive Techniques: This effort demonstrates and matures technological advancements from PE 0602308A/project D02 into complex state-of-the-art simulation environments in support of multi-student and team training. In FY08, developed, assessed, and refined immersive training methods to be more representative of complex political, religious, and cultural environments; demonstrated methods to integrate cultural traits into virtual humans operating in interactive training environments; created visualizations of the complex urban environment to support both immersive training and command and control concepts. In FY09, integrate photorealistic representations of complex terrain and rendering of specific individual facial features onto interactive virtual human models operating in a complex urban environment to support more realistic training; demonstrate intelligent tutoring/computer coaching with virtual instructors that tailor/enhance trainee educational/military experience.	4.670	4.728	3.017	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems		<b>PROJECT NUMBER</b> S28	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will demonstrate methods and technologies that expand immersive environments to support multi-student and team training; and will demonstrate methods to support computer generated after action reviews, virtual human based mentoring, and computer directed scenario adaptation based on multi-player distributed training techniques.				
Total	4.670	4.864	3.017	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems					<b>PROJECT NUMBER</b> S29	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S29: MODELING & SIMULATION - Adv Tech Dev	3.646	3.878	5.883						Continuing	Continuing

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

This project matures and demonstrates next generation training and simulation systems that focus on integrating virtual threats, asymmetric warfare, network-centric operations, and embedding training capabilities and technologies into operational go-to-war future force systems to include dismounted warrior systems. The synergy between these embedded training capabilities and the immersive training advanced technology development in project S28 provides Army units with a set of complementary embedded and deploy-on-demand systems that provide just-in-time, dynamic, realistic training, and mission rehearsal capabilities. Demonstrations include technologies that form a framework for future training applications for the range of future force operations such as robotic control and other sensor operations; mission planning and rehearsal; command, control, and maneuver; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network analysis to support distributed simulations; and vehicle system interface requirements. This project creates a joint environment by synchronizing virtual and constructive simulated forces with the next generation and current training systems from the Army, Navy, Air Force, and Marine forces.

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

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Embedded Techniques (cont'd): In FY10, will team with CERDEC to exploit employing modeling and simulation technologies (i.e. Force Battle Command, Real time Adversarial Intelligence Decision aid) in embedded training for current and future Command and Control (C2) systems used to train for asymmetric urban warfare environments; will exploit technology development of computer generated behaviors to simulate terrorist/insurgency urban warfare for future embedding into C2 systems. Will continue technology maturity for dismounted soldier embedded training prototypes to support next generation Soldier systems in collaboration with U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) and U.S. Army Communications-Electronic Research, Development and Engineering Center (CERDEC).	.000	.000	5.883	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.109	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems		<b>PROJECT NUMBER</b> S29	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Embedded Techniques: This effort demonstrates and matures capabilities (most provided from PE 0602308A/project C90) built into or added onto operational systems, subsystems, or equipment, to enhance and maintain the skill proficiency of Soldiers, and maximizes component commonality among combat vehicles and Soldier computer systems.</p> <p>In FY08, completed development of embedded training hardware component technologies for vehicles by conducting laboratory experiments with embedded training common components and developed user interfaces to support deployable mission planning and rehearsal; matured and demonstrated the use of instructional development tools for deployable learning environments. Results and hardware prototypes were provided to PEO Ground Combat Systems for a common vehicle embedded training system.</p> <p>In FY09, mature combat vehicle and dismounted soldier embedded training systems by conducting experiments in operational environments. Conduct demonstrations, provide results and prototypes for dismounted soldier embedded training to support next generation soldier systems in collaboration with U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) and U.S. Army Communications-Electronic Research, Development and Engineering Center (CERDEC).</p>	3.646	3.769	.000	
Total	3.646	3.878	5.883	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems					<b>PROJECT NUMBER</b> S31	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S31: Modeling and Simulation Infrastructure Technology	9.759	10.077	10.515						Continuing	Continuing

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

This project matures and demonstrates a distributed modeling and simulation (M&S) environment, Modeling Architecture for Technology, Research, and Experimentation (MATREX). MATREX provides a unifying M&S architecture, supporting tools and infrastructure that synchronize and integrate multi-resolution (time and space) modeling applications such as Live, Virtual, and Constructive training applications, operational studies of Network-Centric Warfare (NCW) concepts and technologies, or the modeling of Battle Command operations with elements of advanced communications, information flow, data fusion, decision-making, and information warfare. MATREX also works to address M&S issues of modeling scalability, network design, enterprise services, and third party software compatibility issues.

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 by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL, and executed across the Command.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.282	.000	
MATREX: This effort develops a robust Modeling and Simulation (M&S) environment and Distributed Virtual Laboratory (DVL) wherein a collection of multi-fidelity models, simulations and tools can be integrated and mapped to an evolving architecture for conducting multi-scale (time and spatial resolution) M&S activities to provide M&S data and information to multiple users. In FY08, integrated high-fidelity modeling of networked sensor fusion, initial static weather, chemical-biological-radiological-nuclear effects, and Battle Command human behaviors into MATREX capabilities, developed a complete M&S environment for Army analysis, experimentation and technology trade-off studies by expanding the implementation of the TRADOC Integrated Process 3 (Networked Fires; Intelligence, Surveillance, and Reconnaissance; Battle Command, etc.). Expanded simulation interoperability and infrastructure tools to provide initial support for Test and Training Enabling Architecture (TENA) compatibility resulting in expanded M&S interoperability across the Army. Developed	9.759	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems			<b>PROJECT NUMBER</b> S31	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>a new look-up table simulation as a test surrogate to stand in for high resolution simulations while researching issues of scalability (providing ability to simulate very large/complex battlefield environments). Established and implemented the MATREX DVL with international US coalition partners and over 50 Army based sites across the country currently to establish a Cross-Command Collaboration (3CE) network (via Defense Research and Engineering Network) that allows each user to run their M&amp;S tool independently but integrates the independent results into a overall common shared scenario.</p>						
<p>MATREX (cont'd): In FY09, investigate and develop methodologies (e.g., Distributed Data Management (DDM) and Run-Time Infrastructure (RTI) distribution strategies) to increase MATREX scalability for modeling a future force Brigade Combat Team and enable accurate assessments of command and control concepts. Mature and demonstrate technologies and techniques to shorten M&amp;S event setup time in support of Army experimentation and test events. Integrate and implement data collection and analysis tools to assess consistency of analysis results throughout an acquisition life cycle. Connect additional Army sites into the MATREX DVL to expand the Army's ability to conduct geographically distributed M&amp;S efforts. Conduct initial study of Internet Protocol version 6 (IPv6) and evaluate for anticipated upgrade to DVL network.</p> <p>In FY10, will mature a multi-organization Army laboratory data collection process to support Army technology readiness level demonstrations and to enable consistent data structure/interoperability for multi-organization use throughout the development/design cycle. Will assess and improve current analysis tools to provide an integrated acquisition support capability for Army decision making. Will improve simulation for modeling of weather, terrain, chemical-biological-radiological-nuclear effects, human behavior, human decision-making and networked sensor fusion. Will improve M&amp;S support architectures for cross-domain M&amp;S environment interoperability to include live fire testing, Soldier and hardware-in-the-loop experiments, and software-based testing environments.</p>			.000	9.795	10.515	
Total			9.759	10.077	10.515	
<b>C. Other Program Funding Summary (\$ in Millions)</b>						
N/A						
<b>D. Acquisition Strategy</b>						
N/A						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems	<b>PROJECT NUMBER</b> S31

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603015A Next Generation Training & Simulation Systems					<b>PROJECT NUMBER</b> S33	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
S33: TRAINING AND SIMULATION SYSTEMS INITIATIVES (CA)	3.285	4.485	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Training and Simulation Systems advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Vigilant Auto-ID and Access Control System							.966	1.550	.000	
Enhanced Holographic Imaging Program							1.546	.000	.000	
Joint Medical Simulation Technology Research & Development Center (JMSTRDC)							.000	1.550	.000	
Mobile Medic Training Program							.000	.775	.000	
SBIR/STTR							.000	.126	.000	
Experiential Technologies for Urban Warfare and Disaster Response							.773	.484	.000	
Total							3.285	4.485	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603103A Explosives Demilitarization Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	20.916	13.720	.000						Continuing	Continuing
D51: Explosives Demil Tech	9.998	10.530	.000						Continuing	Continuing
D91: EXPLOSIVE DEMIL DEMONSTRATIONS	10.918	3.190	.000						Continuing	Continuing

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

The objective of this program element (PE) is to support the Explosive Demilitarization Technology Program, a cooperative interservice, interagency effort dedicated to the maturation of safe, efficient, and environmentally acceptable processes for the closed disposal of conventional munitions (project D51). Project D91 funds congressional interest items. This project transitions to PE 0605805/project F24 in FY10.

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 integrated through the leadership of the Product Manager for Demilitarization and the Joint Ordnance Commanders Group Munitions Demilitarization/Disposal Subgroup leveraging support from the Department's Environmental Security Technology Certification Program (ESTCP), the Strategic Environmental Research and Development Program (SERDP), the Joint DOD/DOE Munitions Technology Program, and complementary Service science and technology programs. The Technology Directorate, Defense Ammunition Center, serves as the program manager (PM) Demilitarization's technical and programmatic support staff in this effort.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603103A Explosives Demilitarization Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	21.511	10.564	10.971	
Current BES/President's Budget	20.916	13.720	.000	
Total Adjustments	-.595	3.156	-10.971	
Congressional Program Reductions	.000	-.044		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	3.200		
Total Reprogrammings	.007	.000		
SBIR/STTR Transfer	-.602	.000		

**Change Summary Explanation**

FY 2009 increases are due to congressional adds.

This project transitions to Budget Activity 6, PE 0605805A Project F24 beginning in FY 2010.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603103A Explosives Demilitarization Technology					<b>PROJECT NUMBER</b> D51	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D51: Explosives Demil Tech	9.998	10.530	.000						Continuing	Continuing

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

This project matures safe, efficient, and environmentally acceptable processes for the closed disposal of conventional munitions including explosives, missiles, missile components, and large rocket motors. Efforts in this program emphasize environmentally compliant technologies to enhance existing methods for munitions resource recovery and recycling (R3) and treatment, and seek alternatives to open burning/open detonation (OB/OD). This project transitions to PE 0605805/project F24 in FY10.

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.

The Technology Directorate, Defense Ammunition Center, serves as the PM Demilitarization's technical and programmatic support staff in this effort.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Supercritical Water Oxidation (SCWO): This effort develops technology for use in cleanup of waste streams associated with demilitarization of conventional weapons. In FY09, mature and demonstrate SCWO technology to treat liquid effluent from a supercritical water oxidation reactor.	.000	.589	.000	
Advanced Removal: This effort develops technology to remove propellant from a rocket motor case by cooling the propellant in order to remove it from the rocket motor case. In FY09, initiate design and fabrication of a propellant removal system using Augering techniques; initiate design and fabricate a flexible multi-missile milling system.	.000	.767	.000	
Small Business Innovative Research / Small Business Technology Transfer Programs	.000	.296	.000	
Resource Recovery and Reuse (R3): This effort focuses on enhancing existing methods of munitions R3. In FY08, conducted additional modeling using cluster model technology for the NIR scanners and completed machine vision integration for 155mm projectiles; demonstrated optimized propellant conversion to fertilizer technology; initiated accelerated design and fabrication of the Demilitarization by Inductive Heating Meltout (DIHME) project for 60mm	7.129	6.390	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603103A Explosives Demilitarization Technology		<b>PROJECT NUMBER</b> D51	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
mortars and improved the design in an effort to accommodate an additional demil requirement for 81mm and 120mm mortars; continued Joint Program integration. In FY09, mature and demonstrate DIHME project for 60mm, 81mm, and 120mm mortars; initiate development of machine vision for other projectiles; initiate transition of propellant conversion to fertilizer technology; continue research and development alternatives for ammonium perchlorate; demonstrate nitroamine high explosive (HMX) requalification technology; and continue Joint Program integration.				
<b>Advanced Destruction:</b> This effort focuses on destruction of munitions. In FY08, completed transition of stationary Contained Detonation Technology (CDT); initiated development of characterization data for Acid Hydrolysis steel Cartridge Actuated Device//Propellant Activated Device (CAD/PADs); demonstrated Mobile Plasma Treatment System (MPTS). In FY09, initiate testing and development of Acid Hydrolysis technology; initiate design to demil M433- high explosive dual purpose (HEDP) Cartridges.	1.211	1.703	.000	
<b>Advanced Munitions Disassembly:</b> This effort focuses on the disassembly of conventional munitions. In FY08, initiated transition of robotic disassembly of Area Denial Anti-personnel Mine (ADAM) projectile; transitioned waterjet technology to the Demil by Induction Heating Meltout (DIHME) project for 60mm mortars; designed and fabricated a disassembly system for the Stinger Missile; demonstrated rocket motor segmenting technique. In FY09, complete operational demonstration and initiate transition of rocket motor segmenting technique.	1.658	.785	.000	
<b>Total</b>	9.998	10.530	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603103A Explosives Demilitarization Technology					<b>PROJECT NUMBER</b> D91	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
D91: EXPLOSIVE DEMIL DEMONSTRATIONS	10.918	3.190	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> These are Congressional Interest Items										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Missile Recycling Capability--Letterkenny Munitions Center							6.280	.000	.000	
Sierra Army Depot Cryofracture/Plasma Arc Transportable System							2.319	.000	.000	
Cryofracture/Plasma Arc Demilitarization Program							2.319	1.551	.000	
Unserviceable Ammunition Demilitarization via Chemical Dissolution							.000	.776	.000	
Press-Loaded Explosive Projectile Washout Line							.000	.775	.000	
SBIR/STTR							.000	.088	.000	
Total							10.918	3.190	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603105A MILITARY HIV RESEARCH					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	14.490	15.064	6.657						Continuing	Continuing
H29: MED PROTECT AGNST HIV	6.761	7.091	6.657						Continuing	Continuing
T16: MILITARY HIV INITIATIVES CA	7.729	7.973	.000						Continuing	Continuing

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

This program element (PE) matures and demonstrates advanced technology of candidate human immunodeficiency virus (HIV) vaccines, prepare and conduct human clinical studies to assess safety and efficacy of candidate HIV vaccines, conduct research to control HIV infection in military environments, protect the military blood supply from HIV, and protect military personnel from risks associated with the HIV infection. All HIV technology development activities are conducted in compliance with US Food and Drug Administration (FDA) regulations. FDA requires thorough testing in animal models (preclinical testing) to ensure safety and efficacy prior to approving controlled clinical testing of drugs, vaccines, and medical devices in humans. Normally, clinical trials are conducted in three phases to prove safety and effectiveness of the drug, vaccine, and device for the targeted disease or condition. An increasing number of test subjects are used in each subsequent phase. All test results are submitted to FDA for evaluation to ultimately obtain approval (licensure) for routine medical use. This program is jointly managed through an Interagency Agreement by the US Army Medical Research and Materiel Command (MRMC), the National Institutes of Health, and the National Institute of Allergy and Infectious Diseases (NIAID). This project contains no duplication with any effort within the Military Departments or other government organizations.

