UNCLASSIFIED

Supporting Data FY 2009 Budget Estimate – February 2008

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

UNCLASSIFIED

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS
OF THE
RESEARCH, DEVELOPMENT, TEST AND
EVALUATION, ARMY
FY 2009
BUDGET ESTIMATE
FEBRUARY 2008

VOLUME I
Budget Activities 1, 2 and 3

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

FY 2009 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 2007 through FY 2009.

2. Relationship of the FY 2009 Budget Submission to the FY 2008 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-2/R-3 Exhibits.

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0603460A/JA2	Joint Air-to-Ground Missile (JAGM)	0605450A/JA6
0603782A/355	Warfighter Information Network – Tactical (WIN-T) – Increment 2 – Initial Networking on the Move	0603782A/367
0603782A/355	WIN-T Increment 3 – Full Networking on the Move	0603782A/372
0603827A/S51	ACIS Engineering Development	0604601A/S61
0604642A/E40	Joint Light Tactical vehicle (JLTV) – Advanced Development	0603804A/L04
0605326A/312	Current Force Capability Gaps	0605326A/317

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

C. Establishment of New FY 2009 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 2009 are shown below.

TITLE	PE/PROJECT
Robotics Autonomy, Manipulation, and Portability Research	0601102A/T63
Network Science And Technology Research Center	0601104A/J22
Warfighter Information Network – Tactical (WIN-T) – Increment 2 – Initial Networking on the Move	0603782A/367
Joint Light Tactical Vehicle (JLTV) – Advanced Development	0603804A/L04
Current Force Capability Gaps	0605326A/317
Joint Air-to-Ground Missile (JAGM)	0605450A/JA6

D. FY 2009 programs for which funding existed in the FY 2008 President's Budget Submit (February 2007), but which are no longer funded in the FY 2009 President's Budget Submit.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0603327A/S32	Joint Single Integrated Air Picture (SIAP)	Program Terminated
0603460A/JA2	Joint Air-to-Ground Missile (JAGM)	Program Restructured
0603782A/355	Warfighter Information Network – Tactical (WIN-T)	Program Restructured
0604642A/E40	Light Tactical Vehicle (LTV)	Program Restructured

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

0203801A/DF8/DF9	0603009A
0203808A	0603020A
0301359A	0603322A
0602122A	0603710A/C65
0603005A/C66	0604328A

4. The Consolidated Appropriations Act, 2008 (P.L. 110-161). The Research, Development, Test and Evaluation, Army appropriation did not receive any FY 2008 Consolidated Appropriations Act funding.

5. Performance Metrics. Performance metrics used in the preparation of this justification book may be found in the FY 2009 Army Performance Budget Justification Book, dated March 2008.

6. Program Assessment Rating Tool (PART). In accordance with the President's Management Agenda, Budget and Performance Integration initiative, this program has been assessed using PART. Remarks regarding program performance and plans for performance improvement can be located at the Expectmore.gov website.

Department of the Army
FY 2009 RDT&E Program
President's Budget 2009

Exhibit R-1

08-Jan-2008

	Thousands of Dollars		
	FY 2007	FY 2008	FY 2009
Summary Recap of Budget Activities			
Basic Research	353,401	379,064	379,393
Applied Research	1,188,678	1,175,294	723,502
Advanced Technology Development	1,253,792	1,336,998	738,858
Advanced Component Development And Prototypes	522,833	1,140,451	951,822
System Development And Demonstration	5,179,195	5,181,817	4,981,024
Management Support	1,462,511	1,186,345	1,113,197
Operational System Development	1,390,182	1,640,365	1,632,454
Total RDT&E, Army	11,350,592	12,040,334	10,520,250

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
Basic Research						
1	0601101A	01	In-House Laboratory Independent Research	18,404	21,528	19,832
2	0601102A	01	Defense Research Sciences	166,403	165,020	176,959
3	0601103A	01	University Research Initiatives	76,331	82,416	76,980
4	0601104A	01	University And Industry Research Centers	92,263	110,100	105,622
	TOTAL: Basic Research			353,401	379,064	379,393
	Applied Research					
5	0602105A	02	Materials Technology	62,254	64,517	26,985
6	0602120A	02	Sensors And Electronic Survivability	48,396	62,910	46,147
7	0602122A	02	Tractor Hip	8,261	4,338	18,192
8	0602211A	02	Aviation Technology	39,383	43,280	42,013
9	0602270A	02	Electronic Warfare Technology	30,458	30,013	16,611
10	0602303A	02	Missile Technology	66,141	60,935	48,174
11	0602307A	02	Advanced Weapons Technology	25,996	32,705	19,664
12	0602308A	02	Advanced Concepts And Simulation	23,921	22,903	17,048
13	0602601A	02	Combat Vehicle And Automotive Technology	88,749	93,622	55,234
14	0602618A	02	Ballistics Technology	62,516	68,899	71,550
15	0602622A	02	Chemical, Smoke And Equipment Defeating Technology	12,665	8,976	2,295
16	0602623A	02	Joint Service Small Arms Program	6,012	6,962	7,531
17	0602624A	02	Weapons And Munitions Technology	120,794	102,681	30,576
18	0602705A	02	Electronics And Electronic Devices	80,621	105,492	45,278
19	0602709A	02	Night Vision Technology	35,324	34,924	25,647
20	0602712A	02	Countermine Systems	26,332	30,294	21,815
21	0602716A	02	Human Factors Engineering Technology	40,705	39,763	17,348
22	0602720A	02	Environmental Quality Technology	19,203	20,076	16,064
23	0602782A	02	Command, Control, Communications Technology	46,332	36,955	24,014
24	0602783A	02	Computer And Software Technology	6,602	9,803	5,495
25	0602784A	02	Military Engineering Technology	50,817	58,693	52,066
26	0602785A	02	Manpower/Personnel/Training Technology	15,705	16,102	16,412
27	0602786A	02	Warfighter Technology	43,200	36,237	21,948
28	0602787A	02	Medical Technology	228,291	184,214	75,395
	Total: Applied Research			1,188,678	1,175,294	723,502

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
	Advanced Technology Development					
29	0603001A	03	Warfighter Advanced Technology	63,981	86,103	46,793
30	0603002A	03	Medical Advanced Technology	291,716	299,676	59,043
31	0603003A	03	Aviation Advanced Technology	93,880	98,899	57,277
32	0603004A	03	Weapons And Munitions Advanced Technology	95,165	85,981	73,697
33	0603005A	03	Combat Vehicle And Automotive Advanced Technology	200,974	245,629	107,992
34	0603006A	03	Command, Control, Communications Advanced Technolog	11,626	14,082	9,183
35	0603007A	03	Manpower, Personnel And Training Advanced Technology	9,022	6,740	6,853
36	0603008A	03	Electronic Warfare Advanced Technology	49,542	56,591	50,961
37	0603009A	03	Tractor Hike	9,217	12,553	14,562
38	0603015A	03	Next Generation Training & Simulation Systems	21,561	22,365	18,881
39	0603020A	03	Tractor Rose	5,018	6,485	11,575
40	0603100A	03	IED Defeat Technology Development		2,385	
41	0603103A	03	Explosives Demilitarization Technology	25,004	21,511	10,564
42	0603105A	03	Military HIV Research	12,559	14,903	7,116
43	0603125A	03	Combating Terrorism - Technology Development	12,953	12,978	13,064
44	0603238A	03	Global Surveillance/Air Defense/Precision Strike Techn	12,469		
45	0603270A	03	Electronic Warfare Technology	24,674	41,951	23,996
46	0603313A	03	Missile And Rocket Advanced Technology	69,885	77,259	63,998
47	0603322A	03	Tractor Cage	18,467	18,330	12,372
48	0603606A	03	Landmine Warfare And Barrier Advanced Technology	29,406	30,700	30,797
49	0603607A	03	Joint Service Small Arms Program	11,788	10,629	8,809
50	0603710A	03	Night Vision Advanced Technology	73,826	53,910	39,916
51	0603728A	03	Environmental Quality Technology Demonstrations	16,651	14,887	15,519
52	0603734A	03	Military Engineering Advanced Technology	27,100	28,355	7,654
53	0603772A	03	Advanced Tactical Computer Science And Sensor Technology	67,308	74,096	48,236
	Total: Advanced Technology Development			1,253,792	1,336,998	738,858
	Advanced Component Development And Prototypes					
54	0603024A	04	Unique Item Identification (UID)	1,498	665	649
55	0603305A	04	Army Missle Defense Systems Integration	85,637	127,408	14,005
56	0603308A	04	Army Space Systems Integration	29,109	49,285	19,986
57	0603327A	04	Air And Missile Defense Systems Engineering	134,355	170,383	116,410
58	0603460A	04	Joint Air-To-Ground Missile (JAGM)		53,160	
59	0603619A	04	Landmine Warfare And Barrier - Adv Dev	1,022	24,580	29,234
60	0603627A	04	Smoke, Obscurant And Target Defeating Sys-Adv Dev	5,314	9,363	3,840

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
61	0603639A	04	Tank And Medium Caliber Ammunition	3,476	47,474	45,866
62	0603653A	04	Advanced Tank Armament System (ATAS)	8,391	143,568	108,012
63	0603747A	04	Soldier Support And Survivability[1]	20,865	5,751	30,716
64	0603766A	04	Tactical Electronic Surveillance System - Adv Dev	20,001	14,423	12,275
65	0603774A	04	Night Vision Systems Advanced Development	5,168	3,432	2,588
66	0603779A	04	Environmental Quality Technology - Dem/Val	23,693	18,580	5,355
67	0603782A	04	Warfighter Information Network-Tactical - Dem/Val	119,288	320,068	414,357
68	0603790A	04	NATO Research And Development	4,189	4,927	5,041
69	0603801A	04	Aviation - Adv Dev	8,848	6,440	7,455
70	0603804A	04	Logistics And Engineer Equipment - Adv Dev	9,799	37,993	44,141
71	0603805A	04	Combat Service Support Control System Evaluation	8,403	14,959	17,788
72	0603807A	04	Medical Systems - Adv Dev	22,511	29,689	26,308
73	0603827A	04	Soldier Systems - Advanced Development	10,135	20,090	36,558
74	0603850A	04	Integrated Broadcast Service	1,131	38,213	11,238
	Total: Advanced Component Development And Prototypes			522,833	1,140,451	951,822
	System Development And Demonstration					
75	0604201A	05	Aircraft Avionics	43,662	57,420	71,562
76	0604220A	05	Armed, Deployable OH-58D	217,203	181,145	135,652
77	0604270A	05	Electronic Warfare Development	41,540	57,169	32,325
78	0604321A	05	All Source Analysis System[2]	10,338	5,384	16,465
79	0604328A	05	Tractor Cage	15,574	17,707	16,807
80	0604329A	05	Common Missile	24,210		
81	0604601A	05	Infantry Support Weapons[3]	44,550	63,026	42,414
82	0604604A	05	Medium Tactical Vehicles	12,469	6,354	1,949
83	0604609A	05	Smoke, Obscurant And Target Defeating Sys - Eng Dev	5,129	1,339	5,603
84	0604622A	05	Family Of Heavy Tactical Vehicles	13,034	12,666	2,901
85	0604633A	05	Air Traffic Control	7,877	8,899	14,214
86	0604642A	05	Light Tactical Wheeled Vehicles[4]	24,358	38,256	

[1] FY 2007 funding total includes $7,625 received in GWOT Supplemental. FY 2008 funding total does not include $31,621 previously requested for current FY 2008 GWOT requirements.
[2] FY 2007 funding total includes $3,400 received in GWOT Supplemental.
[3] FY 2007 funding total includes $8,158 received in GWOT Supplemental. FY 2008 funding total does not include $8,158 previously requested for current FY 2008 GWOT requirements.
[4] FY 2008 funding total does not include $20,000 previously requested for current FY 2008 GWOT requirements.

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
87	0604645A	05	Armored Systems Modernization (ASM) - Eng Dev	2,927,532		
88	0604646A	05	Non-Line Of Sight Launch System	313,981	253,075	200,099
89	0604647A	05	Non-Line Of Sight Cannon	108,689	136,929	89,841
90	0604660A	05	FCS Manned Grd Vehicles & Common Grd Vehicle		592,254	774,257
91	0604661A	05	FCS Systems Of Systems Engr & Program Mgmt		1,497,321	1,413,945
92	0604662A	05	FCS Reconnaissance (UAV) Platforms		43,388	34,379
93	0604663A	05	FCS Unmanned Ground Vehicles		90,091	96,918
94	0604664A	05	FCS Unattended Ground Sensors		10,929	12,967
95	0604665A	05	FCS Sustainment & Training R&D		647,649	539,145
96	0604666A	05	Modular Brigade Enhancement	27,900	64,385	64,900
97	0604710A	05	Night Vision Systems - Eng Dev	40,325	47,317	44,508
98	0604713A	05	Combat Feeding, Clothing, And Equipment	2,922	2,485	2,499
99	0604715A	05	Non-System Training Devices - Eng Dev	122,258	35,731	35,424
100	0604741A	05	Air Defense Command, Control And Intelligence - Eng Dev[1]	58,492	21,375	22,415
101	0604742A	05	Constructive Simulation Systems Development	38,849	31,645	26,244
102	0604746A	05	Automatic Test Equipment Development[2]	7,896	9,961	23,582
103	0604760A	05	Distributive Interactive Simulations (Dis) - Eng Dev	20,052	18,180	16,095
104	0604780A	05	Combined Arms Tactical Trainer (CATT) Core	37,683	36,800	29,468
105	0604783A	05	Joint Network Management System	5,026	2,759	676
106	0604802A	05	Weapons And Munitions - Eng Dev	96,673	65,236	52,140
107	0604804A	05	Logistics And Engineer Equipment - Eng Dev	33,205	47,108	37,718
108	0604805A	05	Command, Control, Communications Systems - Eng Dev	10,766	9,942	9,795
109	0604807A	05	Medical Materiel/Medical Biological Defense Equipment	22,226	27,745	34,971
110	0604808A	05	Landmine Warfare/Barrier - Eng Dev	97,555	160,079	126,475
111	0604814A	05	Artillery Munitions - EMD	99,344	64,214	78,197
112	0604817A	05	Combat Identification	38	11,290	10,909
113	0604818A	05	Army Tactical Command & Control Hardware & Software	67,619	100,132	67,535
114	0604820A	05	Radar Development	2,446	7,022	
115	0604822A	05	General Fund Enterprise Business System (GFEBS)	59,998	111,873	60,308
116	0604823A	05	Firefinder	53,408	76,767	47,845
117	0604827A	05	Soldier Systems - Warrior Dem/Val	28,227	1,589	15,790
118	0604854A	05	Artillery Systems - EMD	1,598	24,067	42,300
119	0604869A	05	Patriot/Meads Combined Aggregate Program (CAP)	322,915	369,786	431,270

[1] FY 2007 funding total includes $31,100 received in GWOT Supplemental. FY 2008 funding total does not include $38,900 previously requested for current FY 2008 GWOT requirements.

[2] FY 2008 funding total does not include $6,500 previously requested for current FY 2008 GWOT requirements.

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
120	0604870A	05	Nuclear Arms Control Monitoring Sensor Network	7,193	7,253	6,260
121	0605013A	05	Information Technology Development[1]	104,435	106,075	73,740
122	0605450A	05	Joint Air-To-Ground Missile (JAGM)			118,517
	Total: System Development And Demonstration			5,179,195	5,181,817	4,981,024
	Management Support					
123	0604256A	06	Threat Simulator Development	23,258	23,339	21,416
124	0604258A	06	Target Systems Development	10,113	17,787	13,498
125	0604759A	06	Major T&E Investment	64,067	66,276	64,618
126	0605103A	06	Rand Arroyo Center	20,792	19,149	16,339
127	0605301A	06	Army Kwajalein Atoll	173,455	180,052	174,601
128	0605326A	06	Concepts Experimentation Program	24,787	29,652	28,271
129	0605502A	06	Small Business Innovative Research	272,163	2,385	
130	0605601A	06	Army Test Ranges And Facilities	381,740	355,715	342,079
131	0605602A	06	Army Technical Test Instrumentation And Targets	82,525	85,862	74,624
132	0605604A	06	Survivability/Lethality Analysis	42,769	41,681	41,066
133	0605605A	06	Dod High Energy Laser Test Facility	16,135	8,746	2,835
134	0605606A	06	Aircraft Certification	4,524	4,658	5,054
135	0605702A	06	Meteorological Support To RDT&E Activities	8,302	8,294	8,289
136	0605706A	06	Materiel Systems Analysis	16,464	16,423	17,028
137	0605709A	06	Exploitation Of Foreign Items	4,974	3,291	3,530
138	0605712A	06	Support Of Operational Testing	79,212	78,797	72,942
139	0605716A	06	Army Evaluation Center	55,554	61,295	63,382
140	0605718A	06	Simulation & Modeling For Acq, Rqts, & Tng (SMART)	5,270	6,302	5,325
141	0605801A	06	Programwide Activities[2]	70,598	73,256	73,748
142	0605803A	06	Technical Information Activities	51,266	42,715	42,905
143	0605805A	06	Munitions Standardization, Effectiveness And Safety	36,145	40,947	20,857
144	0605857A	06	Environmental Quality Technology Mgmt Support	4,279	4,926	5,125
145	0605898A	06	Management HQ - R&D	13,893	14,797	15,665
146	0909999A	06	Financing For Cancelled Account Adjustments	226		
	Total: Management Support			1,462,511	1,186,345	1,113,197
	Operational System Development					
147	0603778A	07	MLRS Product Improvement Program	63,189	53,712	59,749
148	0603820A	07	Weapons Capability Modifications UAV	1,549	3,875	

[1] FY 2008 funding total does not include $5,000 previously requested for current FY 2008 GWOT requirements.
[2] FY 2008 funding total does not include $20 previously requested for current FY 2008 GWOT requirements.

				Thousands of Dollars		
				FY 2007	FY 2008	FY 2009
149	0102419A	07	Aerostat Joint Project Office	237,795	478,204	356,434
150	0203726A	07	Adv Field Artillery Tactical Data System	18,848	16,730	15,860
151	0203735A	07	Combat Vehicle Improvement Programs	13,873	41,192	141,114
152	0203740A	07	Maneuver Control System	33,947	45,191	37,151
153	0203744A	07	Aircraft Modifications/Product Improvement Programs	299,405	328,514	452,787
154	0203752A	07	Aircraft Engine Component Improvement Program	836	1,467	332
155	0203758A	07	Digitization	14,490	9,675	9,534
156	0203759A	07	Force XXI Battle Command, Brigade And Below (FBCB2)	26,068	32,194	38,418
157	0203764A	07	Tactical Wheeled Vehicle Improvement Program	11,742		
158	0203801A	07	Missile/Air Defense Product Improvement Program	16,529	30,026	37,871
159	0203802A	07	Other Missile Product Improvement Programs	19,086	1,885	1,527
160	0203808A	07	Tractor Card	7,013	16,467	19,601
161	0208010A	07	Joint Tactical Communications Program (TRI-TAC)	5,621	1,527	920
162	0208053A	07	Joint Tactical Ground System	14,987	23,215	1,957
163	0208058A	07	Joint High Speed Vessel (JHSV)	19,752	5,116	2,936
164	0301359A	07	Special Army Program			
165	0301555A	07	Classified Programs			
166	0301556A	07	Special Program			
167	0303028A	07	Security And Intelligence Activities	11,788	4,571	
168	0303140A	07	Information Systems Security Program[1]	56,583	31,403	38,090
169	0303141A	07	Global Combat Support System	47,092	94,089	104,934
170	0303142A	07	SATCOM Ground Environment (Space)	31,790	107,092	106,327
171	0303150A	07	WWMCCS/Global Command And Control System[2]	16,392	24,620	12,922
172	0303158A	07	Joint Command And Control Program (JC2)[3]	3,929	10,330	15,203
173	0305204A	07	Tactical Unmanned Aerial Vehicles	171,257	100,854	50,976
174	0305206A	07	Airborne Reconnaissance Systems	22		
175	0305208A	07	Distributed Common Ground/Surface Systems[4]	135,298	90,088	57,704
176	0702239A	07	Avionics Component Improvement Program	1,281	1,017	1,023
177	0708045A	07	End Item Industrial Preparedness Activities	109,335	87,311	69,084
178	1001018A	07	NATO Joint Stars	685		

[1] FY 2007 funding total includes $31,600 received in GWOT Supplemental. FY 2008 funding total does not include $23,300 previously requested for current FY 2008 GWOT requirements.
[2] FY 2008 funding total does not include $3,800 previously requested for current FY 2008 GWOT requirements.
[3] FY 2008 funding total does not include $6,200 previously requested for current FY 2008 GWOT requirements.
[4] FY 2008 funding total does not include $12,300 previously requested for current FY 2008 GWOT requirements.

	Thousands of Dollars		
	FY 2007	FY 2008	FY 2009
Total: Operational System Development	1,390,182	1,640,365	1,632,454
Total: RDT&E, Army	11,350,592	12,040,334	10,520,250

Table of Contents - RDT&E Volume I

Table of Contents - RDT&E Volume I

Alphabetic Listing - RDT&E Volume I

Alphabetic Listing - RDT&E Volume I

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601101A - In-House Laboratory Independent Research**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	18404	21528	19832	19238	19297	19699	20110
91A	ILIR-AMC	12866	14022	14673	14086	14090	14378	14672
91C	ILIR-MED R&D CMD	3833	3617	3616	3662	3698	3779	3862
91D	ILIR-CORPS OF ENGR	1522	1309	1339	1279	1292	1320	1349
91E	ILIR-ARI	183	195	204	211	217	222	227
91J	IN-HOUSE LAB INDEPENDENT RESEARCH - MEDICAL (CA)		2385					

A. Mission Description and Budget Item Justification: The goal of the Army's In-House Laboratory Independent Research (ILIR) program is to attract and retain top flight science and engineering PhDs to the Army's research organizations. This 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 provides a source of competitive funds to Army laboratories to stimulate high quality, innovative research with significant opportunity for payoff in Army warfighting capability. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and nurturing promising young scientists and engineers. Successful ILIR projects are typically transitioned to start-up projects under basic or applied research mission funding within an organization. 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 the Department of Defense Basic Research Plan. Project 91E performed at the Army Research Institute for the Behavioral and Social Sciences (ARI) is focused on 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. The work in this program is performed by the Army Materiel Command (AMC), Army Medical Research and Materiel Command (MRMC), the Army Corps of Engineers Engineer Research, and Development Center (ERDC), and the Army Research Institute (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601101A - In-House Laboratory Independent Research**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	19187	19266	19790
Current BES/President's Budget (FY 2009)	18404	21528	19832
Total Adjustments	-783	2262	42
Congressional Program Reductions		-138	
Congressional Rescissions			
Congressional Increases		2400	
Reprogrammings	-363		
SBIR/STTR Transfer	-420		
Adjustments to Budget Years			42

One FY08 congressional adds totaling $2400 were added to this PE.

($2400) Silicon Carbide Armor Manufacturing Initiative

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91A**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
91A ILIR-AMC	12866	14022	14673	14086	14090	14378	14672

A. Mission Description and Budget Item Justification: This project provides funding for In-house Laboratory Independent Research (ILIR) in the Army Materiel Command's six Research, Development, and Engineering Centers (RDECs). This 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 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 the Department of Defense Basic Research Plan. Work in this project is performed by the Army Materiel Command and the Army Research Institute.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Edgewood Chemical Biological Center: In FY07, continued novel approaches to develop a multifunctional biological agent simulant; investigated methodology to identify and quantify physiological response to toxic agents, investigated advanced genetic analysis methods that might lead to facile detection and identification methods for biological material, solicited new concepts to address standoff detection of chemical vapors and aerosols; improved decontamination effectiveness against toxic chemical and biological materials with minimal effect on the environment and materials of construction, including sensitive items such as electronics; characterized protective materials for filters and other materials; and developed and pursued new concepts for multi-purpose obscurant materials. In FY08 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 FY09, will 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.	1244	1050	1058
Armaments RDEC: In FY07, conducted research into modeling of semi-metal energetics, new modalities for e-field sensors, classified mortar variants using acoustic sensors, SiC/carbon nanotube composites, new nitration methods for high density high energy materials to achieve increased lethality, accuracy, survivability, and volume reduction for the armament systems/munitions. In FY08, conduct 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 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 graphine. In FY09, will 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.	2075	1856	1871
Tank-automotive RDEC: In FY07, developed reinforcement learning algorithms and compared performance with bio-inspired robot behaviors for the next generation explosive ordinance disposal (EOD) robots; modeled bio-mimetic composite structure and demonstrated higher performance than current Army composite structures; developed an experimental apparatus and the associated processing techniques for high speed Stokes parameter imaging to support signature countermeasure and robotic vehicle perception applications. In	1380	1325	1334

FY08, investigate experimental engine exploration of JP-8 ignition behavior and flame for high performance military engine combustion; new design methodologies for thick section composites using multiple failure theories for improved light-weight material reliability, and develop spectral fractal geometry and linear/non-linear filtering for real time dynamic simulation of Army tactical and combat vehicles. In FY09, will record real-time polarization images for robotic vehicle terrain perception and signature countermeasure applications; will 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.			
Natick Soldier Center: In FY07, established/confirmed theoretical foundation for electrical and physical effects in hybrid conductive yarns useful in robust e-textiles; used Lie Group theory and dynamical systems analysis to investigate common characteristics in problems/solutions of interest to Soldier mission to provide a mathematical framework to help solve disparate mathematical problems; and examined means for coupling biorecognition elements to polymers with potential to sense food pathogens. In FY08, investigate novel means for controlling nanoscale characteristics through precise morphology control, with potential to impact textiles used in Soldier ensemble, flexible wall shelters, and parachutes. In FY09, will utilize morphology control data results to make initial selections of methodology to verify ability to regulate nanoscale characteristics, will identify nanomaterials (metal or dielectrics) and will develop preliminary design for nanorectenna array for converting visible/near-infrared light to direct current for photonic applications and derive a fundamental understanding of how immobilization influences the antimicrobial peptide mechanisms of lytic behavior for Soldier protection against pathogens.	1406	1458	1470
Aviation and Missile RDEC Missile Efforts: In FY07, demonstrated solid state single-photon emitter for secure quantum communications. Investigated ultra-wide band shifterless beam steering using these VHF oscillators. Fabricated transparent metal stacks using copper and ZnO, to test for ultra-wide bandwidth optical limiting. Developed a "quantum seal" protocol for quantum communication, which allows detection of eavesdroppers after message is received and complete the security analysis against eavesdropping on energy-time cryptographic system. In FY08, explore wide bandgap semiconductor photodetectors for advanced ultraviolet seekers. Investigate ultra-wide band chaotic arrays in radar applications. Fabricate transparent metal stacks for applications to negative refraction and sub-wavelength resolution. In FY09, will develop THz spectroscopic imager for non-destructive testing and stand-off agent detection. Will demonstrate operation of a quantum sensor, for application to sensing electric, magnetic, or microwave fields.	3090	2472	2492
Aviation and Missile RDEC Aviation Efforts: In FY07, conducted experimental work on the limitations and turbulence modeling issues for advanced airfoil design tools operating near stall; conducted experimental study on high Reynolds number 3D bluff body turbulent boundary layer active separation control for fuselage drag reduction; conducted experimental study of passive boundary layer flow control for rotor airfoil dynamic stall initiated by leading edge shock-induced separation. In FY08, conduct experimental aerodynamics study on adaptive shape changes (morphing) under airfoil dynamic stall conditions; continue study on high Reynolds number 3D bluff body turbulent boundary layer active separation control with a focus on turbulence measurements; develop and validate adjunct airfoil optimization methods for unsteady flow conditions. In FY09, will develop and demonstrate modeling and simulation (M & S) tools for performance, loads and vibratory loads correlation on an active rotor application using wind tunnel validation data; will develop improved turbulence models for rotorcraft CFD M & S tools; will assess improved M & S tools on heavy lift interaction aerodynamics validation data; and will investigate closed-loop active flow control for heavy lift tandem fuselage lateral stability.	1414	1791	1805
Communications-Electronics RDEC: In FY07, conducted basic research in the areas of network science and security for mobile networks; investigated polymer and polymer blends with high breakdown voltage characteristics for electrochemical systems; continued analysis of new piezoelectric materials for precision resonator applications; continued to investigate thermal substrate matching for large area material interfaces for next generation of imaging sensors. 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	1816	1639	1652

enhancing heat and mass transfer within micro-reactors. In FY09, will identify basic principles to automatically extract knowledge from text that continuously changes its vocabulary over time; will continue to investigate the phenomenology involving large scale network behavior and implications on security and antenna design, and will investigate the behavioral phenomenology of free space sensors to determine how they respond to environmental stimuli.			
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 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, solicit 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, will continue to 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.	441	2152	2991
Small Business Innovative Research/Small Business Technology Transfer Programs		279	
Total	12866	14022	14673

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91C**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
91C ILIR-MED R&D CMD	3833	3617	3616	3662	3698	3779	3862

A. Mission Description and Budget Item Justification: This project addresses investigator-driven medical and force protection basic research initiatives performed at the six U.S. Army Medical Research and Materiel Command laboratories. Research areas address countermeasures against infectious diseases, defense against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. 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 the Department of Defense Basic Research Plan. Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; U.S. Army Medical Research Institute of Chemical Defense (USAMRICD), Aberdeen Proving Ground, MD; U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; U.S. Army Institute of Environmental Medicine (USARIEM), Natick, MA; U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and U.S. Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07 the program funded 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 FY08 and FY09, the program fund 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 these efforts including research areas such as the use of inactivated bacteria as novel vaccine delivery platforms; induction of enhanced environmental stress tolerance through innovative protein therapies; studies exploring the basic mechanisms underlying the beneficial effects of blood plasma in treatment of severe hemorrhagic shock; and efforts to study the relationships between clotting and inflammation and their relationships to acute respiratory distress syndrome and multi-organ failure.	3833	3166	3251
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, responsiveness, and innovation in exploring basic research of 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 by providing unique and stimulating research opportunities. In FY08, solicit new and continuing basic research efforts focused on fundamental questions in medical science that relate to U.S. Army requirements including increased emphasis on network science. In FY09, will 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.		352	365
Small Business Innovative Research/Small Business Technology Transfer Programs		99	
Total	3833	3617	3616

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91D**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
91D ILIR-CORPS OF ENGR	1522	1309	1339	1279	1292	1320	1349

A. Mission Description and Budget Item Justification: The objective of this basic research project is to support In-House Laboratory Independent Research (ILIR) in the areas of battlespace environments, military engineering, and environmental quality/installations. Past and current ILIR efforts have had, and are having, significant impacts on technology development efforts supporting the Army transformation to the Future Force. 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 the Department of Defense Basic Research Plan. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Geospatial Research and Engineering/Military Engineering/Environmental Quality and Installations: In FY07, investigated environmentally responsive hydrogels for innovative applications in environmental monitoring, engineering, and nanomaterials synthesis. Studied and validated a discrete element model for simulating the mechanical properties of dry soil. Efforts included research designed to provide for improved understanding of biomimetic material that is suitable for incorporation into micro or nano-sensory devices specific for hazardous biological or chemical detection. Accomplishments in this area have resulted in the application for two patents for Novel Fluorescent Protein Markers. In FY08, investigate nanoparticle and molecular dynamics for chemical and biological networked sensing and assess infrasound ability to characterize infrastructure. In FY09, will research factors influencing partitioning and ecological risk of military unique nanomaterials in the environment.	1273	1167	1176
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 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, solicit 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, will continue to 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.	249	118	163
Small Business Innovative Research/Small Business Technology Transfer Programs		24	
Total	1522	1309	1339

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	166403	165020	176959	169627	179744	184747	200742
305	ATR RESEARCH	1190	2236	2314	2365	2376	2406	2437
31B	INFRARED OPTICS RSCH	2092	2425	2560	2611	2616	2659	2698
52C	MAPPING & REMOTE SENS	2126	2624	2706	2741	2763	2823	2886
53A	BATTLEFIELD ENV & SIG	2554	2817	3013	3055	3093	3153	3237
74A	HUMAN ENGINEERING	2518	2942	5545	4588	5208	5481	6401
74F	PERS PERF & TRAINING	3244	3458	6508	5938	6162	6418	7226
F20	ADV PROPULSION RSCH	1929	2184	3332	3280	3321	3363	4078
F22	RSCH IN VEH MOBILITY	475	541	558	564	569	581	594
H42	MATERIALS & MECHANICS	2014	2184	7332	6017	6948	7446	8713
H43	RESEARCH IN BALLISTICS	5618	6103	8157	8226	8263	8404	9200
H44	ADV SENSORS RESEARCH	3486	3998	7212	6320	6603	6903	7546
H45	AIR MOBILITY	1797	2280	2349	2375	2395	2447	2501
H47	APPLIED PHYSICS RSCH	2456	2789	2886	2925	2951	2994	3086
H48	BATTLESPACE INFO & COMM RSC	6112	6677	8920	9070	12012	12097	14837
H52	EQUIP FOR THE SOLDIER	1046	936	982	1007	1032	1051	1078
H57	SCI PROB W/ MIL APPLIC	58303	56478	68333	66888	69176	71022	75607
H66	ADV STRUCTURES RSCH	1508	1608	1717	1764	1803	1839	1887
H67	ENVIRONMENTAL RESEARCH	735	811	911	924	931	951	972
H68	PROC POLLUT ABMT TECH	357	413	426	431	435	445	454
S04	MIL POLLUTANT/HLTH HAZ	600	689	712	721	726	742	758
S13	SCI BS/MED RSH INF DIS	8397	10430	10932	10307	10375	10603	10836
S14	SCI BS/CBT CAS CARE RS	3626	4489	6207	5511	5779	6010	6708
S15	SCI BS/ARMY OP MED RSH	5706	6278	9556	8341	10039	10471	11564
S19	T-MED/SOLDIER STATUS	589	715	752	717	731	747	764
T14	BASIC RESEARCH INITIATIVES - AMC (CA)	34224	25437					

T22	SOIL & ROCK MECH	1769	2158	2228	2257	2274	2324	2375
T23	BASIC RES MIL CONST	1411	1638	1719	1762	1824	1885	1958
T24	SNOW/ICE & FROZEN SOIL	1146	1413	1456	1478	1504	1532	1574
T25	ENVIRONMENTAL RES-COE	4417	5484	6136	6194	6335	6450	6767
T60	BRAIN IMAGING RESEARCH							
T61	Basic Research Initiatives - MRMC (CA)	4958	2785					
T63	ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH			1500	1250	1500	1500	2000

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, provides new concepts and technologies for the Army's Future Force, and provides the means to exploit scientific breakthroughs and avoid technological surprises. It fosters innovation in Army niche areas (such as lightweight armor, energetic materials, night vision) and where the commercial incentive to invest is lacking due to limited markets (e.g., vaccines for tropical diseases). It also focuses university single investigators on research areas of Army 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 expeditiously transition knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry. This translates to a coherent, well-integrated program which is executed by 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 Science and Technology Reliance (Defense Basic Research Advisory Group), and other inter-service working groups. This program responds to the scientific and technological requirements of the Department of Defense Basic Research Plan by enabling technologies that can significantly improve joint war fighting capabilities. The projects in this PE involve basic research efforts directed toward providing fundamental knowledge that will contribute to the solution of military problems related to long-term national security needs. Projects not specifically addressed through R-2a exhibits include F22 - Research in Vehicle Mobility that focuses on research within the advanced military ground vehicle mobility/propulsion areas; H52 - Equipment for the Soldier that focuses on understanding the role of fiber internal structure in responding to ballistic impact, with the goal of establishing the science base to support the design of more effective body armor materials; H67 - 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, Solider support systems, non-stockpile chemical warfare site remediation and decontamination of biological warfare agents; H68 - 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; S04 - 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; S19 - 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.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is managed by: the US Army Research Laboratory (ARL); the US Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC); the US Army Natick Soldier Center (NSC); the Medical Research and Materiel Command (MRMC); the US Army Engineer

Research and Development Center (ERDC); and the US Army Research Institute for the Behavioral and Social Sciences (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	170122	137676	141423
Current BES/President's Budget (FY 2009)	166403	165020	176959
Total Adjustments	-3719	27344	35536
Congressional Program Reductions		-1056	
Congressional Rescissions			
Congressional Increases		28400	
Reprogrammings	-555		
SBIR/STTR Transfer	-3164		
Adjustments to Budget Years			35536

FY09 was increased for basic research efforts in support of the current and future forces in such areas as the Single Investigator Program, Network Science, Neuroscience, and High Deformation Rate Materials.

Sixteen FY08 congressional adds totaling $28400 were added to this PE.

($800) Semiconductor-based Nanotechnology Applications
($1000) Document Exploitation for Handwriting Recognition
($1000) Flexible Electronics Research Initiative
($1000) Innovative, Computational Water-Borne Pathogen Research for Chemical/Biological Detection
($1000) UT-Tyler Organic Semiconductor Modeling and Simulation
($1200) Activated Nanostructures for Deicing
($1600) Direct Methanol Fuel Cell Recharger Program
($1600) Global Military Operating Environments
($1600) Integrated Nanosensors for NBC Threat Detection
($1600) Technology Commercialization and Management Network
($2000) John H. Hopps, Jr. Defense Research Scholars Program
($2400) Cyber Threat Analytics
($2400) Functionally Integrated Reactive Surface Technology (FIRST) Program
($2400) Secure Open Systems Institute
($4000) Perpetually Available and Secure Information Systems (PASIS)
($2800) Combat Mental Health Initiative

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**305**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
305 ATR RESEARCH	1190	2236	2314	2365	2376	2406	2437

A. Mission Description and Budget Item Justification: Automatic Target Recognition (ATR) Research seeks to enhance the effectiveness of Army systems through application of ATR technology 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. It is increasingly desirable to have 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. Electro-optic/infrared imaging systems that use advanced algorithms for compressing data, and detecting and identifying targets over extended battlefield conditions are needed for the Future Force. 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Investigate new algorithms to improve unaided target detection and identification. In FY07, investigated motion and change detection algorithms that exploit the benefits of color and FLIR video fusion, study new methods of fusing visible, near-IR, and IR imagery to improve target detection and classification. In FY08, explore advanced methods for aided tracking via fusion of video modalities and detection likelihoods; investigate statistical algorithms for application in hyperspectral imagery; evaluate methods to classify tracked objects in color and FLIR video; and investigate novel nonlinear fusion methods for anomaly detection using hyperspectral and synthetic aperture radar (SAR). In FY09, will research novel behavior characterization algorithms for color and FLIR video; will 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.	1190	1212	1314
Conduct basic research to support advances in state-of-the-art clandestine Targeting, Tracking, and Locating (TTL) for non-traditional hostile force and non-cooperative targets. Specific technical objectives, products, and deliverables are classified and in accordance with the Hostile Forces TTL Capabilities Development Document (HFTTL CDD) 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, activities are synchronized with research in the Micro Autonomous Systems and Technology (MAST) Collaborative Technology Alliance (CTA). In conjunction with the start of the MAST CTA, investigate		988	1000

microtechnology, Micro Electro Mechanical System (MEMS), nanotechnology, quantum dot technology, aptamer based sensors, nanomicroencapsulation of taggants, hyperspectral imaging algorithms, biomimetics, and carbon nanotubes. Identify technologies that have potential to achieve the goals of clandestine TTL. In FY09, technologies selected for further exploration will begin to be matured. This will include both device and algorithm development. Technologies that are of sufficient technology readiness will transition to applied research.			
Small Business Innovative Research/Small Business Technology Transfer Programs		36	
Total	1190	2236	2314

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**31B**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
31B INFRARED OPTICS RSCH	2092	2425	2560	2611	2616	2659	2698

A. Mission Description and Budget Item Justification: This project supports Army research in materials and devices for active and passive infrared (IR) imaging systems. 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 for the Future Force, IR Focal Plane Arrays (FPAs), and interband cascade lasers (ICLs) with significantly improved performance, lower cost, and increased operating temperatures. 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. 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 are applied to the control of microwaves. The technical barriers in the research program include control of 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
The objective of this project is to support Army research in materials and devices for active and passive IR imaging systems to increase situational awareness in open and complex terrain; improve target detection, identification, and discrimination; and enhance IR countermeasure (IRCM) protection against missile threats. In FY07, investigated high power IR lasers for IRCM and chemical/biological sensing applications, researched dynamic IR photonic-crystal waveguides for control of Radio Frequency signals, and evaluated dry etching and surface passivation procedures for LWIR Type II FPAs. In FY08, investigate high-power IR lasers for free space (ground-to-satellite and satellite-to-ground) communications, design 2-color MWIR/LWIR detector structures, and research nano-scale photonic crystal waveguide device that can reconfigure by a MEMS feature. In FY09, will research frequency modulated IR lasers for covert communication applications, fabricate high operating temperature 2-color MWIR/LWIR Type II FPAs, and design and research chip-scale integrated IR-photonic circuit based on the reconfigurable photonic crystal-MEMS waveguide devices for microwave radar application.	2092	2414	2560
Small Business Innovative Research/Small Business Technology Transfer Programs		11	
Total	2092	2425	2560

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**52C**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
52C	MAPPING & REMOTE SENS	2126	2624	2706	2741	2763	2823	2886