Work is related to and fully coordinated with work funded in program element PE 0602787A, project 873 (HIV Exploratory Research).

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 PE is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. The Henry M. Jackson Foundation, located in Rockville, MD provides support for FDA testing and other research under cooperative agreement.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603105A MILITARY HIV RESEARCH
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	14.903	7.116	6.766	
Current BES/President's Budget	14.490	15.064	6.657	
Total Adjustments	-.413	7.948	-.109	
Congressional Program Reductions	.000	-.052		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	8.000		
Total Reprogrammings	.005	.000		
SBIR/STTR Transfer	-.418	.000		

**Change Summary Explanation**

FY09 increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603105A MILITARY HIV RESEARCH					<b>PROJECT NUMBER</b> H29	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
H29: MED PROTECT AGNST HIV	6.761	7.091	6.657						Continuing	Continuing

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

This project funds research to develop candidate human immunodeficiency virus (HIV) vaccines, assess their safety and effectiveness in testing with human subjects, and protect the military personnel from risks associated with HIV infection. In addition, it is designed to find ways to protect the blood supply from contamination with the virus. All HIV technology development is conducted in compliance with US Food and Drug Administration (FDA) regulations. Tests in human subjects are conducted to demonstrate safety and effectiveness, as required by FDA regulation. Studies are conducted stepwise, first to prove safety, second to demonstrate the desired effectiveness of the drug, vaccine or device for the targeted disease or condition in a small study, and third to demonstrate effectiveness in large, diverse human population trials. All test results are submitted to the FDA for evaluation to ultimately obtain approval (licensure) for medical use. This project supports studies for effectiveness testing on small study groups after which they transition to the next phase of development for completion of effectiveness testing in larger populations.

This program is jointly managed through an Interagency Agreement by the US Army Medical Research and Materiel Command (MRMC) and the National Institute of Allergy and Infectious Diseases (NIAID). This project contains no duplication with any effort within the Military Departments or other government organizations. Work is related to and fully coordinated with work funded in program element PE 0602787A, project 873 (HIV Exploratory Research) are further matured under PE 0603807A, project 811.

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 PE is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation, Rockville, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HIV Program: In FY08, continued with HIV vaccine development and clinical testing of new candidate vaccines, including maintaining the facilities required to assess clinical samples and show vaccine safety and effectiveness; continued long-term clinical follow-up of vaccinated volunteers; and continued to develop and maintain new clinical trial sites in Africa and Asia to maintain a sufficient base of potential volunteers for testing of vaccines under development by the U.S. Government. In FY09, assess ongoing vaccine trials to down-select various candidates and further develop vaccines. Test human volunteers in the US and Africa to assess the safety and physiological response of vaccines prepared with additional HIV subtypes (strains of the HIV virus). Will continue large scale human studies testing in	6.761	6.891	6.657	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603105A MILITARY HIV RESEARCH			<b>PROJECT NUMBER</b> H29	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Thailand to assess the effectiveness of the vaccine candidate that has previously shown good safety profiles. In FY10, will test in human volunteers in Africa to assess the safety and physiological response of vaccines prepared with additional HIV subtypes. Will continue large scale testing in humans in Thailand.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.200	.000	
Total			6.761	7.091	6.657	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603105A MILITARY HIV RESEARCH					<b>PROJECT NUMBER</b> T16	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T16: MILITARY HIV INITIATIVES CA	7.729	7.973	.000						Continuing	Continuing

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

This is a Congressional Interest Item

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HIV Research	7.729	7.750	.000	
SBIR/STTR	.000	.223	.000	
Total	7.729	7.973	.000	

**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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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603125A Combating Terrorism - Technology Development					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	13.220	13.022	11.989						Continuing	Continuing
DF5: AGILE INTEGRATION & DEMONSTRATION	13.220	13.022	11.989						Continuing	Continuing
<b><u>A. Mission Description and Budget Item Justification</u></b>										
<p>This program element (PE)/project accelerates technologies with high payoff to address current operational shortfalls or future force capability gaps. This PE demonstrates programs requiring accelerated action to fill critical technology gaps. In addition, project DF5 includes the Rapid Equipping Force (REF) effort to develop a Transportable Hybrid Electric Power Station (THEPS) that incorporates solar technology, wind technology, advanced storage technology, and intelligent power management technology to reduce use of fossil fuel generators.</p> <p>Work in this PE is related to and fully coordinated with PE 0603710A (Night Vision Advanced Technology), PE 0602303A (Missile Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0602705A (Electronics and Electronic Devices).</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM) and efforts are executed by the appropriate Research, Development, and Engineering Centers (RDECs).</p>										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603125A Combating Terrorism - Technology Development
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	12.978	13.064	13.184	
Current BES/President's Budget	13.220	13.022	11.989	
Total Adjustments	.242	-.042	-1.195	
Congressional Program Reductions	.000	-.042		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	.000		
Total Reprogrammings	.605	.000		
SBIR/STTR Transfer	-.363	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603125A Combating Terrorism - Technology Development					<b>PROJECT NUMBER</b> DF5	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
DF5: AGILE INTEGRATION & DEMONSTRATION	13.220	13.022	11.989						Continuing	Continuing

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

This program element (PE)/project accelerates technologies with high payoff to address current operational shortfalls or future force capability gaps. This PE demonstrates programs requiring accelerated action to fill critical technology gaps. In addition, project DF5 includes the Rapid Equipping Force (REF) effort to develop a Transportable Hybrid Electric Power Station (THEPS) that incorporates solar technology, wind technology, advanced storage technology, and intelligent power management technology to reduce use of fossil fuel generators.

Work in this PE is related to and fully coordinated with PE 0603710A (Night Vision Advanced Technology), PE 0602303A (Missile Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0602705A (Electronics and Electronic Devices).

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 PE is performed by the Army Research, Development, and Engineering Command (RDECOM) and efforts are executed by the appropriate Research, Development, and Engineering Centers (RDECs).

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.365	.000	
Transportable Hybrid Electric Power Station (THEPS): THEPS incorporates solar technology, wind technology, advanced storage technology, and intelligent power management technology to reduce use of fossil fuel generators. In FY08, incorporated spiral development of more efficient photovoltaic technology, wind technology, and advanced algorithms for intelligent power management that provided larger size (10kW and 15kW) for THEPS. The larger size THEPS allowed flexibility in support of remote operations tactical command posts.	5.666	4.484	3.822	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603125A Combating Terrorism - Technology Development		<b>PROJECT NUMBER</b> DF5	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>In FY09, develop and demonstrate 10-15kW and the networked THEPS to provide an intelligent power grid for more efficiencies and redundancies.                      In FY10, THEPS demonstration will be conducted at remote sites and operating bases and demonstrations will continue at Forward Operating Bases (FOB) with less logistics tail and more cost avoidance as a result of consuming less fossil fuel.</p>					
<p>AIDE: This effort accelerates the development and testing of capabilities that address future force needs.                      In FY08 completed maturation, demonstration, and evaluation of ongoing efforts. These efforts identified maturing technologies from within all Army research and development (R&amp;D) activities and the Department of Energy (DOE), to accelerate the development of suitable technologies to the Warfighter for demonstration. Projects included the maturation, demonstration, and evaluation of overhead protection on the Gunners Protection Kit; Soldier Protection Suites; a Soldier power manager system to reduce the quantity and variety of batteries a Soldier must carry; a 3rd Generation FLIR (Forward Looking Infrared) LRAS3 (Long Range Advance Scout Surveillance System); and two projects to increase the effectiveness of the Hellfire missile system. Emphasis continued to be on those high payoff and cost effective areas that provide the operational forces increased protection and survivability, and meet the Operational Need Statements of the deployed forces in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).                      In FY09, complete maturation, demonstration and evaluation of FY08 efforts in preparation for transition to operational units. Identify and mature, through prototype development and testing, additional new technologies from all sources that can be accelerated to overcome the changing capability gaps and requirements shortfalls experienced by operational forces around the globe.                      In FY10, will select, mature, and demonstrate technologies focused on war fighting and counter terrorism technologies, and enhanced force protection. In addition, will introduce medical life saving projects and provide enhanced Soldier capabilities in a 6 to 12 month fielding timeline.</p>			7.554	8.173	8.167
Total			13.220	13.022	11.989
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603125A Combating Terrorism - Technology Development	<b>PROJECT NUMBER</b> DF5

**E. Performance Metrics**

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

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603270A Electronic Warfare Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	41.902	33.086	19.192						Continuing	Continuing
K12: EW Demonstrations (CA)	24.960	9.170	.000						Continuing	Continuing
K15: ADVANCED COMM ECM DEMO	9.143	14.486	9.391						Continuing	Continuing
K16: NON-COMMO ECM TECH DEM	7.799	9.430	9.801						Continuing	Continuing

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

Efforts in this program element (PE) mature and demonstrate electronic warfare (EW) technologies intended to deny, disrupt, locate, or destroy the enemy's Command, Control, and Communications (C3) systems and intelligence, surveillance and reconnaissance assets. This PE matures both countermeasures (CM) and counter-countermeasures (CCM) to deny the enemy the use of their systems while protecting US assets from enemy deception and jamming. This PE supports the maturation and demonstration of technologies to locate and exploit enemy communication systems including computer networks (project K15) and multifunctional EW capability to enhance platform survivability (jamming) and the detection, identification and geo-location of emitters of interest to provide near real-time situational awareness to the commander (project K16). Project K12 funds congressional special interest items.

Work in this PE is coordinated with PE 0603313A (Missile and Rocket Advanced Technology), PE 0603003A (Aviation Advanced Technology), PE 0602270A (EW Techniques), PE 0602120A (Sensors and Electronic Survivability), and PE 0603772A (Advanced Tactical Computer Science).

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 PE is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	41.951	23.996	19.317	
Current BES/President's Budget	41.902	33.086	19.192	
Total Adjustments	-.049	9.090	-.125	
Congressional Program Reductions	.000	-.110		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	9.200		
Total Reprogrammings	1.013	.000		
SBIR/STTR Transfer	-1.062	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> K12	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K12: EW Demonstrations (CA)	24.960	9.170	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Electronic Warfare Demonstrations.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
WIZARD - Remotely Controlled Improvised Explosive Device Countermeasures							1.546	.000	.000	
Advanced Communications ECM Demonstration							9.274	1.551	.000	
Non-communications ECM Technology Demonstration							6.183	1.162	.000	
DAIRCM/CMWS for Army Helicopters							2.705	.000	.000	
Highly Mobile Remote Controlled IED Countermeasures							.000	.775	.000	
ALQ-211 Networked EW Controller							.000	1.550	.000	
SBIR/STTR							.000	.256	.000	
US Army Future Force ELINT							1.933	.000	.000	
Aerial Canopy MASINT System (ACMS)							1.000	1.938	.000	
Advanced IED Jammer Research and Development Program							2.319	1.938	.000	
Total							24.960	9.170	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology	<b>PROJECT NUMBER</b> K12

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> K15	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K15: ADVANCED COMM ECM DEMO	9.143	14.486	9.391						Continuing	Continuing

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

Efforts in this project mature and demonstrate the ability to locate and identify modern tactical battlefield enemy and blue force radio frequency (RF) communications, radars, and computer networks and nodes to enable uninterrupted air and ground based intelligence collection and long range targeting operations in a hostile electromagnetic and cyber environment. This project matures and demonstrates communications countermeasures (CM) and counter-countermeasures (CCM) technologies to first intercept, then identify, and locate tactical communications and degrade threat computer networks and their components.

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

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Ft. Monmouth NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Combat Identification (CID) Technology Demonstration:</b> This effort matures and demonstrates real time CID technologies for light weight tactical vehicles and Soldiers. In FY09, mature and demonstrate the Soldier Radio Waveform (SRW) as a radio-based application that would provide both a target identification (TI) and situational awareness (SA) capability for light vehicle applications as well as urban and open terrain operation for Soldier level applications; mature TI interrogation approaches utilizing either laser or radio frequency components; enhance the SRW software to allow it to respond to directed interrogations for TI capability as well as to provide SA capability even in Global Positioning System denied environments; integrate and demonstrate the processor, transceiver, and antenna for the miniaturized Battlefield Target Identification Device (BTID) CID system on light weight tactical vehicles. Work related to this effort is also being accomplished under PE 0602120A/project H15.	.000	5.088	.000	
<b>Networked Electronic Warfare (EW):</b> This effort provides the capability to autonomously detect, classify, correlate, and geo-locate modern wireless communication emitters on the battle field and in urban terrain.	9.143	9.067	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> K15	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>In FY08, conducted developmental tests of surgical EW techniques against 3 threats simultaneously; integrated complementary jamming and detection/location/neutralization capabilities such as time difference of arrival (TDOA) geolocation and electronic attack based on geolocation; integrated algorithms into government off-the-shelf hardware. In FY09, integrate commercial off-the-shelf 3-D visualization and mapping tools with geo-location solution set for optimal urban situational awareness and emitter representation; integrate capabilities into net-centric solution that combines jamming and detection/location/neutralization capabilities; complete algorithm development and validation and fabrication of adaptive processing arrays. Related work is also accomplished under PE 0602270A/project 442, PE 0602270A/project 906, and PE 0603270A/project K16.</p>					
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.331	.000
<p><b>Offensive Operations:</b> This effort matures and demonstrates integrated Electronic Attack (EA)/Computer Network Operations (CNO) capabilities for the Electronic Warfare Officer (EWO) to plan and engage a multitude of diverse multi-node, multi-waveform, multi-platform and cyber (internetworked computer) targets in a distributed and coordinated fashion while maximizing overall network efficiency, effectiveness, and preserving blue force and non-combatant communications. In FY10, will develop and mature algorithms for distributed scheduling and predicted impact; will mature high-fidelity models of next generation techniques to include lethal effects and threat/node characterization.</p>			.000	.000	4.696
<p><b>Stand-off Non-Cooperative Multi-Intelligence Technologies:</b> This effort matures and demonstrates technologies to detect, identify, map, and track targets, which may include humans, vehicles, communications devices, Unexploded Ordnance (UXO), Concealed Weapons/Concealed Explosives (CW/CE), and booby traps. In FY10, will analyze and design optimum sensor mix; will develop and mature software algorithms and hardware; and will mature modeling and simulation for sensor mix.</p>			.000	.000	4.695
<b>Total</b>			<b>9.143</b>	<b>14.486</b>	<b>9.391</b>
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology	<b>PROJECT NUMBER</b> K15

**E. Performance Metrics**

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

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology					<b>PROJECT NUMBER</b> K16	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K16: NON-COMMO ECM TECH DEM	7.799	9.430	9.801						Continuing	Continuing

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

Efforts in this project mature and demonstrate non-communication, multi-functional electronic warfare capabilities that enhance the survivability of Army air and ground platforms and dismounted forces. This project matures and demonstrates radio frequency (RF), infrared (IR) and electro-optical (EO) sensor and jamming source technologies to detect, locate, deceive, and neutralize (jam) booby traps, radar directed target acquisition systems, target-tracking sensors, surface-to-air missiles (SAMs), air-to-air missiles (AAMs), top attack and electronically fuzed munitions. This project also matures and demonstrates Electronic Support (ES) technologies to detect, identify, and geolocate emitters of interest from an effective standoff distance and provide near real-time situational awareness.