A. Mission Description and Budget Item Justification: The objective of this basic research project is to increase 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 capabilities for the Future Force. The research provides the theoretical underpinnings for program element (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. The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Sensor Phenomenology: In FY07, researched exploitation of multiple types of sensors to characterize critical battlespace environment features. Experimented with mimicking biological sensory functions to characterize the battlespace environment. Examined environmental impacts on steady-state fluorescence time-series of endospore germination as well as amplification methods for uranyl oxide for greater operational stability of detection substrate. Investigated numerous factors believed to influence human behavior in an effort to better understand cause and effect within the battlespace. Similarly, increased understanding between cause and effect will assist in tool development, future experimentation, and simulations of spatial-temporal knowledge discovery models. In FY08, investigate innovative approaches to hyperspectral sensing of labeled targets by stand-off illumination, as well as research fluorescent nanowire arrays and molecular prisms as tunable chemical/biological/radiological sensors. In FY09, will research social network concepts to better assess important interaction within and between our adversaries, directly relating events, and actions to time and geographic space. Will mature research on innovative sensing science focusing on micro-nano sensors and concentrate additional focus on multi-sensory approaches to identifying specific target phenomenology.	2126	2596	2706
Small Business Innovative Research/Small Business Technology Transfer Programs		28	
Total	2126	2624	2706

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**53A**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
53A BATTLEFIELD ENV & SIG	2554	2817	3013	3055	3093	3153	3237

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 Army Modernization Strategy and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, simulated atmospheric effects on aerial mounted acoustic arrays to enhance urban acoustic propagation methodologies to improve model performance. Evaluated results of SWIR system field experiments against model for SWIR performance under a range of optical turbulence conditions to improve system designs. In FY08, measure Two-Dimensional Angular Optical Scattering (TAOS) of atmospheric particles using improved instrumentation designed to improve detection and identification of chem/bio hazards. Implement an inversion technique to extract the optical constants of the spherical atmospheric aerosol particles to enhance capabilities for discrimination/identification of chem/bio hazards. Investigate effects of single urban structure on sound fields to enhance detection and avoidance capabilities. Implement model for propagation through atmospheric water vapor fluctuations at TeraHertz frequencies to improve sensor accuracy. In FY09, will devise and employ a model for radiative transfer effects of clouds on night vision illumination to improve visibility, 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.	1602	1751	1889
Increase survivability of the Future Force and improve situational awareness through research to improve the accuracy of high-resolution meteorology focused on urban and complex terrain in order to account for the natural atmospheric and battle-induced variability. In FY07, investigated critical stable boundary layer phenomena in complex terrain for improved understanding of boundary layer characteristics as they applied to an urban environment; investigated and evaluated the use of coupled modeling capabilities to investigate methods for identifying plume source location that improved plume tracking; and simulated co-located Doppler radar and Doppler lidar to evaluate the ability to improve wind and cloud detection for enhanced capabilities of transport and dispersion models for chem/bio hazards. In FY08,	952	1066	1124

explore the fine-scale structure within the urban boundary layer for input to models depicting transport of chemical/biological and other dispersants. Investigate the vertical flux effects of water vapor in the boundary layer to determine their effects on near-millimeter wavelengths sensor atmospheric propagation models. In FY09, will investigate atmospheric modeling technology for very fine-scale flows to improve local area forecast timeliness and accuracy. Will investigate water vapor fluctuation spectra as influenced by the urban boundary layer for propagation effects in complex terrain that affects sensor performance and imaging capabilities.			
Total	2554	2817	3013

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**74A**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
74A HUMAN ENGINEERING	2518	2942	5545	4588	5208	5481	6401

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. Accordingly, 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 Army Modernization Strategy and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Research to improve Soldier auditory performance. In FY07, explored applications of localization algorithms to maximize audibility of unidentified sound sources; compared noise attenuation provided by the new Improved Combat Arms Earplug (ICAE) with that of the current Combat Arms Earplug (CAE); determined the effects of ICAE on Soldier auditory performance (e.g., localization, speech intelligibility, acoustic signature detection) in the presence of both continuous and impulse noise. In FY08, determine feasibility and limitations of ultrasonic hearing. Explore the effect of sound duration on auditory localization accuracy. In FY09, will investigate synergy between bone conduction and tactile communication for military applications. Will formulate an algorithm for predicting localization error due to headgear.	1425	1225	1461
Research to assess, predict, and improve Soldier performance. In FY07, explored integrated use of real-time neuro-physiological and other objective measures and models to measure Soldier performance in dynamic battlefield environments. In FY08, expand neurophysiological signal artifact reduction techniques to measure Soldier temporal-cognitive processes. In FY09, merge state-of-the-art neuro-sensor technologies with data filtering techniques to enhance brain monitoring and classification methodologies in realistic environments.	1093	1711	2075
Research in neuroergonomics, or the study of the brain at work. In FY09, will investigate human performance and brain function to design Soldier systems for safer and more efficient operation. Will advance understanding of human brain function in relation to cognitive processes and performance in real-world tasks and will conduct research to better understanding the relationship of cognitive functions under stress.			2009

Small Business Innovative Research/Small Business Technology Transfer Programs		6	
Total	2518	2942	5545

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**74F**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
74F PERS PERF & TRAINING	3244	3458	6508	5938	6162	6418	7226

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 network science. 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 are likely to 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/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. The cited work is consistent with Director, Defense Research and Engineering Strategic Plan, the Army Modernization Plan, and the Army Science and Technology Master Plan. This project is managed by the US Army Research Institute for the Behavioral and Social Sciences (ARI). Research in this project is related to and fully coordinated with efforts funded in program element (PE) 0602785A, Project 790.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, examined the human dimensions for optimizing training and performance for complex tasks; investigated methods for accelerating leader development; and identified and modeled the development and relationships among the psychological, demographic, and motivational factors that influence recruit enlistment, Soldier retention, productivity, and organizational citizenship. Examined new approaches to developing unbiased tests of abilities and intelligence that better predict performance; explored relationships among pattern recognition, mental flexibility, creativity, and success; and conducted research on value of multimedia tests for selection and training of future leaders. In FY08, develop methods to identify individuals most susceptible to information biases in complex environments and methods to assess motivation for leadership self-development. Also identify and measure individual-difference variables that predict organizational citizenship and adaptive performance and continue examination of unbiased testing and relationships of pattern recognition, creativity, and mental flexibility. In FY09, will identify and measure individual attributes and learning principles that foster adaptive performance and promote rapid adaptability skill acquisition and retention. Will also develop a new, culture free measure of self-control that will allow prediction of achievement above and beyond cognitive ability. Will mature technology addressing the human dimension for training and enhanced performance.	2283	2379	4507
In FY07, as part of the Army's new initiative in Network Science, began research on human networks with a focus on cognitive and social domains (research focused on individual, unit, and organizational behavior in context of networked environments), with the long-term	961	992	2001

goal of improving network science theory to assist Army counterterrorism efforts. Began a research program that focuses on behavioral modeling, automated tools for dynamic network analysis, trust in distributed teams, and support of scientific collaboration. In FY08, conduct research on human use of networks, communication, and command and control technologies to include automated agents, distributed environments, and improved, integrated assessment. Create new technologies for collaborative scientific inquiries into network science, working with the Army Research Laboratory and Army Research, Development, and Engineering Centers. In FY09, will 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. Will 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. Will explore the regularities of networked social behavior within massively multi-user online environments as simulations of real behavior. 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 for Creative Technology 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.			
Small Business Innovation Research/Small Business Technology Transfer Programs		87	
Total	3244	3458	6508

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**F20**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
F20 ADV PROPULSION RSCH	1929	2184	3332	3280	3321	3363	4078

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 Force. 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, experiments, 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
This research 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 mechanical behavior of future engines and drive trains and enable the design of more fuel efficient and reliable propulsion systems. In FY07, analyzed autonomous diagnostic and repair concepts for gas turbine engine components, and completed baseline experimentation of gear tooth bending strength at elevated temperatures experienced in helicopter transmissions. In FY08, formulate life prediction models for low conductivity thermal barrier coatings to improve turbine design process and complete the face gear dynamic load prediction modeling computer code to improve the transmission design process. In FY09, will 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.	1929	2184	2326
Research in small, highly efficient propulsion for air and ground vehicles. In FY09, will research high priority engine technology shortfalls associated with small Unmanned Aerial Systems (UAS), and will also benefit emerging robotic platforms and energy generation platforms that have similar power requirements. Will conduct research to create small engine-class analytical database and tools.			1006
Total	1929	2184	3332

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H42**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H42 MATERIALS & MECHANICS	2014	2184	7332	6017	6948	7446	8713

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 major issue associated with the current approach of using materials to gain added functionality for Army systems is that one must 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 Force. This research supports materials technology applied research in program element (PE) 0602105A, Project H84. 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Devise new materials and design capabilities, based upon fundamental concepts derived at the microscopic and nano-structural levels, for the Future Force In FY07, enhanced the synergistic effects of structure and electromagnetic interactions within scaled survivable structures, and characterized transport behavior and relevant properties of nanoparticles. In FY08, implement and validate models for fragmentation, reactive materials, and ballistic penetration; enhance processing and non-destructive evaluation for improved armor ceramics; use directed assembly to embed functionality into polymer materials; and validate multifunctional material performance. In FY09, will 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.	2014	2184	2271
High deformation rate materials. In FY09, will investigate engineered scalable materials for armor applications using nanoscale building blocks. Will characterize their properties and feed ballistic modeling efforts to rapidly screen for performance. Future electromagnetic armor requires better field responsive adaptive materials. Will quantify and model the effect of static and transient electric/magnetic/flow fields on the properties of materials for active concepts. Will create underpinning understanding to enable the engineering of expedient materials.			2516
Materials research and processing at small scale. In FY09, will research concept of materials by design which will conduct material modeling studies to enable bottom-up armor materials design. Will research methods relating processing to materials microstructure that feeds ballistic property models. Will focus effort largely on ceramics and complex textile composite materials.			2545
Total	2014	2184	7332

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H43**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H43 RESEARCH IN BALLISTICS	5618	6103	8157	8226	8263	8404	9200

A. Mission Description and Budget Item Justification: This project seeks to improve 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 for the Future Force. 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 program element (PE) 0602618A, Project H80. 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In support of the National Advanced Energetics Initiative, expand and validate physics-based models and experimental techniques to enable design of novel insensitive propellants/explosives with tailored energy release for revolutionary Future Force survivability and weapons effectiveness In FY07, devised predictive meso/multiscale molecular models for design of insensitive propellant/explosive formulations; characterized/modeled ignition and combustion of multi-purpose reactive materials; and derived computational theory for energy storage and release mechanisms in energetic, strained solids/metastable states. In FY08, simulate energy transfer and conversion within shocked and heated energetic materials formulations; fabricate and characterize reduced sensitivity nano-engineered energetic materials; derive theoretical descriptions and produce hyper-energetic polymeric nitrogen; characterize structural bond energy release materials; and refine models to include hot fragment impact, shear ignition sensitivity, emerging multiphase fluid dynamics, thermo-mechanical coupling, and reactive materials initiation. In FY09, will 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.	2706	2635	2732
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. In FY07, proved ability to accurately depict the degradation of ceramic materials in the terminal effects environment; applied the generalized fracture framework to simulate failure penetrators and armor materials; and studied failure and damage of urban structural materials for terminal ballistic events. In FY08, quantify damage in select ceramics using destructive and non-destructive techniques; devise reactive material ignition model; devise a controlled fragmentation model; and implement models for urban structural material failure in continuum codes. In FY09, will 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	2512	2501	2520

model results with actual human injury data obtained from the medical community.			
Extramural research in non-lethal (NL) control methods to exploit potentially innovative approaches that offer unique battlefield and homeland defense capabilities. In FY07, employed efforts to increase computational horsepower, and advances in tissue engineering to develop integrated modeling and experimental approaches to link kinetic energy loading conditions to human injury at the macroscale. Designed and fabricated diffractive optical elements for better light extraction from high energy laser slabs. In FY08, exploit advances in biotechnology to develop more refined modeling and experimental techniques to ascertain the effects of blunt trauma and impulse loading at the cellular level. Attempt to coherently combine multiple optical fibers to enhance high intensity laser output at kilowatt levels. In FY09, will 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. Will 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 VE sources in FY06.	400	880	898
Armor research. In FY09, will investigate modeling and simulation of ballistic impact events to include modeling materials response with enhanced failure models that capture realistic behavior with minimum parameterization. Will create fundamental ceramic/glass model and develop mesoscale approaches; For electromagnetic armor technology, in FY09, will 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.			2007
Small Business Innovative Research/Small Business Technology Transfer Programs		87	
Total	5618	6103	8157

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H44**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H44 ADV SENSORS RESEARCH	3486	3998	7212	6320	6603	6903	7546

A. Mission Description and Budget Item Justification: This project funds basic research to enable new sensing capabilities for the Army's Future Force and 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, and battlefield acoustic signal processing algorithms. Research performed under this project supports survivable sensor systems, 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's Future Force, 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 signal processing techniques for acoustic/seismic sensing systems, improved cryptography techniques, and hazardous material 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 Army Modernization Strategy, and the Army Science and Technology Master Plan.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Research addresses the maturation of technologies for adaptive, active, and intelligent optical systems for high-data-rate military communications and directed energy applications In FY07, performed research into the use of an active Hybrid/RF/optical laser communications and imaging network for Army applications including laser designation and explosives detection. In FY08, research potential configurations for small agile adaptive apertures for high-bandwidth optical communications and directed energy applications, and define conformal adaptive optical components for Gigabit free-space laser communications and directed energy configurations. In FY09, will research parameters and define the operational envelop for the use of ultra short (femtosecond) laser illumination for the Army's active imaging and directed energy applications.	1327	1535	1672
Research focused on improving sensor capabilities to create more survivable/secure systems and displays, and improved hazardous material monitoring. In FY07, used modeling and imaging tools to evaluate UWB image formation options; collaborated with RDEC partners to assess transition possibilities of QC systems; researched decentralized signal processing for ad-hoc sensor networks; studied noise in MEMS flux concentrators and accelerometers; and improved Organic Thin Film Transistor (OTFT) and photovoltaic performance for flexible displays. In FY08, develop methods to mitigate sensitivity of imaging radar to multipath-induced false alarms; conduct limited error rate analyses to assess the potential for compromising quantum systems; research distributed spatial and temporal processing and data fusion algorithms for networks of heterogeneous and possibly mobile sensor nodes; investigate new magnetic sensor technologies for personnel detection; and produce final SERS hazardous material sensing assessment report. In FY09, will research target and clutter	2159	2435	2529

scattering phenomena to support radar detection of a multitude of concealed targets; evaluate completed signal processing algorithms for networks of heterogeneous sensor nodes; assess biologically-inspired techniques for advanced photonic structures, and integrate Organic Light Emitting Diodes (OLEDs) with OTFTs to investigate stability of system for next generation flexible displays.			
Research focused on biologically-inspired sensing and power generation. In FY09 will conduct research to mature novel biologically inspired chemical/biological sensors and sensor arrays and electronic sensors for rapid detection of biological threat hazards and pathogens. Will research bio-inspired materials for lightweight, portable energy generation and storage, and research methods to optimize performance of these materials.			3011
Small Business Innovative Research/Small Business Technology Transfer Programs		28	
Total	3486	3998	7212

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H45**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H45 AIR MOBILITY	1797	2280	2349	2375	2395	2447	2501

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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (BRP). Work in this program element is performed by the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, demonstrated tightly coupled CFD/CSD methods for calculating helicopter airloads and structural loads in maneuvering flight. Explored aeromechanical benefits and issues for advanced rotorcraft configurations. In FY08, develop new methods for accurate aeroelastic stability prediction. Explore rotor fuselage interactions for complex configurations using advanced CFD methods. Investigate aeromechanics issues for high altitude rotors. In FY09, will demonstrate active rotor modeling tool using National Full-scale Aerodynamic Complex validation data, develop improved turbulence models for rotorcraft application and assess improved modeling and simulation tools on heavy-lift interactional aerodynamics validation data.	1797	2236	2349
Small Business Innovative Research/Small Business Technology Transfer Programs		44	
Total	1797	2280	2349

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H47**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H47 APPLIED PHYSICS RSCH	2456	2789	2886	2925	2951	2994	3086

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

Work is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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; and cold-atom chip devices for advanced sensors and ultra-stable atomic clocks In FY07, investigated the fabrication and characterization of prototype carbon nanotube (CNT) and other nanowire-based sensor devices, created a protocol for determining fundamental failure mechanisms in Silicon Carbide (SiC) and Gallium Nitride (GaN) Schottky diodes, and evaluated the improved SiC and GaN devices in test circuits; trapped a cold-atom cloud on a chip and transported the cloud using optical tweezers and a magnetic waveguide to construct miniature sensors; explored highly reversible electrode materials for fast charge of Li-ion batteries, designed efficient air-electrodes for lithium/oxygen cells, and explored sulfur tolerant catalyst for JP-8 reformation. In FY08, investigate CNT and other nanowire-based active electronic devices, explore thermal characteristics of relevant nanostructures, and detect atom interference in a waveguide; investigate regenerable sulfur sorbents for JP8 reformation and materials for high power Li-ion batteries. In FY09, will investigate system insertion for nanoelectronic devices and sensors and failure mechanisms for wide-bandgap electronic devices; will sense a gravitational field gradient using a waveguide atom interferometer for possible use as inertial navigation; and will study thin-film battery materials.	2456	2751	2886
Small Business Innovative Research/Small Business Technology Transfer Programs		38	
Total	2456	2789	2886

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H48**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H48	BATTLESPACE INFO & COMM RSC	6112	6677	8920	9070	12012	12097	14837

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/dismounted commanders/leaders/Soldiers, improve the timeliness, quality and effectiveness of actions and, in the long run, 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 Army Modernization Strategy and the Army Science and Technology Master Plan.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Perform research to provide communications capability for a fully mobile, fully communicating, situationally aware force operating in a highly dynamic, wireless, mobile networking environment populated by hundreds to thousands of networked nodes. In FY07, analyzed experimental data, to determine scalable routing algorithms for protocols (proactive/reactive) using communications traffic and topology scenario generation. In FY08, refine scalable algorithms to incorporate technologies in sensor radios. In FY09, will perform experimental analysis to incorporate technologies in mobile radio units.	1433	1605	1653
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 FY07, implemented first-order laboratory experiments to evaluate and enhance algorithms describing agent generated patterns and events used to refine and optimize algorithms for 3D scene reconstruction from a robotic platform. In FY08, investigate 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, are connected using service oriented architecture networking techniques and information agents. Investigate pose recognition from imagery to determine location in GPS-denied areas. In FY09, will experiment with and 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.	1234	1379	1452
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 FY07, investigated high mobility, channel impairment issues	1440	1601	1691

which are MANET-unique. Algorithms are tailored to MANETS that are severely constrained including topology variation and fading wireless channels. In FY08, design and evaluate intrusion detection algorithms on mobile ad hoc networking protocols, including under hostile conditions, using formal methods to represent protocols. In FY09, will 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.			
Design and implement a laboratory scale common information-processing infrastructure that commanders and troops can use to bridge language barriers in order to anticipate adversaries' behaviors and collaborate with allies. In FY07, refined and optimized algorithms for automated language identification of speech and document machine translation and linked test bed with AFRL and NRL. In FY08, investigate, evaluate, and implement 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, will experiment with algorithms for processing and exploiting handwritten documents such as Arabic and Farsi, which are input to machine translation.	1005	1058	1113
Beginning in FY07, studied the behavior of MANETs as part of the Army's new initiative on Network Science. Emphasis is on mobile communications networks for the Army's University Affiliated Research Center, the Institute for Collaborative Biotechnology at the University of California - Santa Barbara. In FY08, design formal models, abstractions, and metrics for mobile ad hoc networking and extend to simulations, and conduct scalability analyses and design models of mobile ad hoc routing protocols and their functional concepts, incorporating biological paradigms where applicable. In FY09, will 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.	1000	1000	1000
Advanced Computing. Beginning in FY09, research in advanced computing algorithms and techniques will address implementation issues for mobile networking, machine based language translation, and information processing infrastructure. Will research computer based modeling, simulation and data analysis techniques for the study of scientific phenomena and engineering designs.			2011
Small Business Innovative Research/Small Business Technology Transfer Programs		34	
Total	6112	6677	8920

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H57**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H57 SCI PROB W/ MIL APPLIC	58303	56478	68333	66888	69176	71022	75607

A. Mission Description and Budget Item Justification: This extramural research project seeks to discover and exploit 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 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, biology, and materials science), the engineering sciences (mechanical sciences, electronics), and mathematical and information sciences (mathematics, computer, and information sciences), environmental sciences (atmospheric and terrestrial sciences), and the Army's new initiative - Network Science. Targeted research programs in nanotechnology, smart structures, multifunctional and microminiature sensors, intelligent systems, countermine, 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. This project also funds assessments of international 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 in this project is performed extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Basic research in environmental and life sciences Soldier performance, Soldier protection, and novel biotechnologies and biomaterials for new Army capabilities. In FY07, investigated new bioremediation approaches to maintain usable Army training facilities with reduced Soldier toxin exposure and operational and environmental compliance costs; advanced capabilities in bionanoengineering, neurophysiology, and molecular biology for improved Soldier protection; devised airborne Doppler lidar with 4-D wind measurement capabilities; developed new simulations for soil moisture estimation; developed understanding of phenomenological modeling approaches applicable to various sensor types to discriminate low-metal targets and buried unexploded ordinance (UXO) from anthropogenic environmental clutter and to separate closely spaced object sensor signatures; and improved explosives detection from airborne surveillance imagery. In FY08, focus on lower cost technologies for bioremediation, on biomaterials for better Soldier protection and on landmine and UXO detection. In FY09, will focus on new biotechnologies for soldier protection; bionanoengineering for new biomaterials and will invest in basic research to understand biological construction of novel materials, structures and processes. Will research fundamental studies in biochemistry, cell biology, biophysics; will devise a Soldier scale atmospheric test bed addressing unique atmospheric Army operational needs.	6172	6001	8367
Basic research in chemical sciences for advanced power generation, propellants, protective materials, and threat detection In FY07, increased research on selective transport, systems integration of compact power sources, and multi-scale modeling for materials damage based on molecular interactions. In FY08, emphasize research on fuel reformers, molecular control for chem./bio/explosive detection,	6144	6003	7550

and new initiative on chemical information theory for armor materials. In FY09, will focus on optimum design for chemically reacting systems, microreactors for threat detection and health assessment, and structure/function relations for membrane transport.			
Basic research in physics for precision guidance, superior optics, and signature management properties, ultra-sensitive sensors, quantum computing, and secure communications. In FY07, devised negative index materials and photonic materials in the visible range for imaging and sensing applications; provided accurate computational tools to aid in design of new drugs and functional materials, beginning the process of subsuming biochemistry and quantum biology for a firmer basis for nanoscience; explored existence of new superfluid matter with unequal spin; developed theories to determine quantum phases/phase transitions and controls to simulate condensed-matter. In FY08, develop negative-index materials with attempts to build flat lenses and show sub-wavelength images; explore 1 to 2 band loading of optical lattices; conduct preliminary simulations of Hubbard and Heisenberg models; develop continuously tunable microwave filters and sources (10-100 GHz) for communications and imaging RADAR. In FY09, will develop novel quantum cascade lasers and IR photodetectors for remote Chem/Bio detection (CBD), enhanced Light Detection and Ranging (LIDAR) for target tracking, and high power (>100 KW) fiber lasers; will explore use of light filament based sensors for remote CBD, environmental sensing by novel enhanced spectroscopies, solar power at greater than 50 percent conversion efficiency (as a Soldier power source), and free space communications.	8362	8004	9990
Basic research in electronics, photonics, and communications for unmatched networked Command, Control, Communications, and Computing and Intelligence, Surveillance, and Reconnaissance (C4ISR) capabilities. In FY07, devised an integrated nanoscale sensor platform at THz frequencies for biological detection. In FY08, complete a comprehensive model providing fundamental insights into high power quantum dot lasers. In FY09, will develop extremely small tactical antennas operating with high system efficiency across the HF, VHF, and UHF bands.	12881	12005	13650
Basic research in mechanical and material sciences for survivable armor, more lethal anti-armor, improved mobility, and flexible displays for Soldier systems In FY07, created adaptive multiple scale computational models to predict material failure; synthesized carbon nanotube-based damping polymers for vibration reduction in rotor blades; investigated optical switching behavior in novel polymer architectures and excited-state systems for laser protective films; fabricated fully dispersed single-wall carbon nanotube composites, devise the first simultaneously ferroelectric and ferromagnetic materials; synthesized prototype electron gas piezoelectric sensors. In FY08, obtain full flow field diagnostics around an oscillating rotor blade under realistic helicopter flow conditions; perform 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. In FY09, will validate chemical kinetic mechanisms for high temperature and pressure alternative hydrocarbon-based fuels in diesel and turbine engine application. Will research new materials for armor and soldier protection, improve techniques to predict material failures, and study high deformation strain rate materials for ballistic tolerance.	12574	11781	13350
Basic research in mathematical and computer sciences as the backbone for complex, multi-system analysis, modeling and simulation, and information systems. In FY07, developed intelligent processing systems to improve fusion of hard (sensor)/soft (human) information, and also to exploit the network centric nature of the fusion problem. In FY08, develop a theory to support creation of tools for design of heterogeneous swarms for desired tactical emergent behavior. In FY09, will demonstrate the effectiveness of the developed products and tools on swarming in laboratory test-beds. Will enhance research efforts in quantum information sciences. Will research computer techniques to identify attacks against information systems, protecting information systems from attack, and on developing techniques for inherently hardened software.	10530	10020	13121
Basic research to gain an understanding of the fundamental aspects of how networks develop, function, and adapt to environmental pressures and the rate of information flow across the network in manmade and naturally occurring networks. In FY07, performed basic research to extract the common elements of networks across various disciplines, perspectives, layers, theories, and applications to create a	1640	1410	2305

sound basis for a science of networks. The science was aimed at developing theoretical models that can explain and predict network behavior. In FY08, explore the science aimed at developing experimental/theoretical/computational models that can explain and predict the overall behavior of the layered structure of networks of importance to the Army. At the base of the layer cake is the physical network, followed, for example, by the information network, then the communication network and terminating in the social network, with multiple nonlinear interactions within each layer and among the various layers. In FY09, will examine candidate 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 will be constructed to enable network interfacing and control across multiple scales. Moreover the barriers (lack of mathematical infrastructure) to network control across multiple scales will be addressed in this general information context. Will accelerate research to enhance understanding of network systems that provide basis for their properties to function, research network model representations of physical, biological, and social phenomena leading to predictive approaches to these phenomena.			
Small Business Innovative Research/Small Business Technology Transfer Programs		1254	
Total	58303	56478	68333

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**H66**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H66 ADV STRUCTURES RSCH	1508	1608	1717	1764	1803	1839	1887

A. Mission Description and Budget Item Justification: This project funds basic research for improved tools and methods to enable 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 Plan. 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 maturation 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 Army Modernization Strategy and the Army Science and Technology Master Plan. Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 In FY07, formulated mechanics methodology to analyze selectively reinforced metallic and hybrid composite material structures, explored advanced concepts for lightweight, highly tailored and multi-functional composite structures using embedded sensors/actuators. In FY08, research lightweight damage tolerant structures for future large airframes, analyze computational fluid dynamic methods to support unsteady low Reynolds number aerodynamic models for flapping wing Microsystems. In FY09, will evaluate multibody-compatible thin-walled elastic finite element methods to enable aeroelastic predictions for small-scale air vehicle systems.	1508	1608	1717
Total	1508	1608	1717

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**S13**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S13	SCI BS/MED RSH INF DIS	8397	10430	10932	10307	10375	10603	10836

A. Mission Description and Budget Item Justification: This project supports basic research that provides for healthy, medically protected Soldiers for the Future Force. This research investigates medical countermeasures for naturally occurring diseases that have had historically severe impacts on military operations. Malaria is the most significant military infectious disease threat. The malaria parasite becomes resistant to fielded drugs making it necessary to continually search for new drugs to feed the development and licensure pipeline. A vaccine to prevent malaria infection would be ideal but has been elusive, requiring additional basic research for novel vaccine approaches. Basic research to discover what components of an infectious organism cause disease and how the human reacts to these organisms will provide new approaches to prevent disease. In addition, identification of unique features of disease organisms will aid in developing diagnostic tools. Research into the transmission of disease by insects and other organisms (vectors) that carry the disease organisms will help to direct new interventions into preventing disease transmission. The Army is the Department of Defense's lead service for military infectious diseases research, and work in this project is managed by the U.S. Army Medical Research and 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 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 the DoD Basic Research Plan.

Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, Maryland, and its overseas laboratories; the US Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland; and the Naval Medical Research Center, Silver Spring, Maryland, and its overseas laboratories.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Prevention/Treatment of Parasitic Diseases: Conduct basic research to better understand malaria parasites, a necessary foundation to discover medical countermeasures to protect Soldiers from infection. In FY07, designed and screened new drug compounds and new parasite molecules (such as proteins critical for parasite growth) as malaria drug targets. In FY08, utilize molecular technological and modeling to discover new approaches to address malaria, screen thousands of drugs for antimalarial activity and assess potential for development, and search for new malaria proteins as drug targets and vaccine candidates. In FY09, will apply new technologies as they become available to identify novel approaches to prevent/treat malaria, such as improved computer modeling for drug discovery and bioinformatics to better identify important parasite genes and proteins that can be used for drug screening and vaccine targets.	3742	5727	6235
Bacterial Threats Vaccine Programs: Conduct basic research to better understand the biology of bacterial organisms and how to prevent diarrhea and scrub typhus. In FY07, conducted basic research to understand how bacteria cause diarrhea (such as interactions between bacteria and humans) with a focus on discovering new approaches to prevent diarrheal diseases. In FY08, conduct basic research to expand discoveries/studies of those bacterial components that are integral in the disease process and assess them as potential vaccine or other countermeasure candidates. Assess proteins from the scrub typhus organism to better define their role in causing disease and use as potential vaccine targets. In FY09, will continue to assess the proteins and other components expressed on diarrheal and scrub typhus organisms for their role in disease and possible use in protection.	850	1049	918
Viral Threats Vaccine Programs: Conduct basic 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 like Korean hemorrhagic	1002	1149	1794

fever. Basic research includes global risk to the warfighter, virus biology, disease process, and interaction with the human body. In FY07, conducted basic research to better understand hemorrhagic viruses and potential prevention approaches including studies of human-virus interactions between different dengue viruses that may affect vaccine strategies. Continued to study genes of highly lethal viruses to better understand which may provide protection if incorporated into a vaccine. In FY08, perform long-term studies to understand how naturally induced changes in the virus impact the virus's ability to cause disease. In FY09, will conduct basic research to understand hemorrhagic viral diseases and other lethal viruses of military importance and to assess emerging viral threats for their potential to impact military operations to determine whether any identified new threat requires further study.			
Insect Vector Control and Infectious Disease Diagnostics Programs: Conduct basic research to investigate the biology of biting insects and other organisms that transmit disease (called disease vectors) and their control (including Leishmania-infected sand flies) and to expand medical diagnostic and disease surveillance capabilities in the field. In FY07, conducted basic research to identify suitable markers (proteins or other disease-specific molecules) for potential use in insect-based pathogen detection systems and for field clinical diagnosis of human infection. Assembled insect identification keys for use by Preventive Medicine Units (PMUs) in US Central Command region. In FY08, conduct basic research to investigate the biology of insect vectors including vector identification and assembly of insect identification aids for use by PMUs focusing on US Southern Command and Pacific Command regions. Study biology of insects to better understand ways to control them through novel repellents or insect attractants and insecticides. In FY09, will explore the biology of insect vectors and methods of control to expand medical diagnostic and disease surveillance capabilities with a focus on providing new approaches.	2803	2343	1985
Small Business Innovative Research/Small Business Technology Transfer Program		162	
Total	8397	10430	10932

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**S14**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S14	SCI BS/CBT CAS CARE RS	3626	4489	6207	5511	5779	6010	6708

A. Mission Description and Budget Item Justification: This project supports basic research for healthy, medically protected Soldiers for the future force, focusing on a basic understanding of the mechanisms of combat-related trauma. This research identifies trauma-related topic areas for basic techniques and the experimental models necessary to support in-depth trauma research studies. Research conducted under this project forms the basis for the advancement of trauma treatment and surgical procedures to delay cell death and reduce bleeding following traumatic injury, minimize lost duty time from minor battle and non-battle injuries, and provide military medical capabilities for far-forward medical/surgical care of battle and non-battle injuries. 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 the DoD Basic Research Plan.

Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, Maryland, and the U.S. Army Institute of Surgical Research, Fort Sam Houston, Texas.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Hemorrhage Control, Blood, and Resuscitative Fluids: In FY07, completed collaborative studies with the National Heart, Lung, and Blood Institute that focused on novel approaches to restoring and maintaining blood pressure lost due to hemorrhagic shock. In FY08, investigate genetic determinants associated with differences in survival from hemorrhage in an animal model. In FY09, more definitive procedures will be used to more accurately locate the exact gene(s) involved in animals that demonstrated survival.	2386	281	873
Combat Trauma Therapies: In FY07, completed mechanism of action studies for an experimental neuroprotectant drug (NNZ2566) to treat silent seizures caused by brain trauma, defined effects of brain inflammation and genes or proteins associated with delayed cell death on secondary injury using a penetrating ballistic-type brain injury (PBBI) model, and identified and characterized agents that accelerate and enhance soft-tissue wound healing. In FY08, study the effect of novel neuroprotection therapies on cellular responses to injury; continue to examine delayed cell death mechanisms leading to malfunction of brain electrical impulses using PBBI; and begin basic research on tissue reengineering, which will focus on cellular-level mechanisms of tissue growth. Work will be conducted through the Armed Forces Institute of Regenerative Medicine (AFIRM). In FY09, will expand PBBI studies to a larger animal model, continue exploring cellular mechanisms of tissue growth through AFIRM, and begin basic science exploration of repair of maxillofacial bone and soft tissue injuries.	1159	3604	5334
Combat Casualty Bioinformatics and Simulation: In FY07, determined that major hemorrhage can be diagnosed during transport based on vital signs. In FY08, refine the diagnosis of major hemorrhage; modify and develop new algorithms for real-time qualification of vital-sign data; and develop and start testing hardware/software for real-time collection, qualification, and diagnosis of trauma data.	81	524	
Small Business Innovative Research/Small Business Technology Transfer Programs		80	
Total	3626	4489	6207

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**S15**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S15 SCI BS/ARMY OP MED RSH	5706	6278	9556	8341	10039	10471	11564

A. Mission Description and Budget Item Justification: This project supports basic research required to sustain a future force of healthy, medically protected warfighters, including delineation of injury, sustainment, and enhancement of the physiological and psychological capabilities of military personnel under combat operations in all environments. The focus is on physiological and psychological factors limiting Soldier effectiveness and on the characterization of health hazards generated by military systems and resulting from military operations. This includes development of concepts for medical countermeasures to sustain performance when the opportunity for adequate rest is impaired or impossible due to combat conditions. Research is conducted on militarily relevant aspects of environmental physiology and the neurobehavioral aspects of stress. The hazards of exposure to several classes of nonionizing radiation, directed energy, blast, jolt, vibration, noise, and toxic industrial chemicals as environmental contaminants are also investigated under this project. The six main thrust areas are (1) nervous system regulation of stress and cognition, (2) metabolic regulation, (3) control of regional blood flow, (4) oxidative stress interventions, (5) tissue remodeling/plasticity, and (6) biomechanical/biodynamic mechanisms of injury. 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 the DoD Basic Research Plan (BRP). Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, Maryland; the US Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts; and the US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, Alabama.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, explored, through an in-depth literature review, bone marrow-derived stem cell research as an innovative therapeutic mechanism for traumatic retinal injury and initiated identification and isolation of stem cells derived from bone cell injections. In FY08, conduct bone marrow stem cell research as a potential therapeutic intervention for laser-induced eye injury. In FY09, will investigate the gene expression profile and phenotypic nature of bone-marrow derived stem cell inventions for retinal cell trauma.	1454	1498	2362
In FY07, expanded the mathematical model for predicting performance to include individual differences between personnel. In FY08, examine individual components of the performance prediction model within a laboratory environment. In FY09, will refine the individual components to establish a more robust prediction model.	1330	1160	2876
In FY07, explored cold-temperature regulation and its impact on physical activity. In FY08, explore tissue protein analysis as a predictor of performance degradation from exposure to cold. In FY09, will develop a large animal model of classic heat stroke and examine the efficacy of a novel treatment intervention.	2422	3040	3318
In FY07, evaluated computational approaches to identify networks of specific organisms and cellular processes in support of the Army's new initiative in Network Science. This work was conducted in close coordination with researchers at the Army's University Affiliated Research Center, the Institute for Collaborative Biotechnology, at the University of California, Santa Barbara. In FY08, characterize newly discovered networks by developing new mathematical and computational methods that address identified gaps. Investigate whether protein-protein network models, developed for a particular pathogen, are portable to a different pathogen sharing a common set of proteins. In FY09, will 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	500	500	1000

external stimuli.			
Small Business Innovative Research/Small Business Technology Transfer Programs		80	
Total	5706	6278	9556

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**T22**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T22 SOIL & ROCK MECH	1769	2158	2228	2257	2274	2324	2375

A. Mission Description and Budget Item Justification: The objective of this basic research project is to correlate 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 experimental 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 Program Element 0602784A (Military Engineering Technology), Project T40, Mobility/Weapons Effects Technology, that supports the civil engineering technologies for force projection, mobility, maneuver support, and survivability of the Future Force. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (BRP). The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Military Engineering Basic Research: In FY07, determined the feasibility of biological stabilization of soil surfaces for rapid construction on these surfaces; produced techniques for optimizing hardening reactions in organic cements allowing them to become the basis for high-strength, lightweight composites; and produced a concept for low-velocity probe that could provide the capability to remotely determine soil properties. In FY08, produce simulation capabilities for a full, dynamic, micro-scale air-water-solid system and for molecular dynamics of selected carbon nanotubes. In FY09, will extract macro-scale models from the micro-scale simulation capability (air-water-solid) and produce final molecular dynamics modeling for the understanding of cement-based and ceramic materials.	1769	2143	2228
Small Business Innovative Research/Small Business Technology Transfer Programs		15	
Total	1769	2158	2228

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**T23**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T23 BASIC RES MIL CONST	1411	1638	1719	1762	1824	1885	1958

A. Mission Description and Budget Item Justification: The objective of this basic research project is to support 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 Program Element 0602784A (Military Engineering Technology), Projects T41 and T45, Military Facilities Engineering Technology and Energy Technology Applied to Military Facilities. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Facilities Research: In FY07, developed physics based constitutive equations for heat transfer of fluids containing carbon nanotubes (CNT) nanoparticles. Matured molecular level design tool for CNT reinforced composite materials. In FY08, develop robust model-based support for the "Sensing Through Walls" (STW) problem, taking into account critical high-level building design logic and constraints. Determine the complex interactions between a forest edge and an acoustic wave, including the dependence on acoustic ground impedance, microclimate, and biomass structure. Develop predictive understanding of blast wave interaction with man-made barriers. In FY09, will conduct experimentation to be used in developing next generation nanotechnology for facilities, sensor coatings, and constitutive models for micro-particle dispersion.	1411	1611	1719
Small Business Innovative Research/Small Business Technology Transfer Programs		27	
Total	1411	1638	1719

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**T24**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T24	SNOW/ICE & FROZEN SOIL	1146	1413	1456	1478	1504	1532	1574

A. Mission Description and Budget Item Justification: The objective of this basic research project is to increase knowledge in the areas of terrain state and signature physics. 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. It provides the knowledge base for understanding and assessing environmental impacts critical to battlespace awareness. 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Terrain State and Signature Physics: In FY07, investigated characteristic length scales (one to one thousand meters) of terrain response to atmosphere forcing, and related results to scale effects on electromagnetic and acoustic propagation. In FY08, investigate 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 coverage and develop theory to predict coverage given surface roughness and electrical variability. In FY09, will 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.	1146	1412	1456
Small Business Innovative Research/Small Business Technology Transfer Programs		1	
Total	1146	1413	1456

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**T25**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T25 ENVIRONMENTAL RES-COE	4417	5484	6136	6194	6335	6450	6767