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

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM), Communications-Electronic Research, Development, and Engineering Center (CERDEC), Ft. Monmouth NJ, and the Army Research Lab, Adelphi MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Hostile Fire Indication (HFI) and Countermeasure (CM): This effort implements affordable hostile fire indication for aircraft against small arms fire and rocket propelled grenades (RPG) by modifying currently fielded systems. In FY08, completed software modifications to cockpit display HFI display interface; defined overall suite architecture for net-centric survivability in a Simulation environment; conducted live fire test to demonstrate Common Missile Warning System (CMWS) processing upgrades for hostile fire indication and countermeasure; transitioned technology to Aviation and Missile Research, Development, and Engineering Center aircraft survivability program for flight testing.	2.294	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.212	.000	
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats supporting force protection technology.	2.014	2.174	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology			<b>PROJECT NUMBER</b> K16	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, integrated algorithms into government off-the-shelf hardware; conducted performance testing of prototype system; refined the system design based on test results; integrated jamming and detection, location, neutralization capabilities.</p> <p>In FY09, complete algorithm development and validation of adaptive processing arrays; integrate visualization and mapping tools with geolocation solution sets; demonstrate capability in the lab. Work related to this effort is also being accomplished under PE 0602270A/project 442; PE 0602270A/project 906, and PE 0603270A/project K15.</p>						
<p><b>Cueing Sensor:</b> This effort matures and demonstrates low cost infrared sensors that detect rocket propelled grenades, anti-tank guided missiles, tank fired and high energy anti-tank rounds and then cues active protection systems for Army vehicles.</p> <p>In FY08, optimized Focal Plane Array (FPA) design; enhanced and evaluated sensor, electronics, and algorithms for testing on-the-move (OTM) environment.</p> <p>In FY09, demonstrate the cueing sensor software and hardware against different types of live fire munitions (threats to ground vehicle); demonstrate the capability to detect, declare, and classify the live fire threats; transition the cueing sensor hardware and software to the active protection system (APS) effort for integration into the kinetic energy APS vehicle survivability system. Work related to this effort is also being accomplished under PE 0602120A/project H15.</p>			3.491	7.044	.000	
<p><b>Distributed Aperture Infrared Countermeasures (DAIRCM) Technologies:</b> This effort matures and demonstrates an integrated laser source, distribution system, and beam director that support a multi-function helicopter protection capability.</p> <p>In FY10, will investigate and mature a laser pointer tracker (LPT) to be aligned bore-sited with the UV-based CMWS sensors. The LPT will scan areas of interest cued by the missile warning system (MWS) and receive laser return for the incoming threat.</p>			.000	.000	4.900	
<p><b>Advanced Tactical Radio Frequency Countermeasures (ATRFCM) Technologies:</b> This effort matures and demonstrates an integrated Electronic Warfare/Direction Finding system for the protection of platforms from emerging RF threats.</p> <p>In FY10, will mature and demonstrate improved wideband frequency waveform generators for higher spectral purity and modulation flexibility; wideband receivers capable of high speed, dynamic signal demodulation and data collection; and high power, efficient, RF amplifiers, for improved Electronic Warfare (EW)/communications compatibility; will begin integration into a working brassboard for lab and field testing; will develop and mature integrated and distributed packaging for improved vehicle integration and thermal performance.</p>			.000	.000	4.901	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603270A Electronic Warfare Technology		<b>PROJECT NUMBER</b> K16	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
Total			7.799	9.430	9.801
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603313A Missile and Rocket Advanced Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	77.171	76.702	63.951						Continuing	Continuing
G03: Area Defense Advanced Technology	1.919	1.978	1.998						Continuing	Continuing
NA6: Missile and Rocket Initiatives (CA)	16.812	12.917	.000						Continuing	Continuing
206: MISSILE SIMULATION	3.366	3.522	3.518						Continuing	Continuing
263: FUTURE MSL TECH INTEGR(FMTI)	32.093	36.805	42.492						Continuing	Continuing
550: COUNTER ACTIVE PROTECTION	14.891	15.351	8.127						Continuing	Continuing
704: Advanced Missile Demo	8.090	6.129	7.816						Continuing	Continuing

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

This program element (PE) matures and demonstrates advanced missile technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability. The emphasis in this PE is on smaller, lighter weight, more affordable missiles. This PE supports high fidelity simulations including real-time Hardware-in-the-Loop (HWIL) for the design, demonstration and testing of advanced tactical missiles and interceptors (project 206); the maturation and demonstration of missile components with capabilities for locating targets in clutter, precision guidance, high speed missile flight, and missile communications, command, and control (project 263); development of a guided interceptor to work with the active protection system (APS) being developed for Future Combat Systems (FCS) (project 550); maturation and demonstration of tracking and fire control radar technologies against rocket, artillery, and mortar threats (project 704); and the maturation and demonstration of technologies required for force protection against Unmanned Aerial Vehicles and rotary wing aircraft (project G03). Project NA6 funds congressional special interest items.

Work in this PE is related to, and fully coordinated with, with PE 0602303A (Missile Technology), PE 0603003A (Aviation Advanced Technology), PE 0603270A (Electronic Warfare Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle and Automotive 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.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology
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Work in this PE is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) and Space and Missile Defense Command (SMDC) located at Huntsville, AL.

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	77.259	63.998	70.767	
Current BES/President's Budget	77.171	76.702	63.951	
Total Adjustments	-.088	12.704	-6.816	
Congressional Program Reductions	.000	-.256		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	12.960		
Total Reprogrammings	2.027	.000		
SBIR/STTR Transfer	-2.115	.000		

**Change Summary Explanation**

FY09 increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology					<b>PROJECT NUMBER</b> G03	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
G03: Area Defense Advanced Technology	1.919	1.978	1.998						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project matures and demonstrates Air Defense Missile technology to support brigade force protection capability against the following potential threats: Unmanned Aerial Vehicles, rotary wing aircraft and Large Caliber Rockets, Cruise Missiles, etc. and to expand the protection envelope to a division/corps area.</p> <p>The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Small Business Innovative Research/Small Business Technology Transfer Programs						.000	.053	.000		
<p>Air Defense Advanced Technology: This effort matures and demonstrates missile technology to provide capability for warfighter force protection against low and slow flying air vehicle threats in all environments without increasing the force structure.</p> <p>In FY08, established system requirements and performance goals for a missile capable of being launched from existing platforms to provide a force protection capability against slow flying airborne surveillance threats including unmanned air vehicles and rotary wing aircraft. Identified potential missile concepts to meet the requirements and noted critical technologies required to meet performance goals.</p> <p>In FY09, continue to perform trade studies and lethality analysis through modeling and simulation of concepts, select the most favorable concepts for further development and begin maturation and demonstration of associated underlying critical component technologies.</p>						1.919	1.925	1.998		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology		<b>PROJECT NUMBER</b> G03	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will mature and develop critical components for an air defense capability, perform component testing in a laboratory environment, and develop high fidelity simulations. This effort leverages activities from PE 0602303A, project 214 and PE 0603313A, project 263.				
Total	1.919	1.978	1.998	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology					<b>PROJECT NUMBER</b> NA6	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
NA6: Missile and Rocket Initiatives (CA)	16.812	12.917	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Missile and Rocket advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Smart Energetics Architecture for Missile Systems							1.545	.000	.000	
Waterside Wide Area Tactical Coverage & Homing (WaterWATCH)							2.898	.000	.000	
Rapid Response System for Protection of Air and Ground Vehicles							3.866	4.030	.000	
High Fidelity Virtual Simulation and Analysis (HFVSA)							.966	1.550	.000	
Army Virtual Emergency Testbed (AVERT)							2.319	.000	.000	
Perimeter & Maritime Sensor Network							2.319	.000	.000	
Software Engineering Enhancements							2.899	.000	.000	
Heavy Fuel High Efficiency Turbine Engine							.000	1.938	.000	
Long Range Hypersonic Interceptor							.000	.775	.000	
Advanced Commercial Technology Insertion for Aviation & Missile Research, Development, & Engineering							.000	2.325	.000	
Army Responsive Tactical Space System Exerciser (ARTSSE)							.000	1.937	.000	
SBIR/STTR							.000	.362	.000	
Total							16.812	12.917	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology	<b>PROJECT NUMBER</b> NA6
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
206: MISSILE SIMULATION	3.366	3.522	3.518						Continuing	Continuing

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

This project matures and demonstrates modeling and simulation tools for missile design and analysis and improved Hardware-in-the-Loop (HWIL) simulation capabilities. Evaluation of missile technology by means of HWIL provides a cost-effective method that supports missile maturation throughout weapon system life cycles and permits a reduction in the number of flight tests required, as well as improving the confidence of flight test readiness and probability of flight test success.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.093	.000	
Missile Simulation: This effort matures and demonstrates simulation technologies to support missile design, analysis and test.  In FY08, defined architecture and interface requirements for reusable and standardized Hardware-in-the-Loop (HWIL) common prototype modules to provide more cost effective HWIL simulation systems. Developed standardized interfaces, internal components and created a core data network to realize these goals.  In FY09, continue the common HWIL framework development by testing standard high bandwidth interfaces for an infrared (IR) seeker, 6-degree-of-freedom (6-DOF) simulation and facility modules (clock, signal injection, and software). Investigate and develop passive IR projector with polarization capability to evaluate polarized infrared sensors ability to acquire and discriminate targets. Continue development of millimeter wave (MMW) synthetic aperture radar (SAR) integration and signal processing techniques for high-resolution characterization and validation database development from FY07.	3.366	3.429	3.518	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will integrate and test the following prototype components: common HWIL capabilities including PC based scene generation, short-wave IR projector, facility monitor, 6-DOF simulation, signal injection system, and prototype seeker hardware. Develop a prototype interface for the HWIL laser radar (LADAR) projection system. Will transition new IR solar source developed under PE 0602303A to analyze solar implications on missile system performance. Develop a collaborative visualization environment in order to evaluate art-of-the-possible missile component capabilities.				
Total	3.366	3.522	3.518	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology					<b>PROJECT NUMBER</b> 263	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
263: FUTURE MSL TECH INTEGR(FMTI)	32.093	36.805	42.492						Continuing	Continuing

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

This project matures and demonstrates advanced tactical missile technologies such as seekers, controllable thrust motors (gels, pintle-controlled solids, and air breathing) for propulsion, airframes, and guidance and controls for tactical missiles. The project goal is to reduce the cost per kill of precision guided missiles. The project matures the technologies developed and funded under PE 062303A and directly supports systems managed by the Program Executive Officer for Missiles and Space.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	1.005	.000	
Technology for Non-Line-of-Sight Launch System (NLOS-LS) Variants: This effort focuses on demonstrating technologies that leverage the NLOS-LS Container Launch Unit (CLU) to provide a versatile mix of fires and fused effects capabilities for defeat of conventional and asymmetrical threats in all environments. In FY10, will design and develop critical components to support concept refinement and prototype fabrication of an NLOS-LS variant missile capable of rapid, precision deployment of lethal and non-lethal payloads. Will perform subsystem and system-level testing and evaluation in a laboratory environment. Will perform an evaluation of payload delivery feasibility through proof-of-principle flight tests and high fidelity simulations. Will investigate, identify and coordinate design interfaces for selected high payoff payload candidates and evaluate and mature the most promising interfaces to enable integration into NLOS-LS variant. This effort leverages technology development activities from PE602303A.	.000	.000	4.440	
Advanced Propulsion and Warheads: This effort matures propulsion and warhead technology for the Non-Line-of-Sight Launch System (NLOS-LS).	5.807	1.923	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology		<b>PROJECT NUMBER</b> 263	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, investigated enhanced NLOS-LS technologies, including the high efficiency turbo-engine (HETE) technology for potential NLOS-LS variants. Performed bench testing of prototype hardware components and wind tunnel testing of variant concept designs.</p> <p>In FY09, perform integrated prototype system concept demonstrations and evaluations of an NLOS-LS cargo variant for rapid, precision deployment of submunitions.</p>				
<p>Close Combat Networking of Weapons and Sensors: This effort matures and demonstrates enabling technology to provide network lethality capability for transition to Javelin and Tube-launched, Optically-tracked, Wire-guided (TOW) missile systems that will increase warfighter lethality, survivability, and situational awareness.</p> <p>In FY08, completed technical specifications of a digital link to current and future tactical network radios for the TOW Improved Target Acquisition System (ITAS), and Javelin Command Launch Unit (CLU). Conducted networked lethality force effectiveness study to quantify force-multiplying battlefield effects of networked TOW and Javelin, including the capability to transmit standard Variable Message Format (VMF) messages to fielded infantry battle command systems. Conducted mission software design and development, and component-level trade studies and design for CLU strap-on Far Target Locator (FTL) and network interface.</p> <p>In FY09, continue maturation of prototype mission software; conduct prototype strap-on FTL and network interface card development; integrate and demonstrate system level future force (Soldier Radio Waveform) radio interoperability; perform integration and testing with the Javelin CLU. Conduct planning for a networked lethality demonstration employing current and future tactical radios.</p> <p>In FY10, will complete and fully integrate all mission application enhancements with prototype networked ITAS and networked CLU with strap-on FTL and perform system-level tests, followed by Command Launch Unit and ITAS network integration. Will conduct cooperative networked TOW ITAS and Javelin Command Launch Unit capability demonstration.</p>	3.837	4.809	5.576	
<p>Modeling/Simulation and System Performance Evaluation: This effort matures Modeling and Simulation technology for the Non-Line-of-Sight Launch System (NLOS-LS).</p>	2.898	.962	.000	