A. Mission Description and Budget Item Justification: The objective of this basic research project is to investigate 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 program element (PE) 0602720A (Environmental Quality Technology), projects 048, 835, and 896, Military Environmental Restoration Technology, Industrial Operations Pollution Control Technology, Military Medical Environmental Criteria, and Base Facilities Environmental Quality. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Basic Research Plan (DBRP). The US Army Engineer Research and Development Center, headquartered in Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Environmental and Ecological Fate of Explosives, Energetics, and Other Contaminants: In FY07, matured a basic understanding of physical, chemical, and biological phenomena specific to contaminant toxicity assessment and environmental risk assessment. Conducted research to gain fundamental knowledge of ecosystem genomic and proteomic issues to understand how ecosystems form and maintain robust communication networks to ensure survival of their members. Identified DNA gene sequences involved in the anaerobic biodegradation and alterations of cell wall pass-thru proteins for use in probe biosensors for an explosive nitroamine (Cyclonite-RDX) and Perchlorate. Determined the physiological response of soil bacteria to identify protein biomarkers of Hexanitrohexaazaisowurtzitane (CL-20) exposure and metabolism. In FY08, apply computational chemistry to identify molecular structural 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). Investigate detection of biomolecule binding and cleavage events using biomolecules as switches for ultra-sensitive monitoring of MCs. Identify chemical reactions between the DNA sequence and contaminant for applications toward contaminant-unique biosensors. Integrate toxicogenomics data with biological network analysis to serve as a basis to identify mechanisms and interactive toxicity effects of MC mixtures. Improve estimates of waterborne lead absorption, distribution, and subcellular partitioning in prey invertebrates and reptiles. In FY09, will define the equilibrium expressions of major tungsten reactions under relevant geochemical conditions and elucidate tungsten toxicity mechanisms related to intracellular phosphorylation reactions.	2621	3256	2910
Remediation of Explosives, Energetics, and UXO: In FY07, matured RDX microbial and molecular interactions, regulatory genetic networks, breakdown modes and pathways, and novel signaling molecules that lead to improved capability to assess, control, design, and track progress of RDX bioremediation. Determined the physiological response of soil bacteria to identify protein biomarkers of CL-20	1283	1495	1606

exposure and metabolism. Continued to establish a basic understanding of physical, chemical, and biological phenomena specific to contaminant mineralization. In FY08, define mechanisms of high explosives movement through the unsaturated soil zone to the groundwater to support range management and remediation approaches. Investigate the application of the unique physical, chemical, and biological interactions with the environment of DoD specific nanomaterials to potentially support advanced environmental technologies. Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to contaminant mineralization. In FY09, will continue to establish a base of understanding of the physical, chemical, and biological phenomena specific to the remediation of explosives and energetics on training ranges. Will define and quantify the effect of disturbance on the sorption and transformation properties of explosives in soils. Surface and vadose zone phenomena such as the role of colloidal transport in migration of explosives will be quantified.			
Training Land Natural Resources: In FY07, defined the fundamental relationships between landscape structure - habitat feature and effects on the genetic viability of threatened and endangered bird populations. Continued to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigation, and rehabilitation. In FY08, determine 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. Continue to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigation, and rehabilitation. In FY09, will continue to establish a basic understanding of physical, chemical, and biological phenomena specific to ecosystem maintenance, mitigations, and rehabilitation. The complex interactions between forest edge and an acoustic wave, such as generated by artillery, will be described. Relevant descriptive parameters will be incorporated into appropriate computational techniques to allow visualization of noise impact on surrounding lands.	513	612	619
Network Science: In FY09, will identify and define mechanisms controlling the genetic networks associated with ovarian steroidogenesis. A model ecological system will be used to develop numerical-mechanistic descriptions of how learning and environmental heterogeneity contribute to adaptation in hunter prey relationships. The theories/algorithms of animal learning and communication on the propagation of information that affects the balance of survival of individuals in a hunter prey network will be investigated, including an assessment of hierarchical network dynamics in static versus dynamic heterogeneous environments.			1001
Small Business Innovative Research/Small Business Technology Transfer Programs		121	
Total	4417	5484	6136

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601102A - DEFENSE RESEARCH SCIENCES**	**T63**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T63	ROBOTICS AUTONOMY, MANIPULATION, & PORTABILITY RSH			1500	1250	1500	1500	2000

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 Army Modernization Strategy and the Army Science and Technology Master Plan. Work in this project is performed internally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In the area of 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 GPS denied areas, planning, behaviors, intelligent control, and the interface of perception technologies to accomplish Army missions in the area of unmanned systems. In FY09, small staring LADAR and super-resolution LADAR techniques will be developed to provide a small lightweight perception capability that is currently unavailable; hybrid-electric propulsion systems with appropriate size, weight, and logistics will be studied to provide the necessary power for high energy mobility combined with a silent-drive, silent-watch capability; autonomous processing techniques and algorithms for navigation, mapping, object recognition, and intelligent decision making will be developed to address increasingly complex dismounted scenarios; experiments utilizing advanced mechanical and biomimetic components will be conducted to mature technologies that support high ground speeds, robust maneuvering, and efficient stair and obstacle climbing capabilities.			1500

Total			1500

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601103A - University Research Initiatives**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	76331	82416	76980	76364	77832	80701	85664
D55	University Research Initiative	63548	64431	76980	76364	77832	80701	85664
D58	URI ACTIVITIES (CA)	9878	13414					
D63	INST OF BIOENGINEERING AND NANOSCIENCE IN ADV MED							
D66	MEDICAL UNIVERSITY RESEARCH INITIATIVES (CA)	2905	4571					

A. Mission Description and Budget Item Justification: This project supports 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 US 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 and D66 include funding for specific congressional interest initiatives. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work on this project is performed extramurally by the Army Research Laboratory (ARL).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601103A - University Research Initiatives**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	80841	64843	66781
Current BES/President's Budget (FY 2009)	76331	82416	76980
Total Adjustments	-4510	17573	10199
Congressional Program Reductions		-527	
Congressional Rescissions			
Congressional Increases		18100	
Reprogrammings	-2236		
SBIR/STTR Transfer	-2274		
Adjustments to Budget Years			10199

FY09 was increased to support the basic research in support of the Multidisciplinary University Research Initiative (MURI).

Nine FY08 congressional adds totaling $18100 were added to this PE.

($800) Low Temperature Vehicle Perfomance Research
($900) Imaging Research Center
($1000) Hi-tech Eyes for the Battlefield
($1200) Massively Broadband Wireless Integrated Circuits
($1600) Laboratory for Engineered Human Protection (LEAP)
($8000) University Research Initiatives Program Increase
($1000) Consortium for Bone and Tissue Repair and Regeneration
($1600) Burn and Shock Trauma Institute
($2000) Nanomedical Technologies Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601103A - University Research Initiatives**	**D55**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
D55 University Research Initiative	63548	64431	76980	76364	77832	80701	85664

A. Mission Description and Budget Item Justification: This project supports the Multidisciplinary University Research Initiative (MURI) and the Defense University Research Instrumentation Program (DURIP). The MURI program funds university basic research in a wide range of scientific and engineering disciplines pertinent to maintaining the 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. This program element also supports Presidential Early Career Awards for Scientists and Engineers (PECASE). 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 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 extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
MURI: In FY07, supported MURI awards made in prior years and made eight new awards. Topic areas for the FY07 MURI research competition were Biologically Synthesized Quantum Electronic Systems; Attosecond Subwavelength Optical Pulses; Designing and Prescribing an Efficient Natural-like Language for Bots; Ionic Liquid Containing Polymeric Materials; Self-healing Polymer Composites through Mechanochemical Transduction; Engineering of Phase Transforming Electromagnetic-Optical Materials; Robust and Resilient Tactical Mobile Ad-Hoc Network (MANET); Urban Sensor Network Structure For Data Fusion; Dynamic Modeling of 3D Urban Terrain; and Wide-band Gap Semiconductor Based Sensing for Detection and Response to Weapons of Mass Destruction Threats. In FY08 and FY09, continue to support MURI awards made in prior years and initiate new awards in research critical to the Army's future operating capabilities. Increased resources in FY09 will permit the awarding of several additional critical MURI research topics.	51287	51534	65650
PECASE: Supported PECASE investigators started in prior years. In FY07, selected two new investigators. In FY08, select two new investigators and in FY09 will select two new investigators.	958	992	998
DURIP. In FY07, under the Defense University Research Instrumentation Program (DURIP) continued acquisition of instrumentation that enhanced the current research infrastructure and provided new research capabilities to enable scientific exploration and discovery in promising areas vital to Army transformational technologies. In FY08, DURIP continues to fund competitive grants for instrumentation and in FY09 will continue to fund competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to Army transformation.	11303	10102	10332
Small Business Innovative Research/Small Business Technology Transfer Programs		1803	
Total	63548	64431	76980

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601104A - University and Industry Research Centers**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	92263	110100	105622	101814	105671	110259	117867
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	2518	2643	2732	2790	2847	2910	2974
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	7633	7122	11069	8728	9918	11545	12916
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2518	3046	4380	4617	5207	5440	5676
H50	Comms & Networks Collab Tech Alliance (CTA)	7277	6988	7198	7489	7572	7655	7812
H53	ADV DIS INTR SIM RSCH	2013	1973	3496	3500	3800	4072	5318
H54	Micro-Autonomous Systems (MAST) CTA	2915	5958	7661	8187	8205	8385	8570
H56	Adv Decision Arch Collab Tech Alliance (CTA)	5760	5515	5957	6061	6259	6413	6571
H59	UNIV CENTERS OF EXCEL	2368	2858	5219	4488	4549	5368	6502
H62	ELECTROMECH/HYPER PHYS	5949	5979	6154	6542	6672	6819	6969
H64	MATERIALS CENTER	2587	2728	2823	2884	2941	3006	3072
H65	MICROELECTRONICS CTR	871						
H73	NAT AUTO CENTER	2763	2874	2950	2982	3004	3070	3138
J08	INSTITUTE FOR CREATIVE TECHNOLOGY	7104	7436	7698	7918	8079	8259	8443
J09	POWER & ENERGY COLLABORATIVE TECH ALLIANCE (CTA)	2908						
J12	NANOTECHNOLOGY	9413	9834	10097	10432	10755	11105	11260
J13	UNIVERSITY AND INDUSTRY INITIATIVES (CA)	13655	24414					
J14	ECYBERMISSION	4820	5086	5245	5359	5466	5586	5709
J15	NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	5943	7138	7916	8278	8278	8460	8646
J16	NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	1989	2958	2995				
J17	VERTICAL LIFT RESEARCH CENTER OF		1972	2032	2077	2119	2166	2213

	EXCELLENCE							
J19	NAT'L AUTO CENTER (CA)	1259	3578					
J22	NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER			10000	9482	10000	10000	12078

A. Mission Description and Budget Item Justification: A significant portion of the work performed within this program directly supports Future Force requirements 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 has 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 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. The Advanced Sensors CTA has been renamed the Micro-autonomous Systems Technology (MAST) CTA. The work done under the Advanced Sensors CTA and the Power and Energy CTA is being combined into the MAST CTA starting in FY08. This program element (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 program element 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 electromagnetics 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

Work in this PE is managed by: the Army Research Lab (ARL); the US Army Tank-Automotive Research, Development, and Engineering Center (TARDEC); the Simulation and Training Technology Center (STTC); and the US Army Research Institute for the Behavioral and Social Sciences (ARI).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601104A - University and Industry Research Centers**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	95748	84034	87814
Current BES/President's Budget (FY 2009)	92263	110100	105622
Total Adjustments	-3485	26066	17808
Congressional Program Reductions		-2104	
Congressional Rescissions			
Congressional Increases		28170	
Reprogrammings	-796		
SBIR/STTR Transfer	-2689		
Adjustments to Budget Years			17808

FY09 was increased to support the basic research in support of the current and future forces in such areas as Robotics, Neuroscience, Network Science Technology Research Center, High Performance Computing Center and Network Science.

Nineteen FY08 congressional adds totaling $28170 were added to this PE.

($300) Transparent Nanocomposite Armor
($800) Center for Information Assurance
($800) Integrated Systems in Sensing, Imaging and Communications
($950) Florida Collaborative Development of Advanced Materials for Strategic Applications
($1000) Manufacturing and Industrial Technology Center
($1000) Modeling and Analysis of the Response of Structures
($1000) Research Support for Nanoscale Sciences and Technologies
($1120) Visualization for Training and Simulation in Urban Terrains
($1200) Detecting and Eradicating Corrosian in Army Vehicles
($1500) Electron Microprobe Research
($1600) Center of Excellence In Industrial Metrology & 3D Imaging Research
($1600) Development of Enabling Chemical Technologies for Power from Green Sources
($1600) National Network Security Test Bed
($2400) Infotonics Research
($2400) MEMS Antenna for Wireless Comms/UAVs
($2500) Nanoscale Biosensor Research
($2800) Nanotubes Optimized for Lightweight Exceptional Strength Composite Materials
($1600) NAC University Automotive Research Coalitions

($2000) University-based Automotive Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H04**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H04	HBCU/MI CENTERS - TRADOC BATTLELABS	2518	2643	2732	2790	2847	2910	2974

A. Mission Description and Budget Item Justification: 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. The objective is to transition advances resulting from basic research to technology demonstration as rapidly as possible. 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 Program Element 0601104A, Project H59 and is a restructuring of ongoing research into a distinct project for visibility and 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 on this project is performed extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
The HBCU/MI Centers of Excellence for Battlefield Capability Enhancements are: Tuskegee University, research on flexible extremities protection; NCA&T State University, research on flexible displays and predictive modeling of group situational awareness; Tennessee State University, research on sensor fusion; and Prairie View A&M University, research on Beyond-Line-of-Sight Lethality. Collaborations with TRADOC Battle Labs will help accelerate technology transitions to the battlefield. In FY07, devised improved stab resistance using new fabric designs; refined computer-based experimental sense-making model test beds; continued investigation of semiconductor materials growth on flexible substrates; devised multi-modal model sensor networks; devised simulation test bed to determine network performance. In FY08, refine fabric designs with new testing strategies; validate sense-making models with test command groups; characterize semiconductor materials on flexible substrates for optical properties; show use of multi-modal sensor network in urban terrain; refine wireless network protocols using simulation test bed. In FY09, will devise enhanced protection capability of final fabric designs; will deliver deployable decision support programs for test command groups; will design and fabricate hybrid semiconductor devices on flexible substrates and evaluate environmental stability; will show full data-fusion for large-scale sensor networks; will show protocols for wireless sensor network.	2518	2569	2732
Small Business Innovative Research/Small Business Technology Transfer Programs		74	
Total	2518	2643	2732

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H05**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H05	INSTITUTE FOR COLLABORATIVE BIOTECHNOLOGIES	7633	7122	11069	8728	9918	11545	12916

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 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Institute for Collaborative Biotechnologies In FY07, provided foundation for incorporation of deterministic and stochastic dynamic models from biological systems, improving engineered Army network robustness; used the power and selectivity of biomolecular recognition and accelerated genetic selection and rapid evolution for elaboration of growth-directing peptides for specific crystalline semiconductor materials and electrode bridges with potential for electronic device application; enabled controlled surface functionalization and ligand display on, and integration into, materials for application in sensors, multi-functional materials, and device assembly; and devised genetically engineered microbial systems that efficiently incorporated unnatural amino acids into proteins for unique materials for the Army. In FY08, establish biologically based development path toward flexible high-efficiency batteries and new high-efficiency solar energy materials; provide a means to greatly enhance sensitivity in detection of viral pathogens; and enable electronic detection of DNA. In FY09, will define a biocatalytically derived route to low-cost fuel and fuel-cell feedstock using microbes to produce fuels directly from biomass including novel cellulase 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 micro-fluidic channel biomolecular sensors; investigate bio-templated ultra-lightweight batteries for micro unmanned air vehicles.	7633	6923	7969
Neuroscience. In FY09, will perform research in 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. Will investigate the use of other potential brain			3100

imaging techniques such as positron emission tomography (PET) and magnetoencephalography (MEG) and to enhance understanding of brain function. Will study and categorize individual differences in cognitive strategy. Will research methods within neuroscience to provide optimal control for human/machine interfaces.			
Small Business Innovative Research/Small Business Technology Transfer Programs		199	
Total	7633	7122	11069

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H09**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H09	ROBOTICS COLLABORATIVE TECH ALLIANCE (CTA)	2518	3046	4380	4617	5207	5440	5676

A. Mission Description and Budget Item Justification: This project supports a collaborative effort between the competitively selected industry/university consortium, the Robotics Collaborative Technology Alliance (CTA), and the Army Research Laboratory 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 maturation 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 maturation 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 experimental studies. Research products will be transitioned to the companion applied technology program, program element 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Explore new opportunities to enable 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 FY07, extended perception research to explore algorithms that were specialized for application to urban environments and incorporated contextual information into planning processes to create a more natural (human-like) response to dynamic changes in the tactical environment. In FY08, explore methodologies to permit unmanned systems to perform as co-combatants, examining approaches for real-time evaluation of multiple possible adversarial responses, each possessing differing levels of likelihood based upon considerations such as terrain, and a dynamic tactical environment that also includes friendly and non-combatant forces; expand the range of perception algorithms available for classification of structures found in the urban environment and explore methods to fuse detections from individual sensor modalities and/or algorithmic approaches. In FY09, will focus upon 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: explore approaches for autonomous activity recognition; evaluate the performance of both perception, and behavior algorithms in varied tactical environments. Will conduct research to explore human robot interaction, dynamic scene understanding and contextual situational awareness.	2518	2961	4380
Small Business Innovative Research/Small Business Technology Transfer Programs		85	
Total	2518	3046	4380

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H50**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H50	Comms & Networks Collab Tech Alliance (CTA)	7277	6988	7198	7489	7572	7655	7812

A. Mission Description and Budget Item Justification: This project supports a competitively selected university/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 program element (PE) 0602783A (Computer and Software Technology). The results of this work will significantly affect Future Force communications/networking formulation efforts. This program will be re-focused 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. When the International Technology Alliance on Network and Information Sciences (PE/project 0601104A/J15) was established in 2006, joint planning of the research programs will prevent redundancies and leverage accomplishments from both programs. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Department of Defense Basic Research Plan (BRP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Survivable Wireless Mobile Networks: Perform 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 FY07, conducted analytical and experimental studies validating dynamic and survivable resource control to enable mobile networks to predictably exploit distributed network infrastructures. Devised and validated adaptive distributed control of physical, medium-access, and network layers based on statistical inferencing to adapt communications parameters for improved performance. In FY08, devise formal models, abstractions, metrics, and validation techniques for understanding the behavior of large scale military mobile ad hoc networks. Design 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. In FY09, will design networking techniques for sensing the networking operating environment, identifying the best networking functional components, and dynamically composing protocols for superior performance.	2812	2631	2804
Signal Processing for Communication-on-the-Move: Perform research in signal processing techniques to enable reliable low-power multimedia communications among highly mobile users under adverse wireless conditions. In FY07, conducted analytical and experimental studies of signal processing aided medium access control algorithms that improved communications performance while on-the-move. In FY08, design and validate multi-input multi-output multi-carrier waveforms that exploit non-contiguous spectrum during mobile operations. In FY09, will design optimal channel-adaptive distributed multiple access techniques to provide high capacity, interference-robust, multiple access networks for communications-on-the-move.	1701	1524	1651

Secure Jam-Resistant Communication: Perform research in secure, jam-resistant, multi-user communications effective in noisy/cluttered and hostile wireless environments enabling low probability of detection/intercept. In FY07, devised and studied sensor array processing and interference techniques that enabled adaptive antennas for improved interference rejection and spectrum reuse. In FY08, devise low power adaptive medium access control algorithms that are energy-efficient and support duty-cycling to extend the life of sensor networks. In FY09, will design signal separation techniques to mitigate packet collisions and improve signal detection for improved network performance.	1241	1085	1054
Tactical Information Protection: Perform research in scalable, efficient, adaptive, and secure information protection for very resource-constrained and highly mobile ad hoc networks. In FY07, devised and studied security schemes for distributed servers supporting dynamic network infrastructures. Designed energy-efficient and low-latency key management and trust algorithms to enable flexibility in group access control without reliance on strategic security services. In FY08, design and evaluate formal-methods-based protocol specification intrusion detection techniques on mobile ad hoc networking protocols. In FY09, will design resilient clustering algorithms to provide a dynamic detection hierarchy to support detection and localization of attackers under mobile conditions.	1523	1552	1689
Small Business Innovative Research/Small Business Technology Transfer Programs		196	
Total	7277	6988	7198

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H53**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H53 ADV DIS INTR SIM RSCH	2013	1973	3496	3500	3800	4072	5318

A. Mission Description and Budget Item Justification: This project supports Army 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/biological agents, and associated enabling technologies requiring computationally intensive algorithms in the areas of combat systems survivability, battlefield network sciences, chemical/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 program element 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 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Research at the Army High Performance Computing Research Center (AHPCRC). In FY07, developed a computational framework for modeling the dispersion of contaminated agents in turbulent air flow that enables the prediction of the dispersion of aerosolized biological warfare agents during various indoor or outdoor attack scenarios; explored and developed robust wireless communications links in complex environments with possibly hostile jamming while keeping low power at terminals; developed fast and scalable parallel iterative solvers for large-scale electromagnetic problems and their application to the innovative design and optimization through simulations of antenna systems with millions of components In FY08, explore new interdisciplinary methods to evaluate lightweight fabric structure systems, Develop the Flexible Architecture Research Machine to accelerate architecture and algorithmic research on novel parallel models and facilitate experiments on heterogeneous systems that combine central processing units (CPU), graphical processing units (GPU), and field programmable gate arrays (FPGA); investigate and plan new computational approaches to analyze very large-scale networks for battlefield applications . In FY09, will implement interdisciplinary methods to evaluate lightweight fabric structure systems, will implement and test the Flexible Architecture Research Machine to accelerate architecture and algorithmic research on novel parallel models and facilitate experiments on heterogeneous systems that combine CPUs, GPUs, and FPGAs; implement computational approaches to analyze very large-scale networks for battlefield applications; will explore new multi-scale computational approaches for assisting micro-systems design, will develop advanced simulations to develop new materials for military vehicles and equipment, improve wireless battlefield communication, advance detection of biological or chemical attacks and stimulate innovations in supercomputing itself.	1644	1918	3496
Perform research that 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 FY07, investigated coupling of tracking and trajectory prediction algorithms with dynamic planning algorithms.	369		

Small Business Innovative Research/Small Business Technology Transfer Programs		55	
Total	2013	1973	3496

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H54**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H54	Micro-Autonomous Systems (MAST) CTA	2915	5958	7661	8187	8205	8385	8570

A. Mission Description and Budget Item Justification: This project supports two competitively selected industry/university consortia, the Advanced Sensor Collaborative Technology Alliance (CTA) and the Micro Autonomous Systems and Technology (MAST) CTA, that leverage world-class commercial research necessary to address Future Force and Army Transformation needs. The CTAs link a broad range of government technology agencies, as well as industrial and academic partners with the Army Research Lab (ARL). The Advanced Sensors CTA is focused on innovative research in three main technical areas: micro-sensors, electro-optic smart sensors, and advanced radar concepts. Payoff to the warfighter will be advanced sensing technologies to support Future Force requirements. Technical areas addressed under this project include overcoming technical barriers associated with: autonomous calibration and management of micro-sensor networks; multi-domain smart sensors (including multi-spectral infrared focal plane arrays); a novel concept for laser radar (LADAR); multifunctional radar sensors; and sensor modeling and algorithms for automatic target recognition (ATR) through fusion of data from multiple sensors and signal processing. Work in the Advanced Sensors CTA accelerates the transition of technology to program element (PE) 0602120A (Sensors and Electronic Survivability). The MAST CTA will focus 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. Both CTAs facilitate the exchange of people among the collaborating organizations to provide cross-organizational perspectives on basic research challenges, as well as to use state-of-the-art facilities and equipment at the participating organizations. In FY08, this project (Advanced Sensors CTA) transitions to Micro Autonomous Systems and Technologies CTA and is restructured to include FY08 and FY09 funding from project J09 of this program element.The cited works are consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Department of Defense Basic Research Plan (BRP).