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology		<b>PROJECT NUMBER</b> 263	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY08, supported few-on-few simulations and demonstrations of NLOS-LS Precision Attack Missile (PAM). Performed trade studies and generated detailed simulation models to evaluate PAM propulsion and multi-mode seeker technology insertion. Modeled manufacturing and affordability (M&amp;A) issues in preliminary design phase of NLOS-LS variants.</p> <p>In FY09, perform many-on-many system trade studies and generate detailed simulation models for evaluation of NLOS-LS variants and PAM upgrades. Continue to address manufacturing and affordability issues. Conduct excursions to expand the envelope of simulation evaluated conditions.</p>				
<p><b>Multi-Mission/Multi-Purpose Single Missile Propulsion:</b> This effort matures and demonstrates enhanced capability missile propulsion that provide longer ranges, closer inner boundaries increasing mission flexibility, and shorter flight times while increasing system insensitive munitions capability and mission robustness in air-to-ground, ground-to-ground, and ground-to-air roles for transition to PEO Missiles &amp; Space.</p> <p>In FY08, performed system-level trade studies and concept designs of gelled bi-propellants, pintle-controlled solids, and hybrids. Successfully tested two low cost pintle materials in reduced smoke propellant which offer significant cost and weight advantages. Successfully demonstrated a throttleable vortex engine using gel fuel.</p> <p>In FY09, complete concept designs for the best candidate motor and fabricate critical components (including propellants, engine, expulsion systems, and controls) for variable propulsion motors. Begin validation of critical components of these designs.</p> <p>In FY10, will complete testing of missile motor critical components, select best technical approach and begin design, analysis and fabrication of flight-ready motor hardware for static testing.</p>	1.287	2.318	4.885	
<p><b>Enhanced Precision Interceptor Technology:</b> This effort develops and demonstrates interceptor technology, concepts and prototype hardware to defeat rocket, artillery, and mortar threats in flight at extended ranges. This effort is in collaboration with PE 0603313A Vertical Launch Technology and PE 0603313A Technical Fire Control Technology.</p>	.000	.000	8.045	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10 will complete final designs of prototype interceptor components and fabricate and perform bench and field testing of all components. Will also integrate interceptor components and conduct system level Hardware-in-the-Loop (HWIL) testing and evaluation. Update the interceptor designs and simulations based on the test results.				
<p>Technical Fire Control Technology: This effort develops and demonstrates technical fire control technology and prototype hardware and software to determine a firing solution and launch and command an interceptor to defeat rocket, artillery, and mortar threats in flight at extended ranges. This effort is in collaboration with PE 0603313A Enhanced Precision Interceptor Technology and PE 0603313A Vertical Launch Technology.</p> <p>In FY10 will complete final designs of prototype technical fire control components and software, will fabricate and complete bench level testing of all components and software. These technical fire control components will be integrated with the interceptor components developed under PE 0603313A Enhanced Precision Interceptor Technology to support system level Hardware-in-the-Loop (HWIL) testing and evaluation. Update the technical fire control design and software and update simulations based on the test results.</p>	.000	.000	7.040	
<p>Enhanced Seeker Development: This effort matures seeker technology for the Non-Line-of-Sight Launch System (NLOS-LS).</p> <p>In FY08, integrated PAM (Precision Attack Missile) seeker and electronics together and performed tower and captive flight testing of the PAM seeker.</p> <p>In FY09, perform two captive flight tests and continue evaluation and maturation of seeker technology, aided target acquisition (ATA), and electronics. Transition to PEO Missiles &amp; Space as a spiral upgrade to NLOS-LS System Development and Demonstration (SDD) program.</p>	2.898	.962	.000	
<p>Applied Smaller, Lighter, and Cheaper (SLC) Missile Components: Matures and demonstrates technology developed in PE602303A that focuses on developing increasingly smaller, lighter, and cheaper missile components to enhance current system capabilities against asymmetric threats for transition to the next generation small precision munitions. Mature technologies will transition to PM Close Combat Weapon Systems.</p> <p>In FY08, completed and down-selected final multipurpose warhead (MPW) design, performed initial lethality assessments, and warhead pre-qualification tests in conjunction with Armaments Research Development Engineering</p>	5.180	7.489	7.463	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Center, PE602624A. Completed design and conducted captive flight tests (CFT) of uncooled non-gimbaled infrared (IR) seeker reducing size and cost.</p> <p>In FY09, conduct requirements analysis and trade studies for small, low cost electronics and seeker/sensor systems including height of burst sensor (HOBS) and high-reliability TOW rate sensor, and common electronic safe and arm device (ESAD) for small lightweight precision missiles. Leverage latest in nanotechnology and electronics packaging to achieve small, light, missile form factors to meet urban and emerging threats. Integrate MPW with Javelin and conduct tandem/Insensitive Munition tests.</p> <p>In FY10, will mature latest in nano/advanced technology composites for use in lightweight missile structures improving thermal dissipation; complete image-based stabilization/people tracking subsystems; conduct static/dynamic ESAD testing and; down-select and flight test TOW rate sensor package for missile guidance.</p>				
<p>Defense against Rockets, Artillery, and Mortars (RAM): This effort transitions activities from Defense against RAM Interceptor efforts in PE 0602303A to demonstrate an integrated system to counter multiple simultaneous RAM threats. This effort is in collaboration with PE 0603313A Enhanced Precision Interceptor Technology and PE 0603313A Technical Fire Control Technology.</p> <p>In FY08, developed and demonstrated component technologies and initiated and completed preliminary designs of prototype interceptor, launcher, and fire control components capable of intercepting and defeating RAM threats.</p> <p>In FY09, initiate final designs of prototype interceptor, launcher, and fire control components and begin fabrication and bench and field testing of supporting brassboard component technologies. Update and verify system-level RAM Interceptor simulations based on test results.</p> <p>In FY10 will complete final designs of prototype vertical launch, pitch-over components, and integration of system components. Fabricate and complete bench level testing of all components and software. The launch and pitch-over, interceptor and the technical fire control components will be integrated for system level Hardware-in-the-Loop (HWIL) testing and evaluation. Update the vertical launch and pitch-over designs and software and update simulations based on the test results.</p>	10.186	17.337	5.043	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Total	32.093	36.805	42.492	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
550: COUNTER ACTIVE PROTECTION	14.891	15.351	8.127						Continuing	Continuing

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

This project matures and demonstrates integrated survivability technologies and techniques for lightweight combat platforms including light armored vehicles, tactical wheeled vehicles, and helicopters. Efforts include the development of guided interceptors for active protection systems (APS) capable of defeating tank-fired large caliber anti-armor threats, anti-tank guided missiles and long range rocket propelled grenades (RPGs). Work in this project on APS is in collaboration with PE 0602624A (Weapons and Munitions Technologies), project H28, and PE 0603005A (Combat Vehicle and Automotive Advanced Technology), project 221. This project complements work done on adaptive infrared suppressor and acoustic signature technologies matured in the PE 0603003A (Aviation Advanced Technology), project 313. This effort is building on the expertise developed in support of rockets, missile, sensors, and active control to develop innovative solutions survivability.

The cited work is consistent with the Department of Defense 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 Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.411	.000	
Kinetic Energy Active Protection System (KEAPS) Guided Interceptor: This effort develops and demonstrates an interceptor to defeat threats to vehicle survivability focusing on tank fired kinetic energy threats to combat vehicles.  In FY08, completed development of components and began integration into hardware-in-the-loop (HWIL) simulation facility for subsystem testing. Conducted three ballistic flight tests to evaluate interceptor kinematic and aerodynamic performance. Conducted one pre-programmed control flight tests to evaluate control authority, IMU performance, and aerodynamic response to control.  In FY09, complete integration of interceptor components and conduct three control flight tests guiding the interceptor through preprogrammed maneuvers. Complete field testing of the seeker; test it in HWIL to evaluate seeker dynamic	14.891	14.940	8.127	

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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>performance. Demonstrate up to five guided flight tests to evaluate guidance accuracy against live threats under increasing degrees of launch error. Integrate seeker, target detection device (TDD) and electronic safe and arm device (ESAD) into guided interceptor for flight testing. Begin fabrication of guided interceptors for integrated system-level demonstration.</p> <p>In FY10, conduct up to two guided flight tests against live threats to evaluate TDD and ESAD performance. Integrate pop-up-pitch-over (PUPO) apparatus into interceptor for flight tests and complete integration on a combat platform for a fire-on-the-move demonstration. Conduct two flight tests with launch canister and PUPO against live threats. Integrate warhead into interceptor and conduct two full end-to-end flight tests from PUPO to threat defeat.</p> <p>This effort is in collaboration with PE 0602624A (Artillery and Combat Support Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0602618A (Ballistics Technology, Robotics Technology), PE 0603004 (Advanced Munitions Demonstration).</p>				
Total	14.891	15.351	8.127	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
704: Advanced Missile Demo	8.090	6.129	7.816						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This project matures advanced state-of-the-art missile system concepts and related hardware to enhance weapon system lethality, survivability, agility, versatility, deployability, and affordability for defense against the future force air and ground, armored and non-armored threats.</p> <p>The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this project is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.</p>										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Small Business Innovative Research/Small Business Technology Transfer Program						.000	.174	.000		
<p>Advanced Multi-Mission Precision Guided Munition (AMMPGM) for air platforms: This effort demonstrates alternate Hydra-70 rocket aft end configurations for low cost accuracy improvements to transition to PEO Missiles &amp; Space.</p> <p>In FY08, completed fabrication and demonstration of alternate Hydra-70 rocket configurations through hardware-in-the-loop, bench, and live-fire testing.</p>						3.295	.000	.000		
<p>Counter Rockets, Artillery, Mortars (CRAM) Tracking and Fire Control: This effort matures and demonstrates radar technology to provide 360 degree, near hemispherical coverage for track and command intercept of RAM threats. This task supports Defense Against Rocket, Artillery, and Mortar, PE0603313A Project 263 to perform system-level demonstration.</p> <p>In FY08, transitioned short-range surveillance and fire control sensor technology from PE 0603004A. Fabricated prototype short-range surveillance sensors capable of acquiring and tracking RAM threats under realistic operational conditions. Began fabrication of prototype fire control sensor capable of providing required accuracy for intercepting and defeating RAM threats. Initiated and completed preliminary design of a fire control sensor and demonstrated through test capable of providing range resolution required by the interceptor being developed under PE 0603313A Project 263.</p>						4.795	5.955	7.816		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603313A Missile and Rocket Advanced Technology		<b>PROJECT NUMBER</b> 704	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, complete the fabrication and integration of a prototype surveillance sensor. Test the integrate prototype surveillance sensor in an open air environment to verify technology can acquire and track small mortar and rocket targets with very low radar cross sections. Complete final design and begin fabrication and integration of fire control sensor components.</p> <p>In FY10, will complete fire control sensor assembly fabrication and begin to integrate with the other system components developed under Defense Against Rocket, Artillery, and Mortars. Will conduct system-level live-fire testing demonstrating the fire control sensor can track RAM targets with the required accuracy.</p>				
Total	8.090	6.129	7.816	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	30.038	37.534	30.317						Continuing	Continuing
608: COUNTERMINE & BAR DEV	21.756	27.365	25.431						Continuing	Continuing
64C: COUNTERMINE DEMONSTRATIONS (CA)	5.410	6.838	.000						Continuing	Continuing
683: Area Denial Sensors	2.872	3.331	4.886						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
<p>This program element (PE) matures and demonstrates sensor and neutralization technologies required to detect, identify, and then mitigate the effects of landmines, minefields, and obstacles. This PE also conducts modeling and simulation activities to assess the effectiveness of system concepts. This PE supports the maturation and demonstration of enabling component and subsystems for countermine technologies in the areas of countermine and barrier development (project 608), and area denial sensors (project 683). Project 64C funds congressional special interest items.</p> <p>Work in this PE is related to and fully coordinated with PE 0602120A, (Sensors and Electronic Survivability), PE 0602624A, (Weapons and Munitions Technology), PE 0602712A, (Countermine Systems), PE 0602784A (Military Engineering Technology), PE 0603710A, (Night Vision Advanced Technology), and the US Marine Corps.</p> <p>The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.</p> <p>Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM)/Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA.</p>										

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	30.700	30.797	32.541	
Current BES/President's Budget	30.038	37.534	30.317	
Total Adjustments	-.662	6.737	-2.224	
Congressional Program Reductions	.000	-.123		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	6.860		
Total Reprogrammings	.010	.000		
SBIR/STTR Transfer	-.672	.000		

**Change Summary Explanation**

FY09 funding increase is due to congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology					<b>PROJECT NUMBER</b> 608	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
608: COUNTERMINE & BAR DEV	21.756	27.365	25.431						Continuing	Continuing

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

Efforts in this project mature and demonstrate countermine technologies for finding and neutralizing surface and buried threats in varying vegetation, soil, weather, and diurnal conditions. Activities include remote/standoff detection of minefields and neutralization of booby traps, landmines, and minefields. This project also evaluates airborne threat detection sensors and matures them for lightweight plug-and-play use on unmanned aerial systems (UASs) in mission specific applications. Efforts are supported by modeling and simulation assessments to define potential system effectiveness.