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
The MAST CTA will focus on innovative research related to the coherent and collaborative operation of multiple micro autonomous platforms to enhance situational awareness. In mid-FY08, the MAST CTA begins operation and is investigating platform stability and control in high-disturbance environments; bio-inspired, bio-mimetic leg, and wing concepts with integrated sensors and actuators; autonomous and semi-autonomous navigation and control over a network; group cooperative behavior and planning efficient sensing; and information extraction and utilization. Investigations may include vortex-dominated unsteady aerodynamics of flapping wings at low Reynolds numbers, high-force high-bandwidth large-displacement linear actuators, and autonomous and semi-autonomous navigation and control over a network. In FY09, the first full year of operation, the MAST will mature investigate constrained information management within a node; distributed signal processing, including low complexity techniques for distributed multi-modal sensing and fusion, dynamic collaborative processing accounting for sporadic sensing and sensor management, lightweight robust and possibly asymmetric networking; integrated cross-layer communications and network design, architecture analysis to understand fundamental limits, system modeling and simulation, and design tools capable of balancing and optimizing trade-offs in a microsystem architecture, technologies required for the coherent and collaborative operation of multiple micro autonomous platforms, technologies required for the coherent and	2915		

collaborative operation of multiple micro autonomous platforms. Investigations include communications and networking, synthesis, and development of three-dimensional materials and circuit architectures, development of smart multifunctional structures, and materials, low power devices, hybrid power systems and power management, microsystems architectures modeling and simulation, and functional packaging.			
The MAST CTA will focus on innovative research related to the coherent and collaborative operation of multiple micro autonomous platforms to enhance situational awareness. In mid-FY08, the MAST CTA is investigating platform stability and control in high-disturbance environments; bio-inspired, bio-mimetic leg, and wing concepts with integrated sensors and actuators; autonomous and semi-autonomous navigation and control over a network; group cooperative behavior and planning; efficient sensing and information extraction and utilization; constrained information management within a node; distributed signal processing, including low complexity techniques for distributed multi-modal sensing and fusion, dynamic collaborative processing accounting for sporadic sensing and sensor management, lightweight robust and possibly asymmetric networking, integrated cross-layer communications and network design, architecture analysis to understand fundamental limits, system modeling and simulation, and design tools capable of balancing and optimizing trade-offs in a microsystem architecture, technologies required for the coherent and collaborative operation of multiple micro autonomous platforms. Investigations may include vortex-dominated unsteady aerodynamics of flapping wings at low Reynolds numbers, high-force high-bandwidth large-displacement linear actuators, and autonomous and semi-autonomous navigation and control over a network. In FY09, will mature technologies required for the coherent and collaborative operation of multiple micro autonomous platforms. Investigations may include communications and networking, synthesis, and development of three-dimensional materials and circuit architectures, development of smart multifunctional structures, and materials, low power devices, hybrid power systems and power management, microsystems architectures modeling and simulation, and functional packaging.		5791	7661
Small Business Innovative Research/Small Business Technology Transfer Programs		167	
Total	2915	5958	7661

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H56**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H56	Adv Decision Arch Collab Tech Alliance (CTA)	5760	5515	5957	6061	6259	6413	6571

A. Mission Description and Budget Item Justification: This project supports a competitively selected industry/university consortium, the Advanced Decision Architecture Collaborative Technology Alliance (CTA), for the purpose of leveraging world-class commercial research in support of the Future Force and Army transformation needs. The Future Force will require state-of-the-art user-centered decision support technologies to include user-interface concepts, design practices, and principles. These technologies will provide for real-time situational awareness, distributed commander-staff-subordinate collaboration and planning, and execution monitoring in high-tempo, high-stress battlefield environments at speeds that permit the commander and his staff to operate 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 situational awareness, 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. The CTA also 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 advanced decision architecture technology to program element (PE) 0602716A (Human Factors Engineering Technology) and PE 0602783A (Computer and Software Technology). 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) to establish collaborative and synergistic research programs. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Department of Defense Basic Research Plan (BRP). Work in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Modeling and measurements of cognitive processes of Army commanders and staffs (decision makers): In FY07, validated decision architecture for information fusion, which used diagrammatic reasoning as an aid to evaluate the commander's preferred course of action. In FY08, extend and improve a system for the automatic generation of Cognitive Models of Situation Awareness (CMSA). In FY09, will 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 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.	1400	1320	1400
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 FY07, completed prototype decision-making architecture for collaboration and visualization test bed. In FY08, provide tools and techniques to foster better adaptive learning, expert decision-making, and teamwork. In FY09, will 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.	1392	1208	1343

User-adaptive interfaces: Explore ideas, frameworks, and technologies that assist the Soldier in understanding, problem solving, planning, and decision-making. In FY07, integrated capability for multinational, multilingual communication in stability and support test bed. In FY08, investigate interface technologies to fuse and visualize sensed information (persistent surveillance) as relevant tactical events to improve Commander's real time situational awareness. In FY09, will validate functional model of the capabilities of new sensor/network technologies as they could contribute to perceptual awareness including concepts such as trust.	1684	1618	1902
Auto-adaptive information presentation: Investigate how to make autonomous machines team players with their human partners or supervisors in warfighting operations. In FY07, extended software agent systems to provide an agile computing infrastructure for brigade combat teams. In FY08, experimentally test 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, will 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.	1284	1214	1312
Small Business Innovative Research/Small Business Technology Transfer Programs		155	
Total	5760	5515	5957

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H59**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H59 UNIV CENTERS OF EXCEL	2368	2858	5219	4488	4549	5368	6502

A. Mission Description and Budget Item Justification: Army Centers of Excellence (COE) 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. The Rotorcraft Center of Excellence is the only program funded in this project in FY06 and FY07. This COE supports Army Transformation by providing research into technologies that can improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. Beginning in FY08, the Rotorcraft COE will transition to the Vertical Lift Research Center of Excellence under program element (PE) 0601104A, project J17. Also beginning in FY08, this project will fund the International Technology Centers (ITCs) and the Foreign Technology (and Science) Assessment Support (FTAS) program. 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. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Department of Defense Basic Research Plan (BRP).

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
International Technology Centers (ITC)/Foreign Technology (and Science) Assessment Support (FTAS): In FYs 08 and 09, the ITCs will complete the development of their international technology search process by utilizing technology roadmaps provided by the Research, Development, and Engineer Command's (REDCOM) technology Integrate Process Teams (IPTs) to focus on critical technology capability gaps. The ITCs will further refine their country-specific technology search strategies based upon the analysis of foreign Science and Technology (S&T) investment patterns in areas of technology relevant to the US Army. Technology search efforts will then focus on those countries and in those areas of technology having the greatest potential benefit to the US Army. In FYs 08 and 09, FTAS will evaluate progress on the initial program investments from FYs 06 and 07, and solicit new technology proposals for review and selection. The program will solicit technology projects focusing on the maturation of counter terrorism technologies, providing enhanced force protection, enhanced medical life saving projects and providing enhanced Soldier capabilities. A review of the lessons learned from the initial round of FTAS investments, including the selection and review process, will be utilized to improve the program. Prior to FY08, the ITC and FTAS efforts were funded in PE 0601102A, project H57.		2778	5219

Vertical Lift Research Center of Excellence (VLRCOE): In FY07, the VLRCOE developed structures and materials concepts for lightweight composite rotor blades; investigated next generation carbon-nanotube/carbon-fiber composites for mechanical properties enhancement and real-time structural health monitoring; studied, experimentally and analytically, aerodynamic characteristics of active flaps and microflaps for reducing rotor vibration, power, and noise; and developed performance improvements in ducted-fan systems for vertical lift systems and unmanned air vehicle (UAVs). For FYs 08-09, this effort will be restructured into PE 0601104A, project J17 for added focus and management oversight.	2368		
Small Business Innovative Research/Small Business Technology Transfer Programs		80	
Total	2368	2858	5219

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H62**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H62 ELECTROMECH/HYPER PHYS	5949	5979	6154	6542	6672	6819	6969

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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Pulsed Power: In FY07, modeled electromagnetic, mechanical, and thermal properties of candidate EM pulsed power systems and defined techniques to increase their efficiency. In FY08, model and experimentally validate prototype alternate pulsed power systems. In FY09, will provide technology for large-scale solid state converters.	2379	2494	2650
Launch: In FY07, showed long-life, multi-shot EM launcher operation. In FY08, examine advanced materials for launcher components. In FY09, will examine thermal management of EM launchers.	1587	1518	1700
Electromagnetic Lethality: In FY07, established bounds on launch package parasitic mass; designed, fabricated, and tested full scale in-flight deployment mechanisms for second generation novel kinetic energy penetrators. In FY08, measure material properties under short duration electrodynamic and structural loads; examine the target interaction physics of reactive material during hypervelocity impact. In FY09, will complete and validate numerical model of armature physics including gouging and transition; will examine coupled high density/reactive materials during target interaction at hypervelocity.	1983	1800	1804
Small Business Innovative Research/Small Business Technology Transfer Programs		167	
Total	5949	5979	6154

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H64**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H64 MATERIALS CENTER	2587	2728	2823	2884	2941	3006	3072

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 Tech. 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 (program element (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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, devised appropriate physics based models describing the attributes of multifunctional materials; determined the fundamental response of protective polymer based materials; devised new inorganic materials that incorporated microstructures designed for specific armor related properties. In FY08, validate models for multifunctional composite attributes and show multifunctional capabilities in single composite material; devise schemes for synthesis of protective polymers with enhanced energy absorption; identify key materials parameters for the improved performance of metal matrix nanocomposite materials. In FY09, will 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.	2587	2652	2823
Small Business Innovative Research		76	
Total	2587	2728	2823

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**H73**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H73 NAT AUTO CENTER	2763	2874	2950	2982	3004	3070	3138

A. Mission Description and Budget Item Justification: The Center of Excellence for Automotive Research is a key element 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 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 goal of this project is to significantly enhance the Army's transformation to the Future Force by the application of novel, high payoff technologies that can be integrated into Army ground platforms as cost and schedule appropriate. 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 program element (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, the Army Science and Technology Master Plan, and the (DoD) Basic Research Plan (BRP). Work in this project is performed by TARDEC, Warren, MI.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Automotive Research Center (ARC): In FY07, evaluated and analyzed models suitable for ground vehicle design decisions relative to vehicle reliability, reliability based design optimization, high mobility and fuel economy, high power density propulsion, thermal management and parasitic losses, advanced control, robust modeling, and validation of vehicle systems. In FY08, refine and optimize computational models for ground vehicle characteristics including: fuel economy, acceleration, survivability, reliability, and cost effectiveness. Also in FY08, perform unique advanced experimental validation of optimized models to assure proper predictions relative to actual real-world conditions. In FY09, will extend the applicability of the advanced automotive models to future Army ground vehicle requirements that address vehicles exposed to elevated temperatures, increased terrain severity, and other extreme environmental and operational conditions that occur in deployment areas that vehicles must be designed to for achieving performance and protection requirements. In addition, FY09 reseacrh will extended new experimental model validations of these broadened areas of Army ground vehicle automotive models, using advanced instrumentation and efficient state-of-the-art data analysis procedures.	2763	2797	2950
Small Business Innovative Research/Small Business Technology Transfer Programs		77	
Total	2763	2874	2950

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J08**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J08 INSTITUTE FOR CREATIVE TECHNOLOGY	7104	7436	7698	7918	8079	8259	8443

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 R&D 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, investigated the timing, synchronization, and rendering techniques for augmenting the test beds with holographic imagery. In FY08, create custom, multi-view, holographic display solutions for visualizing command data sets. In FY09, will investigate use of Organic Light Emitting Diodes, nano-technologies, and programmable matter (the creation of rudimentary elements which can be programmed into software for simulation components and innovative visual displays) in mixed reality immersive environments.	2743	2784	2966
Conduct basic research in two significant aspects of immersive environments - 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 FY07, investigated the concept of generalized reciprocity as it relates to how objects transform incident illumination into reflected light. Examined perceptual cues needed to produce 3D audio via hybrid headphone-loudspeaker techniques. Extended harmonic warping of ambient sounds to use beat tracking techniques to ensure smooth transitions of effects. In FY08, implement hybrid 3D audio system to create perception of auditory depth in mixed reality environments. Develop 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, will explore concepts for facial and body animation controlled by avatars in real time and investigate methods for development of virtual speakers in immersive environments.	1579	1618	1722

Techniques and human - virtual human interaction: In FY07, explored and conducted research on intelligent avatars for virtual environments to enhance realism of interactions with trainee(s) and increase training effectiveness. In FY08, investigate techniques for appropriate modeling and social schema for avatar based crowd behaviors. In FY09, will 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.	2782	2826	3010
Small Business Innovative Research/Small Business Technology Transfer Programs		208	
Total	7104	7436	7698

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J12**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J12 NANOTECHNOLOGY	9413	9834	10097	10432	10755	11105	11260

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 several major industrial partners including Raytheon and DuPont, the Army Research Laboratory (ARL), the Army's Natick Soldier Center (NSC), and other Army Research Development and Engineering Command (RDECOM) centers in pursuit of its goals. The institute is designated as a University Affiliated Research Center (UARC) to support the Army Future Force Warfighter through 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).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Conduct research in light-weight, multifunctional nanostructured fibers and materials. In FY07, conducted limited fabrication of 2-D and 3-D polymeric structures that had complete band gaps for electromagnetic radiation and elastic waves; assessed the light and sound scattering properties of these materials. Used initiated chemical vapor deposition (iCVD) to impart novel properties to limited numbers of various substrates of interest for electromagnetic interference shielding and destruction of toxic substances. In FY08, devise a theory of a new type of "lasing" based on stimulated emission of hypersound in dual band gap (sound and light) composite polymeric structures; identify optimized structures for photon (light) flow control, and measure sound propagation in select materials. In FY09, will 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. Will devise mechanically robust iCVD coatings fully compatible with electro-spun mats that provide high surface area and a diversity of substrate materials.	1939	2378	2565
Conduct research in Battle Suit Medicine and Blast and Ballistic Protection. In FY07, conducted initial synthesis of families of flexible backbone/pendant group polymers showing promise for high absorption of mechanical energy. In FY08, conduct low rate mechanical testing of mechanical energy absorption for promising polymers. In FY09, will explore relation of molecular structural features to resultant toughness including high strain rate testing.	3822	4865	4966
Conduct research on Soldier Survivability and Protection and Nanosystems Integration. In FY07, conducted initial synthesis and testing of polymers and components for transistors. In FY08, investigate nanoengineered electronic devices for sensing. In FY09, will explore	3652	2316	2566

chemical sensing based upon nanoelectronic building blocks.			
Small Business Innovative Research/Small Business Technology Transfer Programs		275	
Total	9413	9834	10097

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J14**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J14 ECYBERMISSION	4820	5086	5245	5359	5466	5586	5709

A. Mission Description and Budget Item Justification: This project supports eCYBERMISSION, a web-based science, math, and technology competition designed to stimulate interest and encourage advanced education in these areas among middle and high school students nationwide. The project supports Army Transformation through the sponsorship of a nation-wide, educational competition that encourages the nation's youth to pursue advanced education and careers in science, mathematics, and engineering, thereby providing a pool of technologically literate citizenry that potentially grow to become future soldiers and civilians for the Army workforce of tomorrow. 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 supports the President's initiative for education.

Work in this project is performed extramurally by the U. S. Army Research, Development and Engineering Command (RDECOM). Note: This project was previously funded in PE 0601104A Project H59 and was moved to Project J14 for increased visibility and management oversight.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
eCYBERMISSION is a national competition to stimulate interest in science, math and technology in middle and high school students. In FY07, completed a full-scale competition to all middle school (grades 6-8) and 9th grade high school students across the country and Department of Defense Educational Activity (DoDEA) schools. Increased student and teacher participation. In FY08 and FY09, sustain eCYBERMISSION and implement enhancements as necessary based on lessons learned from previous years. Will continue to seek to increase team participation.	4820	4944	5245
Small Business Innovative Research/Small Business Technology Transfer Programs		142	
Total	4820	5086	5245

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J15**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J15	NETWEORK SCIENCES INTERNATIONAL TECHNOLOGY ALLIANC	5943	7138	7916	8278	8278	8460	8646

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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Perform fundamental network and information science research for US/UK coalition operations. In FY07, designed and validated interoperability models for disparate networks using cross-layer adaptation methodologies for distributed resource allocation to optimize application specific metrics. Investigated efficient and adaptive security algorithms to enable formation and operation of secure, flexible coalition operation communities-of-interest. Established initial ontologies for coalition structures and cultural models of planning. In FY08, investigate mathematical frameworks to model the structure and 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. Design protocols for automated policy negotiations and tools for refining high-level user-specified goals into low-level setting of components in coalition environments. Devise and validate analytical networked fusion architectures based on semantic information. In FY09, will investigate models, theory, and algorithms for creating self-organizing wireless networks inspired by highly adaptive biological systems. Will investigate cognitive and socio-cultural factors on coalition command processes and coalition networks to enhance situational awareness and decision-making. Will establish and validate analytic frameworks, leading to tradeoffs between sensing, computing, communications, and actuation, for classes of wireless sensor networks.	5943	6939	7916
Small Business Innovative Research/Small Business Technology Transfer Programs		199	
Total	5943	7138	7916

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J16**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J16	NANOTECHNOLOGY AND MICROELECTRONICS INSTITUTE	1989	2958	2995				

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 then 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, researched enhanced materials for thermal management through tailoring the thermal conductivity of materials, fluids and reducing interface resistance; researched low power nano-electronics; researched nanotechnology-enhanced transparent electronic materials that may augment portable and flexible display technology; researched advanced nanotechnology-enhanced cooling including thermoelectric coolers and adsorption/desorption cooling. In FY08, research specialized thermal management techniques to provide improved cooling of army systems through the fabrication of materials with superior thermal conductivity and functionalized thermal interfaces to enhance heat transfer; research novel nano-technology based sensors and electronics devices, including potentially lower power systems; study nanotechnology-enhanced transparent electronic materials that may improve portable and flexible display technology; investigate 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	1989	2875	2995

superior electrical capabilities; will research advanced nanotechnology-enhanced cooling techniques including thermoelectric and adsorption/desorption cooling.			
Small Business Innovative Research/Small Business Technology Transfer Programs		83	
Total	1989	2958	2995

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J17**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J17	VERTICAL LIFT RESEARCH CENTER OF EXCELLENCE		1972	2032	2077	2119	2166	2213

A. Mission Description and Budget Item Justification: Vertical Lift Research Center of Excellence couples 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 support Army Transformation by providing 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 Army Research Laboratory (ARL) and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Vertical Lift Research Center of Excellence: In FY08, investigate interactional aerodynamics for noise prediction of heavy lift rotorcraft configurations, investigate anti-icing and erosion protection systems for rotor blades, investigate high-lift airfoil concepts for delaying dynamic stall onset and reducing adverse pitching moments; and develop data fusion and biomimetic materials for rotorcraft health monitoring systems. In FY09, will develop light-weight high-flexibility rotorcraft shafts using flexible matrix composites and active bearing controls; and will develop efficient and affordable joining concepts for high-stiffness, light-weight composites.		1917	2032
Small Business Innovative Research/Small Business Technology Transfer Programs		55	
Total		1972	2032

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601104A - University and Industry Research Centers**	**J22**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J22	NETWORK SCIENCE AND TECHNOLOGY RESEARCH CENTER			10000	9482	10000	10000	12078

A. Mission Description and Budget Item Justification: This project funds the establishment of the Network Science and Technology Research Center (NSTRC) to be located at the U.S. Army Aberdeen Proving Ground (APG), Maryland. The NSTRC will be managed through the Army Research Laboratory as an annex to the Institute of Collaborative Biotechnologies (ICB). In this way the Army can leverage its investment in the ICB and three universities along with resources at ARL_s APG location and Communications-Electronics Command assets. 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 experimentation 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 required a phased approach to develop the required infrastructure, which must be cable 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. 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 both internally and extramurally by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
The magnitude and diversity of the required infrastructure to establish the Network Science and Technology Research Center will require a phased implementation approach over multiple years. The extensive infrastructure needed to support this center will be developed initially in FY09 from existing facilities and will require special planning efforts to synchronize with 2005 Base Realignment and Closure (BRAC) relocations already in progress. Facility plans for required infrastructure will be developed to provide for (1) flexible configurations of network experiments and integration, both internally and externally; (2) facility designs that enhance and encourage academic and industry partnerships; and (3) an environment with world class experimental capabilities and a campus-like atmosphere to			10000

attract truly talented personnel.			
Total			10000

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602105A - MATERIALS TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	62254	64517	26985	28384	28658	26079	25552
H7B	Advanced Materials Initiatives (CA)	40625	46026					
H7G	NANOMATERIALS APPLIED RESEARCH	5013	4873	5010	5177	5289	5367	5499
H84	MATERIALS	16616	13618	21975	23207	23369	20712	20053

A. Mission Description and Budget Item Justification: This program element (PE) funds research and evaluation of materials technologies for armor and armaments that will significantly enhance the survivability and lethality of Future Force systems and where feasible, can be exploited to enhance the Current Force. This PE builds on the materials research transitioned from PE 0601102 (Defense Research Sciences) H42 (Materials and Mechanics) project and applies it to specific Army platforms and the individual Soldier. Project H84 is directed toward developing materials technology that contributes to making heavy forces lighter and more deployable and light forces more lethal and survivable. Project H84 provides the technology base required for solving materials-related problems in individual Soldier support equipment, armor (Soldier/vehicle), armaments, aircraft, ground and combat vehicles, and combat support. Project H7G funds the collaborative research efforts in nanomaterials technology between the Army Research Laboratory and the Institute for Soldier Nanotechnologies (ISN) at the Massachusetts Institute of Technology and the ISN industry partners. The effort is focused specifically on the improvement in individual Soldier protection. Work in this PE is related to and fully coordinated with efforts in PE 0602618 (Ballistics Technology), PE 0602601 (Combat Vehicle and Automotive Technology), PE 0602782 (Command, Control, Communications Technology), PE 0602786 (Warfighter Technology), PE 0603001 (Warfighter Advanced Technology), PE 0603004 (Weapons and Munitions Advanced Technology), PE 0603005 (Combat Vehicle Advanced Technology), PE 0603008 (Command, Control, Communications Advanced Technology), and PE 0708045 (Manufacturing Technology).