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 PE is performed by the Army Research, Development, and Engineering Command (RDECOM)/Communications-Electronics Research, Development, and Engineering Center (CERDEC), Ft. Belvoir, VA. Minefield neutralization efforts are closely coordinated with Navy/US Marine Corps.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.575	.000	
Mine and Minefield Detection Payload for Tactical Unmanned Aerial Systems (TUAS): This effort provides the TUAS with a capability to detect booby traps, threat deployment activity, minefields and homemade explosives (HME). In FY09, conduct trade studies and modeling of sensor candidates to meet size, weight, and power constraints of a medium altitude TUAS airborne payload; mature sensors and algorithms tailored to sensor selection and mission; integrate sensor package for manned flight test. In FY10, will perform flight testing/data collections on manned aircraft; will mature algorithms based on sensor data collections and analysis; will complete detailed payload design.	.000	7.932	8.442	
Threat Detection and Neutralization for Route Clearance: This effort demonstrates capabilities to detect and neutralize surface and shallow buried threats on primary and secondary roads from tactical standoff ranges. In FY08, completed sensor effects data analysis to facilitate design of the radio frequency/high power microwave neutralizer; matured the design of the next generation neutralizer; demonstrated detection capabilities of existing forward looking radar systems against representative threats; demonstrated a baseline graphical user interface (GUI) used by	10.107	6.286	10.664	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology		<b>PROJECT NUMBER</b> 608	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>operators to rapidly manipulate sensor to improve target search; began integration of the electro optic infrared (EO/IR) sensor suite data with the baseline GUI and development of detection algorithms to improve target search.</p> <p>In FY09, continue development of detection and neutralization components and algorithms for the EO/IR GUI system to reduce operator workload; conduct series of demonstrations and select the promising technologies for convoy escort and route clearance prototypes; demonstrate sensor fusion algorithms to reduce false alarm rates in high clutter/urban environments.</p> <p>In FY10, will demonstrate standoff detection system integration concepts on manned ground vehicles; will mature EO/IR GUI algorithms to improve system performance; will mature radar fusion algorithms to reduce false alarms; and will improve performance of grenade shape charge munitions from PE 0602712/project H24 for standoff explosive neutralization capability.</p>				
<p>Threat/Mine Detection for In Road Obstacles: This effort advances ground penetrating radar and metal detection technologies integrated onto vehicles to detect the evolving booby traps underbelly threat on primary and secondary roads. This effort leverages the technology results from forward looking radar technology investigations under the Threat Detection and Neutralization for Route Clearance effort.</p> <p>In FY08, matured down looking ground penetrating radar (GPR) modules, improved performance of GPR sensor and signal processing; matured electromagnetic/magnetometer detection technologies for deeply buried in-road threats; matured fabrication and integration of GPR prototype to vehicle for detection of buried in road threat.</p> <p>In FY09, mature GPR capabilities by combining modules into vehicle sized sensor array; mature electromagnetic detection technologies for deeply buried in-road metallic threats while increasing on route speeds; mature metal detection capabilities and begin integration onto unmanned ground vehicle; demonstrate the improved unmanned GPR capability.</p> <p>In FY10, will complete GPR demonstration; will begin integration of a combined metal detection and GPR sensor suite which includes a modular lightweight mount to interface with tactical ground vehicles; will begin fabrication of combined metal detection/GPR sensor.</p>	11.649	12.572	6.325	
<b>Total</b>	21.756	27.365	25.431	
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology	<b>PROJECT NUMBER</b> 608
<b><u>D. Acquisition Strategy</u></b> N/A		
<b><u>E. Performance Metrics</u></b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology					<b>PROJECT NUMBER</b> 64C	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
64C: COUNTERMINE DEMONSTRATIONS (CA)	5.410	6.838	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> Congressional Interest Item funding for Countermine advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Demining Technology							3.865	5.715	.000	
Enhanced Landmine and IED Detection Technology							1.545	.931	.000	
SBIR/STTR							.000	.192	.000	
Total							5.410	6.838	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A										
<b>D. Acquisition Strategy</b> N/A										
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology					<b>PROJECT NUMBER</b> 683	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
683: Area Denial Sensors	2.872	3.331	4.886						Continuing	Continuing

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

Efforts in this project mature and demonstrate surveillance, command, and control technology components for alternative area protection systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). The technology includes distributed personnel surveillance systems and command and control systems to be used with man-in-the-loop overwatch fires. This project uses modeling and simulation to evaluate new concepts and modify doctrine. This project also constructs components, as well as, system architectures and conducts evaluations at the system level in field tests.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Area Denial Sensors: The effort provides demonstration of surveillance technologies components for area protection systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). In FY08, continued maturation of personnel discrimination algorithms; incorporated advanced personnel detection sensors into testbed Unmanned Ground Sensors (UGS); and demonstrated modeling and simulation of sensor and operator interface. In FY09, demonstrate detection and discrimination of combatant/noncombatant targets with testbed UGS in the laboratory environment; begin development of next generation detection and discrimination target sensor system by conducting trade studies and analysis of candidate sensing approaches with the potential to meet power and bandwidth constraints as well as range and environment requirements. For FY10, will continue development of personnel detection sensors and algorithms demonstration in laboratory environment; will develop and assess concepts on how to use the sensors with alternative personnel landmine systems; and will continue maturation of detection algorithms and sensors.	2.872	3.257	4.886	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.074	.000	
<b>Total</b>	<b>2.872</b>	<b>3.331</b>	<b>4.886</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603606A Landmine Warfare and Barrier Advanced Technology	<b>PROJECT NUMBER</b> 683
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					<b>R-1 ITEM NOMENCLATURE</b> PE 0603607A JOINT SERVICE SMALL ARMS PROGRAM					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	16.367	8.781	8.996						Continuing	Continuing
62D: SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)	2.512	.000	.000						Continuing	Continuing
627: JT SVC SA PROG (JSSAP)	13.855	8.781	8.996						Continuing	Continuing

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

This program element (PE) matures and demonstrates advanced technologies that integrate into individual and crew served weapons for all Services. This PE supports the maturation and demonstration of Lightweight Small Arms Technologies (LSAT) that offer significantly reduced weight over the currently fielded weapons and ammunition. All efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), the Joint Capabilities Integration Development System's Small Arms Analysis, and the resulting Capabilities Development Documents for the Services. Project 62D funds congressional special interest items.

Work in this PE is related to and fully integrated with the efforts funded in PE 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions 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 in this PE is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603607A JOINT SERVICE SMALL ARMS PROGRAM
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	10.629	8.809	9.085	
Current BES/President's Budget	16.367	8.781	8.996	
Total Adjustments	5.738	-.028	-.089	
Congressional Program Reductions	.000	-.028		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	.000		
Total Reprogrammings	6.006	.000		
SBIR/STTR Transfer	-.268	.000		

**Change Summary Explanation**

FY08 increased because of the transfer in of High Explosive Air-Burst (HEAB) Weapon Technology.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603607A JOINT SERVICE SMALL ARMS PROGRAM					<b>PROJECT NUMBER</b> 62D	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
62D: SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)	2.512	.000	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
These are Congressional Interest Items										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Polymer Small Arms Production							1.545	.000	.000	
Modular Individual Weapon Sight and Low Cost Remote Weapon Station							.967	.000	.000	
Total							2.512	.000	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603607A JOINT SERVICE SMALL ARMS PROGRAM					<b>PROJECT NUMBER</b> 627	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
627: JT SVC SA PROG (JSSAP)	13.855	8.781	8.996						Continuing	Continuing

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

This project matures and demonstrates advanced technologies that provide greater lethality and range at a significantly reduced weight. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden while maintaining or improving current levels of performance.

Work in this PE is related to and fully integrated with the efforts funded in PE 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions 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 in this PE is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.213	.000	
<b>Lightweight Small Arms Systems (LSAS):</b> The LSAS takes technologies that were successfully demonstrated in the Lightweight Small Arms Technologies (LSAT) effort and applies them to specific weapon systems and missions. In FY08, matured and demonstrated high payoff technologies from LSAT that were technically successful, affordable, and manufacturable. Identified and continued maturation of selected ammunition and weapon configurations including cased-telescoped and caseless ammunition, lightweight machine guns and rifles/carbines. In FY09, mature and demonstrate improved caseless ammunition formulation, fabricate small quantities of ammunition and weapons prototypes in order to conduct additional testing of hardware and validate design and analyses; begin to assess integration of technologies being developed under PE 0602623A such as graphite foam, improved lethality projectiles, and recoilless components. In FY10, will demonstrate TRL 5 for both the new lightweight machine gun and caseless ammunition, and continue integration of successful components tested from PE 0602623A.	7.142	7.319	7.428	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603607A JOINT SERVICE SMALL ARMS PROGRAM		<b>PROJECT NUMBER</b> 627	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
High Explosive Air-Burst Weapon Technology: In FY08, built two Individual Airburst Weapon systems demonstrators and validated design of weapon and airburst rounds. Validated fuze safety performance in preparation for test a Safety Certification from the Army Fuze Safety Review Board. Procured additional hardware to support building three additional demonstrators and sufficient rounds to enable design validation testing and user assessment.			6.000	.000	.000
Small Arms Technology Assessment and Effectiveness Modeling: This task addresses the application of technology component solutions to mitigate identified capability gaps in the JSSAP strategy. In FY08, began system integration planning and developed additional scenarios to assess utility of existing and potential future weapon concepts utilizing current force-on-force simulation. In FY09, further mature higher order simulations to assess the utility of complimentary programs in PE 0602623A/project H21. In FY10, will demonstrate and optimize weapon concepts at the individual warfighter level and small team level that are derived from simulation results obtained previously utilizing force-on-force effectiveness simulations.			.713	1.249	1.568
Total			13.855	8.781	8.996
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A					
<b>D. Acquisition Strategy</b> N/A					
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY
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COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	62.618	70.682	40.329						Continuing	Continuing
C65: DC65	.393	.000	.000						Continuing	Continuing
K70: NIGHT VISION ADV TECH	22.354	23.478	24.672						Continuing	Continuing
K73: NIGHT VISION SENSOR DEMONSTRATIONS (CA)	27.797	30.898	.000						Continuing	Continuing
K86: NIGHT VISION, ABN SYS	12.074	16.306	15.657						Continuing	Continuing

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

This program element (PE) matures and demonstrates sensor technology that increases Warfighter survivability and lethality by providing sensor capabilities to acquire and engage targets at longer ranges in complex environments and conditions (e.g. day/night, obscured, smoke, adverse weather). This PE focuses on assessing the military utility and maturing concepts of operation to address counter ambush operations (project 590). This PE will mature and demonstrate technologies that: improve the Soldier's ability to see at night; and provide rapid wide area search, multispectral aided target detection (AiTD) and passive long range target identification (ID beyond threat detection) in both an air and ground test-beds (project K70). This PE matures and demonstrates sensors and algorithms designed: to detect targets (vehicles, personnel) in camouflage, concealment, and deception from airborne platforms; and provides pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions (project K86). Project K73 funds congressional special interest items. Project C65 supports classified activities. Properly accessed individuals can obtain further information from the ASA(ALT) Special Programs Office.

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 PE is related to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE 0603774A (Night Vision Systems Advanced Development), and PE 0604710A (Night Vision Systems Engineering Development), PE 0603005A (Combat Vehicle and Automotive Advanced Technology).

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY
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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.

**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	53.910	39.916	40.595	
Current BES/President's Budget	62.618	70.682	40.329	
Total Adjustments	8.708	30.766	-.266	
Congressional Program Reductions	.000	-.234		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	31.000		
Total Reprogrammings	10.037	.000		
SBIR/STTR Transfer	-1.329	.000		

**Change Summary Explanation**

FY08 funding increase was due to transfer of Congressional interest items.

FY09 funding increase is due to Congressional adds

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> K70	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K70: NIGHT VISION ADV TECH	22.354	23.478	24.672						Continuing	Continuing

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

Efforts in this project mature and demonstrate high-performance integrated sensor/multi-sensor technologies to increase target detection range, extend target identification range, and reduce target acquisition (TA) timelines for dismounted Soldiers and tactical vehicles against threats that are beyond today's detection ranges or are partially obscured by terrain features.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<b>Miniature Target Acquisition, Far Target Locator System:</b> This effort matures and demonstrates with a miniature light weight, low powered, hand held far target locator system, to include real-time adaptive Visible Near Infrared/Short Wave Infrared/Long Wave Infrared (VNIR/ SWIR/LWIR) sensor fusion, a laser rangefinder/marker/illuminator, embedded gaps, target position determination, image and video transmission/reception/display, and electronic zoom with super-resolution capabilities. In FY08, leveraged the DARPA Multispectral Adaptive Networked Tactical Imaging System (MANTIS) Phase III program technologies of short wave infrared (SWIR), sensor fusion, and power management; began to integrate those technologies into the next generation of handheld multispectral (TV, near infrared (NIR), longwave infrared (LWIR)) target locator that uses a digital magnetic compass and global positioning system (gps) to pinpoint and relay target coordinates; and demonstrated day/night SWIR and improve laser capabilities. In FY09, conduct series of field tests/data collections to demonstrate the required SWIR and laser phenomenology necessary for target detection capability of those hard to find targets; and develop and demonstrate an interface with existing/developmental dismounted Soldier communication systems for real time video/image transmission.	3.000	3.430	.000	
<b>Weapon Sight Technology:</b>	.000	.000	6.046	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> K70	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
This effort develops, integrates, and demonstrates critical component for the next generation of weapon sight systems for mounted and dismounted Soldier use. In FY10, will develop and mature optical augmentation (OA) sensor and hardware; will begin Phase I weapon sight (WS) as defined in design studies and configuration definition; will conduct technical evaluation of included technologies; and will down select the optimum technology demonstrator for system integration.				
<b>Third Generation Infrared (IR) Technology:</b> This effort demonstrates compact high performance sensors for air and ground scouts and line of sight shooters, optimized for both rapid wide area search and passive long range target identification. It includes the development of multi-spectral aided target recognition and advanced digital signal processing algorithms to complement 3rd generation IR imagers. In FY08, finalized common air and ground integrated detector/cooler assembly specifications; completed the integration of the dual band focal plane array (FPA), dual F-number dewar, and miniaturized electronics into the common electro optic system (CEOS); and conducted multi-spectral aided target recognition evaluation with dual band FPA, and dual F-number dewar.	9.123	.000	.000	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.504	.000	
<b>Soldier Mobility Vision System:</b> This effort matures and demonstrates low power prototype system with full field-of-view (40 degree minimum) digitally-fused uncooled long wave IR and image intensified (I2) visible/near IR helmet mounted vision system for mobility, target detection, and situational awareness in complex terrain. In FY08, completed Application Specific Integrated Circuit (ASIC) fabrication and delivered working ASIC to the PEO Soldier digital enhanced night vision goggle (DENVG) program; began system hardware maturation and integration. In FY09, complete the integration of soldier vision technologies; conduct technical testing, and user evaluation; and transition technologies to the DENVG program.	4.446	3.310	.000	
<b>Urban Sensor Suite:</b> This effort develops and integrates 360 degree closed hatch vision capability with threat detection and cueing sensors and algorithms, high resolution interrogation sensors (for slew to cue identification), improved resolution driving sensors, and high bandwidth video capture capabilities in urban operations for improved survivability, lethality, and reduced crew workload.	.000	6.661	9.836	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY			<b>PROJECT NUMBER</b> K70	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>In FY09, complete trade off analyses of sensor and system design approaches; define system architecture and interfaces; complete modeling and simulation of human factors and operator cognitive work loading; conduct analysis for threat detection sensors, algorithms, high resolution interrogation sensors, video architectures and capture technologies; begin system design/integration and mature hardware concepts.</p> <p>In FY10, will evaluate threat detection sensor and baseline acoustic cueing, On The Move (OTM) Moving Target Indicator (MTI) and slew to cue algorithm performance; will integrate baseline detection sensors and algorithms to vehicle demonstration platform; will conduct demonstration of integrated detection and slew capabilities; will demonstrate baseline 360 degrees video capture approach for improve situational awareness while OTM; will mature and integrate the sensor system and algorithm efforts.</p>						
<p><b>Laser Designator Technology:</b> This effort leverages US Army investments in low power laser designation technology to provide advanced lightweight target detection and call for fire capability.</p> <p>In FY08, completed performance modeling and trade off analyses of a modular, ultra lightweight, man portable, low power, multi-sensor system for individual dismounted Soldiers and vehicular missions that utilizes small pixel, mid wave infrared (MWIR) thermal sensor technology, far target location capability, and clip-on laser designator; and begin the fabrication of the small pixel, large format (1280X720) MWIR thermal imaging sensor.</p> <p>In FY09, continue the fabrication of the small pixel, large format MWIR thermal imaging sensor; conduct trade-off analyses of small pixel MWIR versus small pixel medium format (640X480) uncooled longwave infrared (LW) thermal sensor; begin fabrication of small pixel, medium format MWIR, uncooled LWIR thermal sensors; begin fabrication of lightweight, clip-on common designator module (CDM); begin far target location improvement program development effort; and conduct initial laboratory test (similar to field environment) performance evaluation of the small pixel, large format MWIR thermal sensor.</p> <p>In FY10, will complete fabrication and demonstrate small pixel medium format MWIR and uncooled LWIR thermal sensors for target performance; will demonstrate prototype of lightweight clip-on CDM; will continue the development of the far target location effort, and will assess far target location performance efforts.</p>			5.322	8.117	7.309	
<p><b>Sensor and Information Fusion for Improved Hostile Fire Situational Awareness :</b> This effort builds on existing distributed aperture system (DAS) architecture and demonstration hardware to demonstrate automated pop up target detection algorithms and a 360 degree by 90 degree digital video recording capability with gunfire detection and audible sensing onto a vehicle platform.</p>			.463	1.456	1.481	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
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<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, developed user approved vignettes to define requirements, defined sensor capabilities and product transitions. In FY09, conduct trade off analyses of sensor and system design approaches; complete modeling and simulation of human factors and operator cognitive loading of information; demonstrate system architecture and planned interfaces; and begin hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and targeting information for the vehicle commander and crew in the urban fight. In FY10, will complete hardware development efforts; and mature and demonstrate driving and situational awareness (SA) indirect vision / drive-by-wire / driver assist design concepts, and guidelines with a local SA display for dismounted Soldiers.				
Total	22.354	23.478	24.672	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> K73	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K73: NIGHT VISION SENSOR DEMONSTRATIONS (CA)	27.797	30.898	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Night Vision advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Administrative Database Error (DFAS 1002 Prior year Actuals Update)							10.026	.000	.000	
Cable Warning and Obstacle Avoidance System							1.159	.000	.000	
Enhanced Digital Electronic Night-Vision (EDEN)							3.090	1.550	.000	
Hyperspectral Sensors for Improved Force Protection (Hyper-IFP)							1.545	1.550	.000	
FCS Short Range Electro Optic (SREO) Sensor for Stryker							3.091	1.550	.000	
Advanced Night Vision Sensors							1.932	.000	.000	
Hand Launched Unmanned Aerial System High Performance Payload (SUAS HPP)							2.318	.000	.000	
UCXR System							3.091	.000	.000	
Next Generation FPA Development							1.545	.000	.000	
Personal Miniature Thermal Viewer							.000	1.550	.000	
Smart Data Project: Real-Time Geospatial Video Sensor Intelligence							.000	.775	.000	
Brownout Situational Awareness Sensor							.000	1.550	.000	
Night Vision Advanced Technology Research							.000	11.625	.000	
InfraRed Goggle Upgrade System (IRGUS)							.000	.775	.000	
Mini-LRAS3 Scout Surveillance System							.000	1.550	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> K73	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Passive IR Sensor for Persistent Wide Area Surveillance	.000	1.938	.000	
Smart Sensor Supercomputing Center	.000	5.620	.000	
SBIR/STTR	.000	.865	.000	
Total	27.797	30.898	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY					<b>PROJECT NUMBER</b> K86	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K86: NIGHT VISION, ABN SYS	12.074	16.306	15.657						Continuing	Continuing

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

Efforts in this project mature and demonstrate intelligence, surveillance, reconnaissance, targeting, and pilotage technologies in support of the Army's aviation and networked systems. This project matures and demonstrates technology efforts that focus on improved reconnaissance, surveillance and target acquisition and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for attack, scout, cargo, and utility helicopters and unmanned aerial systems (UASs). UAS payload efforts mature and demonstrate small, lightweight, modular, payloads (electro-optical/infrared, laser radar, designator) to support target detection, identification, location, tracking, and targeting of tactical targets for the Brigade Combat Team.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Advanced Lasers for Unmanned Aerial System (UAS) Payloads: This effort develops, integrates and demonstrates an advanced target acquisition and designation laser payload to satisfy the reconnaissance, surveillance, and target acquisition (RSTA) mission requirements for the Class I unmanned aircraft system (UAS) customized to a 7 lb payload capacity. In FY08, conducted design studies to investigate promising compact payload concepts, finalized payload performance goals, and established laser component requirements; began development of 7 lb payload compatible with the Class 1 UASs with reconnaissance, surveillance, target acquisition (RSTA), and laser designation (LD) capabilities. In FY09, validate performance of the laser designator/laser range finder components in a relevant environment and demonstrate proof-of-principle RSTA and LD payload breadboard; finalize RSTA and LD payload system design; and conduct initial demonstrations of the laser, detector, and pointing/stabilization subsystems. In FY10, will validate performance of micro-turret payload laser, imaging and stabilization components and integrate them into a unified package; will complete transition and incorporation into the Advanced Demonstrator Payload of the	2.880	8.880	9.410	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> K86	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
laser designator/laser rangefinder component; and will mature and test compact 2-axis laser/infrared stabilized payload components.				
<p>Third Generation Infrared (IR) Technology: This effort demonstrates the benefits of Third Generation Infrared Technologies, long range target identification (identification beyond threat detection), wide area search, for aviation platforms. In FY08, completed demonstration of wide area search algorithms, and integrate into the airborne control station; performed flight tests of the surrogate AN/ZSQ-2 aviation turrets wide area search capability; recorded third generation imagery to support dual color Aided Target Recognition (AiTR) maturation; and completed the fabrication and testing of the dual color, dual f-number slim-line imagers optics.</p>	4.400	.000	.000	
<p>Airborne Unmanned Persistent Imaging: This effort demonstrates day and night persistent surveillance imaging (PSI) and enhanced reconnaissance, surveillance, and target acquisition (RSTA) capabilities from a single payload on the extended range/multi-purpose (ER/MP) unmanned aerial system (UAS). In FY10, will mature step stare software; and begin intelligent, tiered data processing development and hardware design trade studies.</p>	.000	.000	1.991	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.401	.000	
<p>Objective Pilotage for Utility and Lift (OPUL): This effort develops, integrates, tests and demonstrates a sensor suite that provides multi-pilot helicopters and crews simultaneous multi-user, wide field of regard imagery of the immediate surroundings. The OPUL system is designed for pilotage and navigation, providing advanced sensors for improved image quality under degraded and brown out conditions. In FY08, down-selected sensor configurations, refined requirements and design specifications, assessed and selected available displays (helmet mounted display, panel mounted display); and matured design and built sensor suite (including sensor pods, processors, displays, and required interface equipment). In FY09, integrate sensor suite onto a helicopter testbed; conduct flight evaluation to perform engineering checkout; assess integration and sensor suite performance; study human factors aspect of multi-sensor, multi-spectral, eye points and their impact on mission performance; and conduct limited user flight assessment.</p>	4.794	7.025	4.256	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603710A NIGHT VISION ADVANCED TECHNOLOGY		<b>PROJECT NUMBER</b> K86	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will complete human factors performance studies; and will conduct extensive flight evaluations and demonstrations with varying mission scenarios and environmental conditions.				
Total	12.074	16.306	15.657	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603728A Environmental Quality Technology Demonstrations					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	14.611	15.468	15.706						Continuing	Continuing
002: ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1.984	2.057	2.128						Continuing	Continuing
025: POLLUTION PREVENTION TECHNOLOGY	3.411	3.610	3.640						Continuing	Continuing
03E: ENVIRONMENTAL RESTORATION TECHNOLOGY	9.216	9.801	9.938						Continuing	Continuing

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

This program element (PE) matures and demonstrates technologies that assist Army installations in becoming environmentally compatible without compromising the readiness or training critical to the success of the future force. This program includes technology demonstrations for: restoration of sites contaminated with toxic and/or hazardous materials (such as unexploded ordnance [UXO]) resulting from Army operations; pollution prevention to minimize the Army's use and generation of toxic chemicals and hazardous wastes; compliance with environmental laws by control, treatment, and disposal of hazardous waste products; and conservation of natural and cultural resources while providing a realistic environment for mission activities. This program demonstrates technological feasibility, assesses the technology and its producibility, and transitions mature technologies from the laboratory to installations. Technologies developed by this program element improve the Army's ability to achieve environmental restoration and compliance at its installations, at active and inactive ranges and other training lands, and at its rework and production facilities. Technologies demonstrated focus on reducing the cost of treating hazardous effluents and remediating Army sites contaminated by hazardous/toxic material. Technologies demonstrated within this program element are transitioned from PE 0602720A (Environmental Quality Technology).

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

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

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>		<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations			
<b><u>B. Program Change Summary (\$ in Millions)</u></b>					
		<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>	<b><u>FY 2010</u></b>	<b><u>FY 2011</u></b>
Previous President's Budget		14.887	15.519	15.760	
Current BES/President's Budget		14.611	15.468	15.706	
Total Adjustments		-.276	-.051	-.054	
Congressional Program Reductions		.000	-.051		
Congressional Rescissions		.000	.000		
Total Congressional Increases		.000	.000		
Total Reprogrammings		.005	.000		
SBIR/STTR Transfer		-.281	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations					<b>PROJECT NUMBER</b> 002	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
002: ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1.984	2.057	2.128						Continuing	Continuing

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

This project will mature and demonstrate technologies transitioned from PE 0602720A (Environmental Quality Technology), projects 048 and 896 that assist Army installations in achieving environmental compliance. These technologies reduce the cost of treating hazardous effluents from Army installations, including ammunition plants, depots and arsenals, to satisfy increasingly stringent wastewater and air pollutant discharge standards. Army facilities are subject to fines and facility shutdowns for violation of federal, state, and local air and wastewater discharge regulations. This technology is essential to control and reduce the generation of waste to satisfy hazardous waste reduction goals, and to avoid future hazardous waste disposal costs and liabilities to the Army. Efforts under this project enable the Army to reduce pollution at installations while complying with the myriad of federal, state, and host country regulations dealing with hazardous wastewater, air emissions, and solid wastes. Technologies demonstrated also reduce the cost of resolving training noise compliance issues for the Army, avoid reductions in availability of training facilities, and sustain the viability of testing and training ranges as well as protect the critical resources of the Army.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Installation Operations: Demonstrate environmentally safe and cost-effective technologies to manage and reduce the increase in noise and pollution concerns associated with training ranges. In FY08, completed initial blast noise complaint risk study criteria and developed impulse noise prediction models. Developed a new User Interface, to take full advantage of Army geographical information systems (GIS) capability, for the BNOISE2 software package, which is the tool used by all of DoD for prediction and impact assessment of training blast noise. In FY09, complete complaint risk guidelines and a new noise modeling calculation engine for peak noise events based on statistical data and numerical analysis propagation algorithms. Develop new noise complaint criteria to provide defensible guidelines regarding appropriate installation action in response to noise complaints, to maintain both amicable community	1.984	2.029	2.128	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations			<b>PROJECT NUMBER</b> 002	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
relations and mission accomplishment. Complete a large-scale propagation demonstration to provide foundational weather and blast noise data that will enable improved understanding and prediction algorithms for blast noise from training and testing. In FY10, will utilize cell-based sensor for toxins with on-board reactive oxygen species electrode.						
Small Business Innovative Research/Small Business Technology Transfer Programs			.000	.028	.000	
Total			1.984	2.057	2.128	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>D. Acquisition Strategy</b> N/A						
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations					<b>PROJECT NUMBER</b> 025	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
025: POLLUTION PREVENTION TECHNOLOGY	3.411	3.610	3.640						Continuing	Continuing

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

The objective of this project is to mature and demonstrate pollution prevention advanced technologies required for sustainable operation of Army weapon systems, to include compliance with regulations mandated by federal, state, and local environmental and health laws. Technology thrusts under this project include: (1) demonstration of new coating materials, systems, and processes to exceed all existing, new and projected national laws and local regulations; (2) demonstration of advanced nanocomposite packaging systems and advanced technologies for the reuse/recycling of supplied resources during deployed operations in order to reduce logistics, health and force protection impacts; (3) demonstration of advanced technologies to enable sustainment of propellant, explosive and pyrotechnic production and maintenance facilities and training ranges through elimination or significant reduction of environmental impacts. These technologies will ensure that advanced energetic materials required for future force's high performance munitions are developed that meet weapons lethality and survivability goals and that are compliant with environmental and health laws. The project transitions technologies from PE 0602720A, project 895.