Work in this project is performed by the Army Research laboratory and is intended to transition materials technologies and support the Army materiel efforts at the Armaments Research, Development, and Engineering Center, Picatinny Arsenal, NJ; the Tank and Automotive Research, Development, and Engineering Center, Warren, MI; the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL; the Natick Soldier Research, Development, and Engineering Center, Natick, MA; the Edgewood Chemical and Biological Center, Edgewood, MD; and the Communications and Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

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. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	60102	18614	19029
Current BES/President's Budget (FY 2009)	62254	64517	26985
Total Adjustments	2152	45903	7956
Congressional Program Reductions		-427	
Congressional Rescissions			
Congressional Increases		46330	
Reprogrammings	3454		
SBIR/STTR Transfer	-1302		
Adjustments to Budget Years			7956

FY09 was increased for research of composite ceramic materials for body armor as well as reactive and electromagnetic vehicle armor technologies.

Twenty-four FY08 congressional adds totaling $46330 were added to this PE.

($400) Control System-for Laser Powder Deposition
($400) Improvised Explosive Device Simulation In Different Solis
($480) Novel Extremity Body Armor
($800) Advanced Lightweight Transparent Armor for Tactical Wheeled Vehicles and Force Protection
($1000) Cold Spray Wear Coating for FCS
($1200) Cutting Tools for Aerospace Materials
($1200) Project Kryptolite
($1350) Titanium Fabrication for Military/Industrial Equipment
($1500) Multi-scale Modeling of Impact Resistant Materials for Body Armor
($1600) Enhanced Holographic Imaging Program
($1600) Lightweight Motors for the Future Combat System
($1600) Nanomanufacturing of Multifunctional Sensors
($1600) Ultra Lightweight Metallic Armor
($2000) 3D Woven Ballistic Materials for Future Combat Systems
($2000) Advanced Materials Development and Manufacturing of Body Armor
($2000) Complex-shaped Armor for Soldier Torso and Extremity Protection
($2000) Next Generation Lightweight Electric Drive Systems for Army Weapons
($2000) Polymer Center of Excellence for Blast-Ballistic Protective Armor
($2400) Advanced Ceramic Surface Engineering for Helicopter Compressor Blades

($2400) Nickel Boron Coating-Technology for Army Weapons
($2400) Ultra-Endurance Coating
($4000) Nanotechnologies Initiative
($4000) Protection Against Improvised Explosive Devices
($6400) Future Affordable Multi-Utility Materials for the Army Future Combat Systems

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602105A - MATERIALS TECHNOLOGY**	**H7G**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H7G	NANOMATERIALS APPLIED RESEARCH	5013	4873	5010	5177	5289	5367	5499

A. Mission Description and Budget Item Justification: This project funds the integration of government and industry scientific capabilities on research to advance innovative nanomaterials technologies and exploit breakthroughs in nanomaterials basic research toward improving future Soldier program's survivability, lethality, and sustainability. This project funds collaborative research in nanomaterials technology between the Army Research Laboratory (ARL), the Institute for Soldier Nanotechnologies (ISN), at the Massachusetts Institute of Technology, and the ISN industry partners. The research is focused on nanomaterials and includes the development of models to facilitate the exploration of concepts for improving individual Soldier protection. Nanomaterial research holds promise in providing the capability to tailor the mechanical and thermal response of materials to enable desired performance improvements specific to the application of interest.

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

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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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. In FY07, matured multi-functional materials concepts to include addressing scalable processing and fabrication methods; improved nanomaterials ingredients for sensor applications; and quantified performance of nanoengineered composite fabrics. In FY08, research technologies to enable multifunctional designs utilizing multiple nanomaterial constituents. In FY09, will validate performance enhancements enabled through insertion of nanomaterials constituents in scalable processes.	5013	4760	5010
Small Business Innovative Research/Small Business Technology Transfer Programs		113	
Total	5013	4873	5010

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602105A - MATERIALS TECHNOLOGY**	**H84**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H84 MATERIALS	16616	13618	21975	23207	23369	20712	20053

A. Mission Description and Budget Item Justification: This project provides the technical foundation for materials technology in metals, ceramics, polymers, and composites that are essential for lethal and survivable Future Force Systems, and where feasible, can be exploited to enhance Current Force capabilities. In order to meet the challenge of Army transformation, new systems must be significantly lighter, more deployable and more sustainable. Achieving such systems requires new material and structural solutions that offer significant weight reduction with improved performance, durability, and cost reduction for application to individual Soldier support equipment, armor (Soldier/vehicle), armaments, aircraft, ground combat vehicles, and combat support equipment. This project will address these needs 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 in armor/armament materials, as well as lightweight structural 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 Future Force systems.

The work is conducted by the Army Research Laboratory, at its Aberdeen Proving Ground, MD, and Hampton, VA, locations, and provides required technologies for advanced development programs at the Armaments Research, Development, and Engineering Center, Picatinny Arsenal, NJ; the Tank and Automotive Research, Development, and Engineering Center, Warren, MI; the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL; the Natick Soldier Research, Development, and Engineering Center, Natick, MA; the Edgewood Chemical and Biological Center, Edgewood, MD; and the Communications and Electronics Research, Development, and Engineering Center (CERDEC), Ft. Monmouth, NJ.

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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Optimize lightweight armor materials/structures, processing methodology, and modeling and simulation tools to enable formulation of lightweight, frontal, and structural armors that will revolutionize the survivability of Current and Future Force platforms and tactical vehicles. In FY07, evaluated these multi-material assemblies against ballistic, mine blast, and other emerging threats. Investigated and conducted experiments and analysis to accelerate composite ceramic armor for the current and future force combat and tactical wheeled vehicles. In FY08, devise processing capabilities to fabricate multi-layer and hybrid materials; prove ballistic multi-hit capability while maintaining single hit performance; show capability to fabricate constant-radius, curved, transparent ceramic plates, and apply advanced polishing techniques. In FY09, will evaluate transparent armors and multi-layer/hybrid materials options against current and emerging threats; will provide computational models and simulations of lightweight air supported structures that allow for improved planning, and reduce the number of prototypes needed to develop new lightweight highly mobile medical tent systems.	7232	5047	5108

Optimize lightweight armor materials and defeat mechanisms against emerging threats to enable affordable design of future 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 FY07, validated simulation and designed tools for individual warfighter protection and lethality applications and transitioned promising first generation protection/lethality concepts to development community. In FY08, show simulation capability for multiple density target with complex projectile failures; and incorporate low density surrogate and multi-density range targets into assessment methodology. In FY09, will increase fidelity of simulation capability and transition second generation protection/lethality concepts to development community.	2550	2650	2730
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 FY07, matured processes and techniques for fabricating ultra-fine grain materials that resulted in penetrators with improved strength and stiffness; identified and demonstrated a process for application of an erosion-resistant appliqué on a lightweight composite cylinder to enable future lightweight armaments. In FY08, explore micro-mechanics effects of blast and impact shock on prospective warhead and projectile materials; examine methods for controlled fragmentation of projectile body materials; fabricate long metal matrix composite (MMC) sections with advanced liner material and perform full scale experimental validation of MMC tube. In FY09, will design material system to provide the desired multi-functional capability to enhance damage on relevant targets and conduct benchmark experiments with that material system.	4334	4165	4298
Design and optimize electro-ceramic materials and processing techniques for integration by CERDEC into advanced antennas that will enable affordable and reliable command, control and communications (C3) for Current and Future Force platforms. In FY07, investigated novel material concepts to increase the temperature stability of active thin film materials. In FY08, design and prove a materials reactor to grow thin films for tunable devices; characterize microstructural, interfacial and surface properties of the grown films. In FY09, will develop unique growth process science to achieve compositionally graded perovskite oxide thin film materials and will integrate the material into a specialized device structure.	500	500	500
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 FY07, advanced design capabilities for advanced nanomaterials and validated scalable processing methods; investigated effects of nanoengineering on the mechanical and physical properties of composite materials; quantified effects of nanomaterial modified coating systems on materials performance; modified and matured improved physics-based nanomaterials property models. In FY08, perform parametric processing studies of advanced nanomaterial compositions; apply modeling results to the maturation of reactive materials; assess and validate performance of nanoengineered composite materials for survivability and lethality applications. In FY09, will scale-up the process methodology for fabricating fully-dense, boron carbide plates; will perform microstructural and mechanical property characterization.	2000	1255	1346
Armor Materials: In FY09, will 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. Material technologies for reactive armor and electromagnetic armor design solutions will be used in PE 0602618 (H80), and PE 0602601 (C05).			7993
Small Business Innovative Research/Small Business Technology Transfer Programs		1	
Total	16616	13618	21975

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	48396	62910	46147	40993	41457	42877	44332
140	HI-POWER MICROWAVE TEC	5355	6114	6194	6267	6315	6455	6600
H15	GROUND COMBAT ID TECH	5131	5934	13051	7915	7976	8153	8337
H16	S3I TECHNOLOGY	16922	18683	19514	19249	19437	20368	21317
SA1	Sensors and Electronic Initiatives (CA)	13800	23743					
SA2	BIOTECHNOLOGY APPLIED RESEARCH	3860	4474	5752	5874	5991	6125	6262
SA3	COMBAT IDENTIFICATION COMPONENT TECHNOLOGIES (CA)	2130	2384					
TS1	TACTICAL SPACE RESEARCH	1198	1578	1636	1688	1738	1776	1816

A. Mission Description and Budget Item Justification: The objective of this program is to research and evaluate technologies that will enhance the capabilities of the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Focus is on providing sensor, signal, and information processing technology for advanced reconnaissance, surveillance, and target acquisition (RSTA); ground-to-ground and air-to-ground combat identification (ID), fire control systems, fuzing, and guidance-integrated fuzing functions in future munitions; significantly improving the survivability, lethality, deployability, and sustainability of future tactical vehicles/platforms by devising 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 funds research, development, and evaluation of RF weapon technology, high energy laser technology, and high power components. Project H15 funds 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 H16 funds studies that will provide the Soldier with decisive new capabilities to locate, identify, and engage battlefield targets in tactical and urban environments. In project SA2, the Army Research Laboratory in collaboration with the Institute for Collaborative Biotechnology (ICB) a University Affiliated Research Center (UARC) led by the University of California, Santa Barbara in partnership with California Institute of Technology and Massachusetts Institute of Technology and their industry partners conducts applied research focused on biological sensors and biological photovoltaic power generation. Work in SA2 will exploit breakthroughs in biotechnology basic research transitioning from the ICB to enable Future Force capabilities in sensors, electronics, and photonics. Projects SA1 and SA3 fund congressional special interest items. Project TS1 funds research, development, 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.

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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

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

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	48575	39826	41017
Current BES/President's Budget (FY 2009)	48396	62910	46147
Total Adjustments	-179	23084	5130
Congressional Program Reductions		-3216	
Congressional Rescissions			
Congressional Increases		26300	
Reprogrammings	683		
SBIR/STTR Transfer	-862		
Adjustments to Budget Years			5130

FY09 was increased for applied research for combat identification.

Sixteen FY08 congressional adds totaling $26300 were added to this PE.

($800) S3I Technology
($800) Wearable Video Capture System
($1000) Advanced Detection of Explosives Program
($1000) Electromagnetic Geolocation
($1000) Land and Sea Special Operations (LASSO)
($1000) Single Crystal Chemical Vapor Deposition Diamond Thermal Management Elements for high-energy lasers
($1000) Urban Warfare Knowledge Base
($1600) High Brightness Diode-pumped Fiber Laser (HIBriD-FL)
($1600) Nanophotonic Devices
($1600) Terahertz Spectrometer Technology
($2000) Advanced Bonded Diamond for Optical Applications
($2000) Center for Advanced Microelectronics Manufacturing (CAMM)
($2000) Integrated Multi-Target Remote-Sensing Technology and Its Applications
($2000) Urban Warfare Analysis Center (UWAC)
($4500) One-Step JP-6 Bio Diesel Fuel
($2400) Network Enabled Combat Identification (CID)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**	**140**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
140 HI-POWER MICROWAVE TEC	5355	6114	6194	6267	6315	6455	6600

A. Mission Description and Budget Item Justification: This project funds research and evaluation of traditional and non-traditional Radio Frequency (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/munitions. Realizing DEW capabilities for diverse targets at a variety of lethality levels and operational ranges requires optimizing the DEW system including devising compact, high density power systems meeting stringent weight and volume restrictions. System optimization relies on determining the most effective DEW parameters and system components needed to defeat classes of selected targets; i.e., determining the desired DE effects drives the DEW component and system design, including power. 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/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.

Work on this project is performed by the US Army Research, Development, and Engineering Command's Army Research Laboratory (ARL) in coordination with the Tank and Automotive Research, Development, and Engineering Center; the Armaments Research, Development, and Engineering Center; 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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. In FY07, matured high temperature SiC power modules for power conversion levels >100 kW. Designed and built an isotope battery based on isotope material figures-of-merit, and SiC-conversion efficiencies. Measured efficiency of novel Stirling engine. In FY08, mature development of high-temperature SiC power modules for operation at power conversion levels >200 kW. Investigate 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. Model Stirling engine characteristics and optimize parameters for battery charging loads determined by CERDEC. Investigate carbon-monoflourides alloys as anodes and continue work on high energy cathodes for Li-Air batteries. In FY09, will develop SiC power modules for operation at high temperature for power conversion levels >350 kW. Will evaluate gallium-nitride (GaN) and diamond materials for use as direct energy converter in extended life batteries for unattended sensor and prognostics and diagnostics.	1354	2282	2232
Research and mature novel solid-state laser concepts, architectures, and design components enabling High Energy Laser (HEL)	1791	2412	2440

technology for Army specific DEW applications. Exploit breakthroughs in laser technology and photonics basic research to meet the stringent weight/volume requirements for Future Force platforms. Applied research will be conducted by ARL in close collaboration with domestic ceramic (and other) material vendors, university researchers, and major laser diode manufacturers. In FY07, investigated and evaluated the efficiency of the ultra-low quantum defect, high power "eye-safe" fiber laser (~1600 nm) with direct diode pumping by long-wavelength (InP) laser diodes (or surrogate narrowband fiber laser); conducted feasibility study of Tellurium Oxide (TeO2) as phase conjugate wavefront-correcting mirror for high power applications. In FY08, evaluate composite ceramic laser materials to increase laser power; evaluate volume Bragg grating based, spectral narrowing of diode pumps for high brightness pumping schemes. Complete feasibility study of TeO2 for high power applications. In FY09, will implement a new approach to the thin disk laser architecture based on edge pumping of a composite doped-undoped gain element.			
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 FY07, investigated integration of threat neutralization breadboard on countermine platforms and conducted lab/field experiment to show effectiveness. Investigated RF effects levels on threat mines of interest to CERDEC. Determined feasibility of RF DE countermine systems by identifying power/energy requirements. Designed and built counter smart mine concept to show proof of principle and transitioned to CERDEC/PM Close Combat Systems. Investigated susceptibility profiles of network components to assess vulnerability of Future Force network. In FY08, measure the RF susceptibility levels of threat sensors/communications of interest to CERDEC. Use data to identify system design requirements for counter electronic system. Build models to help predict the effective range of counter electronic system. Investigate susceptibility profiles of wireless network components. In FY09, will design experimental counter electronic system and will conduct lab and/or field test to evaluate the capability. Will 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. Will identify and acquire critical components of Unmanned Aerial Vehicles and evaluate failure levels. Will transition data and system design to AMRDEC for further evaluation. Will investigate susceptibility profiles for two Future Force systems.	2210	1326	1522
Small Business Innovative Research/Small Business Technology Transfer Programs		94	
Total	5355	6114	6194

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**	**H15**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H15	GROUND COMBAT ID TECH	5131	5934	13051	7915	7976	8153	8337

A. Mission Description and Budget Item Justification: This project funds research and investigation of 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 for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Efforts include research on enabling technologies to demonstrate a common battlespace picture for joint coalition situation awareness, reduction of weight and cost of previously developed CID systems, and evaluation of multiband radio frequency (RF) tags as a CID enabler. This project also funds research on embedded radio algorithm developments as well as Soldier RF Tag hardware for multiband and aerial platform interoperability. Efforts associated with this project increase the survivability and lethality of Coalition Forces by providing fusion of battlefield sensor and situational awareness data to identify friend from foe, thereby, reducing fratricide incidents across the battlefield. Additionally, this project funds investigations of cost-effective sensors for use in threat warning systems for enhanced battlefield situation awareness and target cueing for Army ground combat vehicles. Coordination will be accomplished with other services, allies, and coalition partners. Efforts in this program element (PE) are coordinated with PE 0603270A (EW Technology), PE 0602270A (EW Techniques), 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 is performed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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. In FY07, designed Geometric Pairing (GP) and RF Tag hardware for the ground Soldier to demonstrate dismounted integration concepts and technical performance characteristics; conducted first technical evaluation of GP situation awareness and RF Tag concepts. In FY08, conduct final technical testing of representative models of GP and RF Tag technologies in a high fidelity lab environment and final technical testing of millimeter wave (mmW) ID application specific integrated circuits (ASIC) in a high fidelity lab facility; complete regression tests of mmW ID ASICs to validate compliance with STANAG (NATO Standardization Agreement) 4579; conduct virtual experiments with hardware in the loop for BCT ground-to-ground technologies. In FY09, will develop an integrated approach for a network enabled architecture that will provide CID capability to Soldiers and Close Air Support/Strike Aircraft; will investigate embedding CID waveforms in the Joint Tactical Radio Systems; will investigate non cooperative technologies for foe and neutral identification in a battlefield environment; will investigate RF Tags for Air to Ground SA applications; will develop a consolidated target identification and SA data display. Related work is also accomplished under PE 0603270A, Project K16.	1612	1835	7831
Fusion Based Technologies: This effort develops an advanced knowledge generation capability to provide actionable intelligence enabling timely decision-making by commanders and timely action by Soldiers in the execution of operations. In FY07, demonstrated capabilities in identification and tracking of force aggregates in information noisy scenarios with realistic terrain characteristics and demonstrated initial capabilities for inferring enemy objectives/intent in conventional and asymmetric scenarios. In FY08, develop	672	1153	

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.			
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 cue active protection system for Army vehicles. In FY07, developed cueing sensor algorithms and processing; performed live-fire test of prototype sensors and systems. In FY08, optimize focal plane arrays design; enhance sensor, electronics, and algorithms for on-the-move environment. Related work is also accomplished under PE 0602270A, Project 442; PE 0603270A, Project K15; and PE 0603772A, Project 243.	2847	2807	
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. In FY09, will 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; will investigate large capacity field programmable gate arrays to reduce the processor and transceiver sizes; will develop and demonstrate novel mmW antenna designs that will produce a similar shaped antenna pattern within a smaller, lower profile configuration; and will investigate approaches for target ID correlation. Work related to this effort is also being accomplished under PE 0603270A, Project K15.			5220
Small Business Innovative Research/Small Business Technology Transfer Programs		139	
Total	5131	5934	13051

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**	**H16**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H16 S3I TECHNOLOGY	16922	18683	19514	19249	19437	20368	21317

A. Mission Description and Budget Item Justification: The objective of this project is to provide the future Soldier with decisive new capabilities to locate, identify, and engage battlefield targets in tactical and urban environments. This project is focused on applied research of advanced sensors, signal processing, and information technologies to enable these capabilities for the Future Force and other emerging thrusts. The ultimate impact and utility of this work will be to protect Soldiers and to greatly increase their lethality, range, and speed of engagement. 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. Cost reduction is a key focus. Significant areas of research include: low cost sensors designed to be employed in large numbers as unattended ground sensors (UGS) for force protection, 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, etc.; low cost acoustic, seismic, and magnetic sensors that can passively detect and track battlefield targets such as tanks, helicopters, etc., and locate gun fire; sensor technologies for the detection and tracking 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; Opto-Electronic (OE) interconnects and processors are being built to greatly speed the movement of information within and between electronic digital processing units to facilitate smart sensors, adaptive sensors, and sensor fusion; 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.