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

Work in this project is performed by the Research, Development, and Engineering Command's (RDECOM) Army Research Laboratory (ARL), Aberdeen, MD, Natick Soldier Research, Development and Engineering Center (NSRDEC), Natick, MA, Armaments Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ, Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL, Tank-Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI and Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Sustainable Painting Operations: In FY08, designed and evaluated touch-up kits containing hazardous air pollutant (HAP)-free paints for on-system field maintenance. In FY09, mature advanced HAP-free primer and topcoat formulations for all applications of the chemical agent resistant coating system. Zero Footprint Camp:	3.411	3.509	3.640	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations		<b>PROJECT NUMBER</b> 025	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY08, optimized nanocomposite packaging structures and evaluated prototype packages in a simulated operational environment. Compliant Ordnance Lifecycle: In FY08, evaluated environmental health of new propellants, pyrotechnics and explosives, refined alternative rocket propellants/motor combinations, and demonstrated improved colored smoke compositions. In FY09, scale-up synthesis of environmentally benign RDX replacement candidates for demonstration in munitions, demonstrate gelled hydrazine monopropellant replacement, and refine solventless processing techniques. In FY10, will assess performance of potential RDX replacements on the kilogram scale, will demonstrate hybrid propulsion system as potential alternative to ammonium perchlorate, and will evaluate low-toxicity colored smoke formulations in a relevant environment.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.101	.000	
<b>Total</b>	<b>3.411</b>	<b>3.610</b>	<b>3.640</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations					<b>PROJECT NUMBER</b> 03E	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
03E: ENVIRONMENTAL RESTORATION TECHNOLOGY	9.216	9.801	9.938						Continuing	Continuing

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

This project will mature and demonstrate technologies transitioned from PE 0602720A (Environmental Quality Technology), project 835 that improves the Army's ability to achieve cost-effective environmental restoration of contaminated (unexploded ordnance, military unique compounds, and energetic materials) sites at its installations, active and inactive ranges, its rework and production facilities, and in the battlefield. Technologies matured within this project enable the Army to cost effectively address current environmental liabilities resulting from soil and groundwater contamination. Current and planned efforts enable the Army to efficiently characterize, evaluate, assess, and remediate soil and groundwater at installations, ranges, facilities, and during battlefield operations. Efforts also identify ways to economically comply with the myriad of federal, state, and host country regulations dealing with contaminated soil and groundwater. A key aspect of this work is the enhancement of risk assessment techniques that can more accurately display the environmental risks associated with munitions residues. This program includes pilot scale field studies to establish technological feasibility and assess performance and productivity of the risk assessment techniques.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Unexploded Ordnance (UXO): In FY08, completed development of rapid computational modeling for active range scenarios and conducted field evaluations of: rapid route survey and evaluation systems; target/berm/bunker survey and assessment systems; and a multi-sensor projectile impact assessment, positioning, and characterization system for range operations. In FY09, conduct field evaluations of specialized instrumentation for targets, berms, and bunkers for monitoring impacts and condition assessment. Investigate innovative technologies for range UXO maintenance and for mitigation of unique and emerging UXO.	2.260	1.728	2.118	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations		<b>PROJECT NUMBER</b> 03E	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY10, will identify range monitoring and maintenance systems for sustainable range operations. Will retain identification and characterization of unique and emerging UXO and will begin development of protocols for adaptive detection.				
<p><b>Hazard/Risk Assessment Tools for Toxicity of Munitions Constituents (MCs):</b>                      In FY08, initiated advanced toxicogenomic molecular tools to quantitatively assess MC exposure, mathematical models of toxicity and effects due to existing, well characterized MC, predicting multiple stressor impacts on toxicity, MC toxicity mechanisms in ecological species, and species developmental pathways affected by MCs.                      In FY09, conduct cross-species validation of MC effects. Will initiate advanced protocols for rapid screening and monitoring of ecological impact of MCs. Develop advanced computational chemistry predictions of chemical structures and physical properties of adsorbed explosives in soils. Conduct technology demonstration of exposure quantification metrics for select representative nanomaterials.                      In FY10, will devise mathematical models of effects and toxicity due to existing MCs. Will characterize multiple stressor impacts on toxicity. Will identify developmental pathways affected by MCs and toxicity mechanisms in alternate ecological species, and will complete a cross species validation of MC effects. Will devise computational chemistry predictive methods of chemical structures and physical properties of MC adsorbed soils, MC reactivity and decomposition, and chemical mechanisms of MC breakdown by soil microbes.</p>	2.405	4.352	6.888	
<p><b>Long Term Monitoring Applications:</b>                      In FY08, completed advance development of prototype gene signature array microchip sensor for MCs. Evaluated field detection of MCs and emerging contaminants with negative ion miniature mass spectrometry. Conducted field evaluation of catalytic DNA and Surface Plasmon Resonance (SPR) affinity array sensors.                      In FY09, complete advanced development of in situ biosensor technologies implemented in direct push wells. Conduct final field evaluation of a novel analytical instrument (negative ion miniature mass spectrometer) for monitoring multiple contaminants under a wide range of site conditions.                      In FY10, will complete the development of a rapid, sensitive, near real time on-site assessment of Army-related contamination.</p>	1.385	1.145	.351	
<p><b>In Situ Remediation Technologies for Contaminated Groundwater and Soils:</b>                      In FY08, matured near-surface biostabilization and phytostabilization technologies for inorganics on small arms firing ranges (SAFRs). Constructed integrated assessment models for inorganics on SAFRs.</p>	.855	.149	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603728A Environmental Quality Technology Demonstrations		<b>PROJECT NUMBER</b> 03E	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, finalize and validate remediation/management of inorganic residues on SAFRs with process guidance, specifications, and protocols.				
Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges: In FY08, completed field evaluation of statistically valid range characterization/sampling protocols for MC sources on active range soils and surface waters. Continued maturing on-site, topical alkaline hydrolysis of impact area explosives and quantifying the effects of wildfire control practices on active ranges. In FY09, conduct field evaluations of advanced spatial components for range risk assessment in range assessment modeling system (ARAMS). Continue to quantify the effects of wildfire control practices on active ranges. Perform field evaluation of on-site, topical alkaline hydrolysis of impact area explosives. In FY10, will provide the capability to rapidly and accurately quantify MC sources, distribution, and transport in soil and surface water and to cost-effectively manage residual MCs on active Army training ranges.	2.311	2.275	.581	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.152	.000	
<b>Total</b>	<b>9.216</b>	<b>9.801</b>	<b>9.938</b>	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603734A Military Engineering Advanced Technology					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	34.581	35.855	5.911						Continuing	Continuing
T08: COMBAT ENG SYSTEMS	6.686	7.630	5.911						Continuing	Continuing
T13: Stationary Power & Energy Tech Demonstrations (CA)	15.748	13.395	.000						Continuing	Continuing
T15: MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)	12.147	14.830	.000						Continuing	Continuing

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

The objective of this program element (PE) is to mature and demonstrate advanced military engineering and geospatial research and engineering technologies. Military engineering technologies demonstrated include adaptive protection technologies that provide the Warfighter with protective systems to combat highly adaptive and increasingly severe threats. Geospatial research and engineering technologies demonstrated include Battlespace Terrain Reasoning and Awareness (BTRA) and Joint-Geospatial Enterprise Services (J-GES) technologies. BTRA enables the Warfighter to understand the impact of the terrain and weather effects during planning and execution of military operations. The J-GES program matures and demonstrates technology that supports network centric delivery and update of geospatial data and services to all echelons for battle command planning and mission rehearsal. Technologies demonstrated within this PE are transitioned from 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 in this PE is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	28.355	7.654	5.772	
Current BES/President's Budget	34.581	35.855	5.911	
Total Adjustments	6.226	28.201	.139	
Congressional Program Reductions	.000	-.119		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	28.320		
Total Reprogrammings	6.939	.000		
SBIR/STTR Transfer	-.713	.000		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology					<b>PROJECT NUMBER</b> T08	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T08: COMBAT ENG SYSTEMS	6.686	7.630	5.911						Continuing	Continuing

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

This advanced technology development project will mature and demonstrate advanced military engineering and geospatial research and engineering technologies that support the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Technologies demonstrated within this project are transitioned from program element 0602784A (Military Engineering Technology), projects 855, T40, and T42. Defeat of Emerging Adaptive Threats (DEFEAT) technologies will provide the warfighter with protective systems that save lives and increase the survivability of fixed facilities and critical assets. Battlespace Terrain Reasoning and Awareness (BTRA) technologies enable the warfighter to understand the impact of the terrain and weather effects during planning and execution of military operations. Technologies developed in this area will be advanced through future work in Battlespace Terrain Reasoning and Awareness - Battle Command (BTRA-BC) and Collaborative Battlespace Reasoning and Awareness (COBRA) efforts to increase the agility of the decision making process. The Joint-Geospatial Enterprise Services (J-GES) research program matures and demonstrates technology that supports network centric delivery and update of geospatial data and services to all echelons for battle command planning and mission rehearsal and will quantify the utility of geospatial information to Battle Command and the Military Decision Making Process (MDMP).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.124	.000	
Battlespace Terrain Reasoning and Awareness - Battle Command (BTRA-BC): In FY08, accredited sensor effects software developed using Capability Maturity Model Integration (CMMI) processes and transition to Commercialized Joint Mapping Tool Kit program of record. In FY09, demonstrate and evaluate tools designed for urban data and urban routing structures within Joint-Geospatial Enterprise Services (J-GES). In FY10, will demonstrate unified net-centric data strategies within common architecture and framework across Intelligence, Operations, and Geospatial communities.	5.537	6.244	4.784	
	1.149	1.262	1.127	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology		<b>PROJECT NUMBER</b> T08	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Joint-Geospatial Enterprise Services (J-GES): In FY08, continued evaluation focused on assessing geospatial data/information flow across multiple echelons to support battle command planning and mission rehearsal, as well as on identifying transition opportunities for these geo-services to Battle Command and Intelligence, Surveillance, and Reconnaissance programs. In FY09, transition urban-focused geospatial research and technologies developed under PE 0602784A/project 855 into the J-GES environment for demonstration and validation. In FY10, will conduct evaluations that will assess geospatial data and information requirements for users and evaluate trade-offs with regard to force structure, location and storage of geospatial data and information, available bandwidth, and computation resources across the enterprise.				
Total	6.686	7.630	5.911	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology					<b>PROJECT NUMBER</b> T13	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T13: Stationary Power & Energy Tech Demonstrations (CA)	15.748	13.395	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Stationary Power and Energy advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>						<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	
Quiet, Low-Impact Alternative Energy Technology						.000	2.170	.000		
1 Megawatt Molten Carbonate Fuel Cell Demonstrator at 29 Palms						3.091	.000	.000		
Defense Applications of Carbonate Fuel Cells						1.545	1.550	.000		
Gas Engine Driven Air Conditioning Demonstration (GEDAC)						1.159	2.325	.000		
Advanced Tactical Fuels for the Military						1.933	3.875	.000		
Zero Energy Homes at Ft, Knox, Kentucky						.967	.000	.000		
Development and Research of Zero Energy Homes at FT Campbell						2.125	.000	.000		
Army Applications of Direct Carbon Fuel Cells						1.546	.775	.000		
Regenerative Fuel Cell System for Silent Camp Operations						2.898	.000	.000		
Natural Gas Firetube Boiler Demonstration						.484	.000	.000		
Direct Methanol Fuel Cell Development (pending transfer to 62705)						.000	.775	.000		
Complete Molten Carbonate Fuel Cell Demonstrator-Parks Reserve Forces Training Area						.000	1.550	.000		
SBIR/STTR						.000	.375	.000		
<b>Total</b>						<b>15.748</b>	<b>13.395</b>	<b>.000</b>		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology	<b>PROJECT NUMBER</b> T13
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology					<b>PROJECT NUMBER</b> T15	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
T15: MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)	12.147	14.830	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
These are Congressional Interest Items										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Biomass-to-Liquid Using Synthetic Enzymes							.000	1.938	.000	
Conversion of Munciple Solid Waste to Renewable Diesel Fuel							.000	1.550	.000	
Buckeye							4.609	.000	.000	
University Center for Disaster Preparedness and Emergency Response							.000	1.550	.000	
Fireproofing/Corrosion Resistant Coating System for Military Infrastructure							.967	.000	.000	
C-RAM Armor Development							1.161	.775	.000	
Synthetic Auto Virtual Environment (SAVE)							1.546	2.325	.000	
JGES for Improved Combat Situational Awareness							3.864	.000	.000	
Enhanced Holographic Imager							.000	2.403	.000	
Nanotechnology for Potable Water and Waste Treatment							.000	.969	.000	
Human Terrain Geographic Decision Support							.000	2.906	.000	
SBIR/STTR							.000	.414	.000	
<b>Total</b>							<b>12.147</b>	<b>14.830</b>	<b>.000</b>	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603734A Military Engineering Advanced Technology	<b>PROJECT NUMBER</b> T15
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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**Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification** **DATE:** May 2009

<b>APPROPRIATION/BUDGET ACTIVITY</b>					<b>R-1 ITEM NOMENCLATURE</b>					
2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)					PE 0603772A Advanced Tactical Computer Science and Sensor Technology					
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	69.266	62.031	41.561						Continuing	Continuing
1AA: Tactical Computer Science Demonstrations (CA)	6.570	3.588	.000						Continuing	Continuing
1AB: SENSOR DEMONSTRATIONS (CA)	9.275	10.366	.000						Continuing	Continuing
101: Tactical Command and Control	15.850	16.326	13.692						Continuing	Continuing
243: Sensors and Signals Processing	37.571	31.751	27.869						Continuing	Continuing

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

Efforts in this program element (PE) mature and demonstrate technologies that will allow the Warfighter to effectively collect, analyze, transfer, and display situational awareness information in a network-centric battlefield environment. It matures and demonstrates architectures and provides technologies that enable synchronized Command and Control (C2) during rapid, mobile, dispersed, and Joint operations. It matures and develops software applications to more effectively integrate battle command across all echelons and to enable more effective utilization of resources (project D101). This PE also matures signal processing and fusion technologies for Army sensors; matures and demonstrates radio frequency (RF) systems to track and identify enemy forces and personnel; matures and demonstrates multi-sensor control and correlation for improving reconnaissance, surveillance, tracking, and target acquisition, (Project 243). Projects 1AA and 1AB fund congressional special interest items.

Work in this PE is fully coordinated with PE 0602270A (EW Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0602120A (Sensors and Electronic Survivability), and PE 0603270A (EW 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 in this PE is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering, Center (CERDEC), Fort Monmouth, NJ.

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<b>Exhibit R-2, PB 2010 Army RDT&amp;E Budget Item Justification</b>	<b>DATE:</b> May 2009
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<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology
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**B. Program Change Summary (\$ in Millions)**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>
Previous President's Budget	74.096	48.236	41.699	
Current BES/President's Budget	69.266	62.031	41.561	
Total Adjustments	-4.830	13.795	-.138	
Congressional Program Reductions	.000	-.205		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	14.000		
Total Reprogrammings	-3.078	.000		
SBIR/STTR Transfer	-1.752	.000		

**Change Summary Explanation**

FY09 funding increase is due to Congressional adds.

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology					<b>PROJECT NUMBER</b> 1AA	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
1AA: Tactical Computer Science Demonstrations (CA)	6.570	3.588	.000						Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b>										
Congressional Interest Item funding for Tactical Computer Science advanced technology development.										
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>							<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Software Lifecycle Affordability Management Phase II (SLAM II)							1.932	.775	.000	
VideoArgus							.000	1.937	.000	
Embedding Iris Recognition Technology On-board Warfighter Personal Equipment							.000	.775	.000	
Aviation Responsive Maintenance System							1.545	.000	.000	
Shared Vision							3.093	.000	.000	
SBIR/STTR							.000	.101	.000	
Total							6.570	3.588	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>										
N/A										
<b>D. Acquisition Strategy</b>										
N/A										
<b>E. Performance Metrics</b>										
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology					<b>PROJECT NUMBER</b> 1AB		
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	
1AB: SENSOR DEMONSTRATIONS (CA)	9.275	10.366	.000						Continuing	Continuing	
<b>A. Mission Description and Budget Item Justification</b>											
Congressional Interest Item funding for Sensor advanced technology development.											
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>								<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
HYPERSAR Radar								3.091	2.325	.000	
X-Band Interferometric Radar (XBIR)								1.932	.000	.000	
Sensor Visualization and Data Fusion (SVDF)								1.159	.000	.000	
Advanced Radar Transceiver Integrated Circuits Development								.775	.775	.000	
Enhanced Multi-Mission Radar								2.318	.000	.000	
Radar Tag Emitters								.000	2.325	.000	
Foliage Penetrating Reconnaissance, Surveillance, Tracking and Engagement Radar (FORESTER)								.000	3.101	.000	
CERDEC Airborne and Ground Wideband Digital Communications and Antenna Testbed								.000	1.550	.000	
SBIR/STTR								.000	.290	.000	
Total								9.275	10.366	.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
N/A											
<b>D. Acquisition Strategy</b>											
N/A											

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology	<b>PROJECT NUMBER</b> 1AB
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>								<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology					<b>PROJECT NUMBER</b> 101	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
101: Tactical Command and Control	15.850	16.326	13.692						Continuing	Continuing

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

Efforts in this project mature and demonstrate technologies to move and display timely and relevant information across the battlefield to provide commanders at all echelons the situational awareness (SA) that allows them to understand, decide, and act faster than their adversaries, resulting in increased operating tempo (OPTEMPO), improved force synchronization, and reduced fratricide. This project matures and demonstrates technology solutions addressing: information storage and retrieval; digital transfer and display of battlefield SA and position/location information; synchronization of combined and Joint force operations; software services optimized for Command and Control (C2) of unmanned air and ground robotic systems; and C2 On-the-Move (OTM).

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>Command and Control (C2) for Unmanned Systems:                      This effort develops and demonstrates software services that provide coordinated dynamic battle command tactical control of Unmanned Systems (UMS) and software tool sets that enable the commander to manage teams of manned and multiple unmanned air and ground platform assets.                      In FY08, matured and demonstrated tactical battle command services for unmanned ground vehicles; prepared for and participated in a Command and Control of Robotic Entities (C2ORE) lab demonstration at Fort Monmouth, NJ; matured air/ground collaboration software services.                      In FY09, mature tactical battle command services and air/ground collaboration services to include unmanned ground systems (UGSs), unmanned aerial systems (UASs), and unmanned ground vehicles (UGVs) and demonstrate all in a relevant environment; execute a C2ORE capstone demonstration with up to five UGS clusters, five UGVs, and three UASs; analyze data and provide evaluation and analysis report detailing lessons learned and metrics evaluated.                      In FY10, will develop and mature software services for unmanned collaboration and coordination, UGV/UAV platform behaviors and C2 information knowledge management of unmanned systems to provide the capability to manage</p>	8.700	9.132	3.652	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology		<b>PROJECT NUMBER</b> 101	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
large numbers of air and ground robots over extended urban areas at scales beyond current robot inventories due to the expansion of unmanned assets in the battlespace.				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.188	.000	
<p>Integrated Battle Command (BC):                      This effort matures and demonstrates technologies that allow forces to effectively collect, analyze, transfer, and display information in a net-centric battlefield environment. Technology areas include intelligent software agents, server virtualization, knowledge management, and automated query technologies.                      In FY08, matured, demonstrated, and transitioned to PM FCS managed connector software (SW) to support the interfacing, and information management and exchange between Brigade Combat Team (BCT) and echelons above brigade (between disparate service-based architectures (SoSCOE and NCES)) command and control (C2) SW applications; matured and delivered final SW products for running estimate, information search and retrieval, and decision support services to PM for inclusion in PM Tactical Battle Command SW services baseline.                      In FY09, mature network monitoring service for application in dynamic control of the Global Information Grid, from tactical through enterprise level network architectures, will mature and demonstrate network monitoring services that allow other systems to monitor their own throughput and packet loss to enable dynamic adjustment and optimization of network utilization; demonstrate how quality of service metrics can be utilized to help intelligently manage the resources of distributed C2 service providers; develop digital mission representation to share/understand data between intelligence and operations functions.                      Related work is also accomplished under PE 0602782A/project 779.</p>	7.150	5.518	.000	
<p>Integrated Battle Command (BC)(continued):                      In FY10, will mature and demonstrate intelligent agent based BC services for compliance on a Service Oriented Architecture; will mature services for generation of warnings and alerts relevant to the commanders critical information requirements; will mature and evaluate methods and SW to train and improve information sharing and collaboration in network-enabled operations; will demonstrate/validate data aggregation and alert capabilities based on mission context. Related work is also accomplished under PE 0602782A/project 779.</p>	.000	.000	8.009	
<p>Battle Space Awareness and Positioning:                      This effort demonstrates positioning and navigation tools to mitigate the impacts of jamming, terrain features, and buildings that limit the performance of Global Positioning System (GPS) only navigation systems.</p>	.000	1.488	2.031	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology		<b>PROJECT NUMBER</b> 101	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
In FY09, build on the munitions-focused Common Guidance Common Sense Micro-Electro Mechanical System (MEMS) Inertial Measurement Units (IMUs) effort and mature the MEMS IMUs for suitable precision and accuracy for dismounted Soldier and tactical vehicle applications; evaluate MEMS preliminary design models of gyroscopes in a laboratory environment and develop prototype gyroscopes suitable for integration into a MEMS IMU for evaluation in a relevant environment. In FY10, will begin the integration of position/navigation sensors with technologies that exploit the synergy between position/navigation and communications, such as radio frequency (RF) ranging and network-assisted GPS. Related work is also accomplished under PE 0602782A/project 779.				
Total	15.850	16.326	13.692	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>D. Acquisition Strategy</b> N/A				
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>									<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)				<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology					<b>PROJECT NUMBER</b> 243	
<b>COST (\$ in Millions)</b>	<b>FY 2008 Actual</b>	<b>FY 2009 Estimate</b>	<b>FY 2010 Estimate</b>	<b>FY 2011 Estimate</b>	<b>FY 2012 Estimate</b>	<b>FY 2013 Estimate</b>	<b>FY 2014 Estimate</b>	<b>FY 2015 Estimate</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
243: Sensors and Signals Processing	37.571	31.751	27.869						Continuing	Continuing

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

Efforts in this project mature and demonstrate improved radar, sensor fusion, and correlation technologies for wide area reconnaissance, surveillance, tracking, and targeting of platforms and individuals in all terrain including complex and urban environments. Sensor fusion efforts mature and demonstrate sensor management and data correlation, and relationship discovery services of a multi-INT fusion system. Sensor and simulated sensor candidates may include moving-target-indicator (MTI)/synthetic aperture radar (SAR), electro-optical/infrared (EO/IR), signals intelligence (SIGINT), measurements and signatures intelligence (MASINT), Human Intelligence (HUMINT), and biometrics technologies. Technologies will be matured with significant leveraging of achievements from industry, Defense Advanced Research Projects Agency (DARPA), and other Services.

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

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

**B. Accomplishments/Planned Program (\$ in Millions)**

	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
Foliage Penetrating (FOPEN) Radar for Unmanned Aerial Systems (UASs): This effort matures and demonstrates a FOPEN radar capability to meet the size, weight, and power requirements for a Class IV fixed wing UAS. Advancements in both radar and exploitation processing technology enable increased radar performance to include ground and non-metallic building penetration for detection of hidden roadside target/weapons caches. In FY08, began fabrication of two system demonstrators and spares (specific steps include: integration and test of transmitters, antennas, receivers, and processors; lab tests for sensitivity/calibration, motion compensation, frequency notching, interface and control, modes, mission planning, built-in-test, and data link functions; and environmental and ground end-to-end acceptance tests); completed development of first FOPEN system; conducted radar performance flight testing on a manned surrogate UAS platform; began air worthiness release documentation. In FY09, complete development of second system; complete air worthiness release documentation and flight testing of second system on manned surrogate UAS platform; mature algorithms for increased detection of targets of interest,	20.205	19.340	16.738	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology		<b>PROJECT NUMBER</b> 243	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
develop specifications and perform required analysis for testing on target UAS platform; begin radar integration on target UAS. In FY10, will obtain UAV test bed platform; complete development of second system; continue integration data link with radar for remote operation and data dissemination; continue conduction of environmental and ground end-to-end acceptance tests; conduct and complete radar performance flight testing on a manned surrogate UAS platform; complete first system radar integration on target UAS; conduct UAS flight testing on first system; and begin second system radar integration on target UAS.				
Sensor Fusion: This effort matures and demonstrates automated tools to mitigate the fusion, exploitation, and sensor management/cross-cueing problems associated with prosecuting and tracking individuals, recognizing their patterns of association, and thereby, being able to track the organizations they form. This effort allows the commander to target significant individuals and to understand the organizations exerting influence in his area of operation sufficiently to disrupt or attack the organizational infrastructure. In FY08, matured initial human intelligence (HUMINT) extraction, multi-INT Correlation (Level 1 Fusion), and contextual data mediator software services; matured and finalized the Service Oriented Architecture (SOA) fusion framework; demonstrated and evaluated initial integrated software services; matured relationship discovery service (Level 2a Fusion). In FY09, finalize services development and integration and test in the integration lab; demonstrate mature software services in Army or Joint experiments; conduct final high fidelity lab experiments and demonstrations of fusion automation and demonstrations of fusion automation and answering capabilities, and transition to PM Distributed Common Ground System Army (DCGS-A). Related work is also accomplished under PE 0602120A/project H15, PE 0602270A/project 442, and PE 0602270A/project 906.	3.875	3.401	.000	
Weapon-Locating (Ground) radar technologies: This effort matures and demonstrates medium-range sensor technologies for locating indirect fire weapons and extending traditional counterfire target acquisition to shooters operating into or from within natural and urban canyons and firing in improvised fashions (tracks rocket, artillery and mortar targets). In FY10, will mature radar beam forming technologies and multi-aperture/multi-spectral unconventional signal processing (non-Fourier frequency transforms and non-Gaussian clutter estimates) techniques.	.000	.000	2.045	
Measurement and Signature Intelligence Technologies (MASINT) for clandestine tagging, tracking, and locating:	2.878	3.372	1.965	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology		<b>PROJECT NUMBER</b> 243	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
<p>This effort matures and demonstrates MASINT technologies capable of detecting, tracking, and/or identifying human activities and/or infrastructures. The emphasis is to identify appropriate technical approaches, demonstrate embedded processing, and mature algorithms for multi-mode fusion of sensor data. Candidate technologies include: fiber optic seismic/magnetic technologies (highly sensitive for detection of walking personnel with/without weapons and/or tunneling detection); air deployable (air droppable) networked sensor system for a jungle environment (integration of seismic/acoustic sensor with jungle canopy relay); human infrastructure detection technologies (algorithms, sensors, etc); radio frequency MASINT detector, ultra-light multi-target indicator radar for unattended ground sensors and unmanned air vehicles.</p> <p>In FY08, evaluated candidate technologies for tagging, tracking and locating (TTL), selected Modern Communications Emitter Geolocation (MCEG) technologies as the most viable to pursue for near-term demonstration and testing for potential spiral transition to the user community.</p> <p>In FY09, enhance demonstrators and/or evaluate new candidate technologies for near-term prototype development; integrate selected technologies into a system demonstrator; demonstrate/test selected technologies for potential spiral transition to the user community.</p> <p>In FY10, will mature and down-select candidate technologies for TTL based on updated guidance from user community and conduct prototype integration.</p> <p>Related work is also accomplished under PE 0602120A/project H16.</p>				
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.822	.000	
<p>Omni-directional Situational Awareness (SA) (Airborne) radar technologies: This effort matures and demonstrates coupled radar-Electro-Optical (EO)/Infrared (IR) SA technologies for small unmanned aerial systems (UAS) to extend detection.</p> <p>In FY10, will develop and mature a Ground Moving Target Indicator (GMTI) radar sensor weighing less than one pound with 360-degree field-of-view and investigate integration with an existing EO/IR payload including control and display software integration techniques necessary to facilitate efficient cueing and complementary usage of GMTI and EO/IR sensors.</p>	.000	.000	2.047	
<p>Suite of Sense Through the Wall (STTW) Systems: STTW matures and demonstrates technologies to provide mounted/dismounted users with the capability to detect, locate, and see personnel with concealed weapons and explosives hidden behind walls, doors, and other visible obstructions.</p>	6.103	.000	.000	

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>			<b>DATE:</b> May 2009		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)		<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology		<b>PROJECT NUMBER</b> 243	
<b>B. Accomplishments/Planned Program (\$ in Millions)</b>			<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<p>In FY08, completed integration of personnel/Concealed Weapon Detection (CWD)/Concealed Explosive Detection (CED) prototypes; conducted final development testing of integrated STTW CWD/CED technology demonstrators against multiple wall types; conducted additional testing in urban and complex environments to continue evaluation of new operational concepts/tactics, techniques, and procedures; transitioned complete suite of STTW systems to PEO Solider (Soldier borne) and PM Robotic Unmanned Systems (RUS) (SUGV/UGV mounted). Work related to this effort is also being accomplished under PE 0602270A/project 442.</p>					
<p>Ground Moving Target Indicator (GMTI) and Imaging Surveillance Radar:                      This effort demonstrates an all-weather GMTI and Synthetic Aperture Radar (SAR) for all-terrain (foliated and open) detection and tracking of mounted and dismounted threats in a package form-fit-function compatible with a Class IV rotary wing UAS. This effort is maturing DARPA investments in GMTI and synthetic aperture radar and applying lessons learned to build a multi-function radar system that will satisfy Class IV UAS size weight and power requirements.                      In FY08, matured radar model and existing trackers; continued hardware and software development; conducted component testing; assembled radar components; conducted tower testing of the prototype system to support risk reduction and acquired data needed for the development of signal processing algorithms; developed moving target indicator (MTI) exploitation approach; integrated software package into the development environment for evaluation under varying operating conditions.                      In FY09, complete radar development and tower testing; integrate system onto a manned surrogate platform and initiate flight testing; collect tower and flight test data to support development of adaptive MTI processing algorithms, advanced motion compensation techniques and advanced exploitation and evaluation tools.                      In FY10, will complete development and demonstrate advanced tracking and exploitation algorithms, techniques and tools; will demonstrate payload on manned surrogate platform.</p>			4.510	4.816	5.074
<b>Total</b>			37.571	31.751	27.869
<b>C. Other Program Funding Summary (\$ in Millions)</b>					
N/A					
<b>D. Acquisition Strategy</b>					
N/A					

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<b>Exhibit R-2a, PB 2010 Army RDT&amp;E Project Justification</b>		<b>DATE:</b> May 2009
<b>APPROPRIATION/BUDGET ACTIVITY</b> 2040 - Research, Development, Test & Evaluation, Army/BA 3 - Advanced Technology Development (ATD)	<b>R-1 ITEM NOMENCLATURE</b> PE 0603772A Advanced Tactical Computer Science and Sensor Technology	<b>PROJECT NUMBER</b> 243
<b>E. Performance Metrics</b> Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

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