Work is coordinated with Army organizations, particularly the Night Vision Electronic Sensors Directorate, 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 program element (PE) 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technologies), and PE 0603001A (Warfighter Advanced Technology).

Work in this area is performed by the Army Research Laboratory (ARL).

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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Develop technologies for low-cost UGS to enhance persistent Army sensing capabilities. Research focus is based on opportunities and feedback from UGS used in Operation Iraqi Freedom. A key focus is on detecting people. Investigate fusion algorithms using multi-	3630	3779	4696

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. In FY07, devised and matured algorithms for low cost persistent sensing and change detection. Designed biomimetic acoustic sensing systems for a helmet mounting; evaluated low cost, high sensitivity magnetic sensor, and evaluated E-field sensor suitability for low cost UGS. Designed and evaluated fusion algorithms for multi-band IR sensor target detection; integrated advanced multi-target tracking techniques for imagery to enhance force protection and adapted ATR methods for multimodal fusion. In FY08, prepare 1st generation multi-modal algorithms for fielding in Army UGS systems; evaluate use of hyperspectral technology, including band selection techniques for target detection; create image enhancement algorithm toolbox to enable feasibility studies; optimize and transition the high sensitivity magnetic sensor and extend advanced infrasonic algorithms to extract a larger class of transient events. In FY09, will evaluate the combination of advanced imaging sensor types for ATR such as polarimetric FLIR with LADAR; will extend autonomous acoustic sensing and processing algorithms to new platforms; will investigate use of magnetic and E-field sensors on vehicles.			
Investigate and mature 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. In FY07, designed detection algorithms and began sensor fusion algorithm maturation for imagery. Evaluated a correlation matrix to establish relationships between sensor detection capabilities and relevant target signatures. Collected additional multimodal data. In FY08, experimentally validate an integrated hyper-modal sensor test-bed tailored for urban operations; devise node-based algorithms for detecting human infrastructure and presence in hidden/confined spaces and establish a database of co-registered, hyper-modal relevant signatures and features that are detectable with available sensor technologies. In FY09, will investigate the application of sensor fusion algorithms and sensor networks to new Army applications, such as force protection and homeland security applications.	3610	3500	2072
Conduct applied research to support advances in state-of-the-art clandestine Tagging, Tracking, and Locating (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 advanced research in clandestine TTL. In FY09, will research extremely wide ranging technologies that are applicable to clandestine TTL. Will identify technologies that have potential to achieve the goals of clandestine TTL and conduct research to mature these areas.			1397
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 FY07, designed and evaluated multi-element magneto-optical switches and characterized response time. In FY08, investigate large-area fast electro-optic shutter devices and evaluate nonlinear optical tandem limiters. In FY09, will develop and evaluate demonstrator protection devices across the visible spectrum.	2578	3078	2652
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. In FY07, matured advanced through-the-wall imaging capabilities consistent with a randomized, distributed array implementation concept. In FY08, examine techniques to combine radar data with other advanced perception sensors to improve obstacle detection on autonomous navigation systems. In FY09, will 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.	3051	3739	3807

Develop Multi Function Radio Frequency System (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 Ultra-Violet (UV) optoelectronics for covert line-of-sight and non-line-of-sight communications and for photoluminescent detection of biological threats. In FY07, established MFRFS radar model for use in analyzing the radar limitations in adverse environments and evaluated RF imaging and collision avoidance radar for robotic perception. Explored high-brightness active regions for light emitting diodes and lasers operating at wavelengths below 300 nm for UV covert communications and bio-agent detection. In FY08, evaluate communication functionality with MFRFS demonstration array ; investigate methods for increasing communication rates achievable with MFRFS hardware and explore integrated receiver/exciter design and develop methods for increasing frequency flexibility. Investigate UV laser development in the 280 nm to 340 nm range. In FY09, will evaluate methods for detecting stationary dismounts using biometric signatures and develop waveforms and algorithms for implementing these techniques in MFRFS. Will investigate feasibility of a solar-blind 280 nm avalanche photodiode.	1553	2339	2286
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 FY07, explored robotic asset management and control technologies in order to enable semi-autonomous assets with the ability to provide persistent surveillance. In FY08, define robotic asset control technologies and investigate bio-inspired asset behavior algorithm as software components within a stimulation environment. In FY09, will conduct lab experiments in order 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, will devise and develop algorithms to scale to more complex scenes.	2500	2165	2604
Small Business Innovative Research/Small Business Technology Transfer Programs		83	
Total	16922	18683	19514

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**	**SA2**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
SA2 BIOTECHNOLOGY APPLIED RESEARCH	3860	4474	5752	5874	5991	6125	6262

A. Mission Description and Budget Item Justification: The objective of this project is to transition biotechnology research from the Army's Institute for Collaborative Biotechnologies (ICB), a University Affiliated Research Center (UARC). 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). The ICB is focused on advancing the survivability of both the Soldier and weapons systems through fundamental breakthroughs in the area of biotechnology. This project will conduct applied research that transitions breakthroughs in biotechnology basic research from the ICB to enable revolutionary Future Force 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. This applied research effort will ensure that the basic science developed at the ICB is directed towards and transitioned to Army devices and systems. The in-house research program (~20%) will link the ICB research to Army requirements and enhance the transition of this technology into the Army. Most of the 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 Army seeks to provide the interdisciplinary fundamental knowledge and technical capabilities to manipulate biological systems and components, and to exploit biologically derived products and processes for both the Soldier and engineered systems and platforms. The process of transformation requires revolutionary advances in performance of Army weapons systems, including improvements in engineered systems impacting Soldier survivability.

Work in this project is performed by ARL in coordination with ECBC, NSRDEC, and other Army 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Institute for Collaborative Biotechnologies: In FY07, identified biologically-based and inspired sensors and materials to design and fabricate "sense and respond" system components, investigated biologically-inspired control, and networking capability for these systems; evaluated the biological sensors in a relevant environment and transitioned to ECBC and/or NSRDEC. Began fabrication of microbial fuel cells and optimize power output for low power sensor applications. Established baseline methodologies for comparisons of novel molecular recognition elements (MREs) devised using rapid micro-fluidic screening and currently used antibodies. In FY08, design biologically-based and inspired sensors and materials for "sense and respond" systems components and determine the feasibility of	3860	4359	5752

biologically inspired control and network systems for these devices, investigate high-throughput screening of microbe, and fuel candidates for microbial fuel cells, waste reclamation, and bioremediation. Optimize and perform side-by-side comparison evaluation of novel MREs and standard antibody using baseline methodologies. In FY09, will 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 nano-fibers. Will 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 and scale-up protein system for conversion of methane to methanol for fuels to reduce logistics burden. Optimize bio-inspired control system for collection of data 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.			
Small Business Innovative Research/Small Business Technology Transfer Programs		115	
Total	3860	4474	5752

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602120A - Sensors and Electronic Survivability**	**TS1**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
TS1 TACTICAL SPACE RESEARCH	1198	1578	1636	1688	1738	1776	1816

A. Mission Description and Budget Item Justification: The objective of this project is to design, develop, and evaluate space-based technologies that provide the ground commander with the ability to identify and exploit opportunities early as well as to enhance planning for and conducting operations. Critical Army Required Capabilities identified in the Army Space Master Plan include the need for increased situational awareness; the ability to network, communicate, and share information, and the ability to control, direct, and download information from space and high altitude assets within the theater. Focus of this project is on space and high altitude based sensors, signal, and information processing technology; advanced intelligence, surveillance, and reconnaissance (ISR) capabilities; battle command, control, and communications; target acquisition; position/navigation; threat warning; and space superiority technologies with the potential to provide ground forces relevant and timely information to influence operations. 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. This includes applied research in technologies that provide the theater forces with persistent intelligence, surveillance, and reconnaissance and dedicated communications payloads that can be integrated into high altitude long loiter and tactically responsive space platforms. Validated and executable technologies emerging from this project will 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 Space and Missile Defense Technical Center in Huntsville, AL. This project is designated as a DoD Space Program.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, in cooperation with the Naval Research Laboratory (NRL) designed and analyzed very small (~20 pounds) sensor and communication payload technologies, including on-orbit reprogrammable software radios, optical sensor with direct downlink, multiple phenomena using a common aperture, and multi-spectral surveillance Electro-Optical / Infra Red (EO / IR), for Army assured communications and persistent Intelligence, Surveillance, and Reconnaissance (ISR) applications; supported the Operationally Responsive Space (ORS) Office in evaluating the technical maturity of responsive space payloads, including kinetic event detection, small Synthetic Aperture Radar (SAR) packages, Communications / Intelligence mapping, and Communications On-The-Move. In FY08, select best very small sensor and communications payload technology candidates for breadboard development; identify ORS payload technologies suitable for Army applications and build breadboards for further assessment. In FY09, will verify sensor and communications very small payload breadboard performance in a laboratory environment and identify candidates for further maturation; will assess performance of ORS payload technologies in a laboratory simulated high-altitude environment to assess viability for further development and maturation in a space environment.	1198	1534	1636
Small Business Innovative Research / Small Business Technology Transfer Programs		44	
Total	1198	1578	1636

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602211A - AVIATION TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	39383	43280	42013	41598	41194	41977	40295
47A	AERON & ACFT WPNS TECH	27568	35157	37761	37297	36869	37556	35775
47B	VEH PROP & STRUCT TECH	4261	4147	4252	4301	4325	4421	4520
47C	ROTORCRAFT COMPONENT TECHNOLOGIES (CA)	7554	3976					

A. Mission Description and Budget Item Justification: The Aviation Technology program element (PE) conducts applied research applicable to both manned and unmanned rotary wing vehicle (RWV) technologies in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Emphasis is on developing rotary wing platform technologies to support manned and unmanned rotary wing vehicle combat and combat support operations for attack, reconnaissance, air assault, survivability, and command and control missions. Technologies that enable autonomous flight, higher aerodynamic loads, lower detectability, and increased maneuverability are emphasized. Increased effort is being placed on technologies to increase both manned and unmanned aircraft survivability, crashworthiness, and crew protection. Prognostics and diagnostics technologies are being developed and evaluated to support Condition Based Maintenance (CBM) efforts desired to reduce Operating and Support (O&S) costs of Current and Future Force airframes. This PE advances integrated unmanned operations through autonomous collaboration and refinement of unmanned technologies. 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). Department of Defense (DoD) systems such as the AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook, Armed Reconnaissance Helicopter, Light Utility Helicopter, the U.S. Navy SH-60 Seahawk, and U.S. Marine Corps V-22 Osprey, AH-1 Cobra, and CH-53 Super Stallion benefit and are supported directly or indirectly by this PE. This PE does not duplicate any efforts within the Military Departments. The Army is the executive agent for the maturation of rotorcraft science and technology on behalf of all Service needs. 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, with facilities located at Redstone Arsenal, AL; Fort Eustis, VA; Moffett Field, CA; and Hampton, VA, and at the Army Research Laboratory, with facilities located at Adelphi, MD; Hampton, VA; and Cleveland, OH.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	40156	42567	42051
Current BES/President's Budget (FY 2009)	39383	43280	42013
Total Adjustments	-773	713	-38
Congressional Program Reductions		-3287	
Congressional Rescissions			
Congressional Increases		4000	
Reprogrammings	-297		
SBIR/STTR Transfer	-476		
Adjustments to Budget Years			-38

Two FY08 congressional adds totaling $4000 were added to this PE.

($1600) Composite Small Main Rotor Blades
($2400) Aircraft Structural Condition Monitoring (ASCM) for Diagnostics and Prognostics

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602211A - AVIATION TECHNOLOGY**	**47A**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
47A	AERON & ACFT WPNS TECH	27568	35157	37761	37297	36869	37556	35775

A. Mission Description and Budget Item Justification: The Aeronautical and Aircraft Weapons Technology project develops 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 survivability; and improve combat sustainability. This project supports the Future Force by providing technology to improve capabilities in Force Application and Focused Logistics. 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. The propulsion technologies investigated in this project provide improved specific fuel consumption, horsepower to weight ratios, and operation and support (O&S) cost savings for manned and unmanned systems. These engine component technologies address engine needs for future aircraft with up to a 50 percent endurance and 30 percent payload increase projected over currently available turbine engines. Aircraft survivability component technologies include adaptive Infrared (IR) signature suppression of engine and airframe thermal sources, visual signature control, acoustic signature attenuation, in-cockpit threat situational awareness, and survivability re-route decision aiding systems. Advanced active controls, aerodynamics, handling qualities, and smart material (materials that respond to specific stimuli) technologies provide rotors and flight controls capable of increased payload, range, agility, maneuverability, and survivability. Manned / unmanned system interfaces, autonomous collaborative flight controls, flight simulation, weapons and sensor integration, pilot-vehicle interface technologies, and advanced mission equipment packages are being pursued that provide full spectrum engagement, precision, and selectable lethality, suitable for the target and engagement scenarios. The operations and sustainment technologies provide advanced prognostic / diagnostic algorithms necessary to implement Condition Based Maintenance (CBM). 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. 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. Work in this PE is related to and fully coordinated with program elements 0603710A (Night Vision Advanced Technology); 0603624A (Weapons and Munitions Technology); and 0602203A (Missile Technology).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
National Rotorcraft Technology Center (NRTC): In FY07, incorporated and evaluated fluid damper and magnetic-particle damper models in comprehensive analyses. Designed and tested wireless proximity sensors. Conducted passive layered isolator flight test demonstration. Performed simulation test of ad-hoc networking of rotorcraft teams. Developed advanced sensors and networks for a practical condition based maintenance implementation. Designed improved crashworthy armored seats. Developed metal matrix composite design for airframe applications. Designed drive train torque measurement system. In FY08, perform wind tunnel tests of rotor designs with improved static/dynamic stall characteristics. Test oscillatory jets on rotor airfoils to assess effect on aerodynamic improvements. Perform qualification test on improved drive system gears. Test improved crashworthy armored seats. Test metal matrix composite design for airframe applications to assess structural suitability as a substitute for a titanium structure. Investigate and evaluate a drive train torque measurement system to aid in assessing loads on the system. In FY09, will perform bird strike and head impact	7464	8262	8616

simulations for rotorcraft crashworthiness and survivability. Will conduct certification testing and probabilistic analysis to evaluate damage tolerance methodologies. Will test advanced drive system designs for noise and wear characteristics. Will evaluate active crash protection system for application to rotary wing unmanned aerial systems.			
Rotor Technology: In FY07, wind tunnel tested active/passive integration techniques for enhancement of on-blade controls, both for blade section concepts as well as two model rotor designs. Validated an analytical model of the system. In FY08, evaluate, via wind tunnel tests, on-blade control for model rotor system to include performance enhancement and primary control.	4203	3269	
Aircrew Survivability Technologies: In FY07, developed cognitive decision aiding (CDA) planners that enable a manned/unmanned team to respond to pop-up threats as a team, and not just as individual platforms. Integrated and evaluated the performance of the CDA planners with the Threat Lethality Predictor (TLP) algorithms. In FY08, develop CDA-TLP specific cockpit controls, displays, and aural cues. Refine performance and mission effectiveness goals using simulation. Initiate development of crash criteria (that establishes 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. Develop conventional ballistic threat and advanced crew protection concepts followed by preliminary designs for selected concepts. In FY09, will develop updated design guidelines based on emerging criteria. Will complete preliminary design of a quiet propeller for Class 2/3 UAS such as Shadow 200. Will develop and test innovative techniques for reducing detection of propeller and rotor driven aircraft by threat systems. Will develop analytical tools (executable software) required to evaluate both material behaviors during ballistic and high energy impact events.	4015	7041	7173
Rotorcraft Airframe Technology: In FY07, refined multifunctional structure technology, reducing parasitic weight by adding capabilities to primary structure (e.g., integrated armor). Modified technologies to improve structural efficiency and lower design load uncertainty on airframe/rotor structures. Developed criteria using a strain-allowable approach for repair and continued use of ballistically damaged, life-limited, dynamic structures. In FY08, develop integrity management by fusing loads monitoring and damage detection capabilities to improve safety and survivability. Evaluate ballistic properties and effectiveness of reduced-weight multifunctional structural armor. In FY09, will conduct laboratory testing to evaluate strain-allowable integrity approach; and will develop and evaluate emerging platform concepts and validate modeling fidelity.	2392	1251	4280
Advanced Engines: In FY07, completed fabrication and conducted test of advanced ceramic matrix composite power turbine blades to validate improved performance, reduce weight, and increase durability. In FY08, complete design of advanced compressor for improved engine performance and reduced weight; and complete advanced combustor design, fabrication, and evaluation. In FY09, will complete design of advanced inlet particle separator that improves engine performance and durability. Will complete fabrication of advanced compressor for improved engine performance and reduced weight. Will complete advanced combustor rig-test to validate improved engine performance and structural adequacy.	1360	1965	2046
Network Operations and System Integration and Intelligent and Active Control: In FY07, applied control optimization analysis tools to UH-60M upgrade fly-by-wire control system and evaluated in the Rotorcraft Air Crew Systems Concepts Airborne Laboratory (RASCAL) in-flight simulator. Successfully demonstrated external load stabilization for aerodynamically active slung load, increasing transport speed from 60 to 110 knots. In FY08, investigate stability margin requirements for upgraded/new configuration and integrate aerodynamics and structural dynamics into control systems optimization. In FY09, will expand handling quality requirements and flight control systems for legacy upgrades, multi-role, and heavy-lift rotorcraft and extend autonomous obstacle field navigation with increased agility. Digital Situational Awareness Testbed: In FY07, developed guidelines for control of multiple UAS from a single station (either airborne or ground). In FY08, develop and evaluate supervisory control interface for multiple heterogeneous UAS. In FY09, will conduct	8134	7338	7510

tests of supervisory control techniques for control of multiple UAS. Advanced Rotary Wing Concepts: In FY07, began integration of advanced targeting and stabilization technologies to provide a precision attack capability for rotary wing UAS. In FY08, conduct flight test demonstrations of precision attack capability from test bed UAS operating in support of manned aviation and ground troops in a MOUT environment. In FY09, will conduct flight test demonstrations using different sensors and weapons systems to gauge precision to be expected from rotary wing UAS in varying flight modes, i.e., high and low hover, firing on the move, and moving targets.			
System Concepts Studies: In FY08, initiate design of an analysis environment which integrates higher-fidelity models for aeromechanics and flight controls into the process for design synthesis of rotorcraft configurations. Focus 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 assessments. Examine a Variable Speed Tilt Rotor within the analysis environment and use results to refine the overall design of the analysis environment. In FY09, will expand the design of the analysis environment to include the capability to analyze a Slowed Rotor Compound Helicopter. Will investigate interfaces to allow inclusion of other new and emerging technical capabilities and rotorcraft configurations.		1133	2995
Durability and Sustainment Techs: In FY08, initiate development of prognostic algorithms for dynamic rotor head components. Develop predictive models for hydraulics and actuators used for aircraft flight controls (based on Failure Modes, Effects, and Criticality Analysis and manufacturer's analysis of failed components). Evaluate the predictive models based on the fusion of the data-driven and model-based approaches, with bench testing of components to verify the models. Determine placement of corrosion sensors for use in development of corrosion assessment algorithms. Perform rig-testing of ceramic components to characterize the failure modes. Embed sensors in structural components and assess feedback to form basis of damage detection algorithms. Evaluate sensor and loads monitoring feedback methods for structural diagnostics/prognostics and reduction of uncertainty in probabilistic methods for life management. In FY09, will perform rig-testing of dynamic rotor head components, begin bench testing of flight control algorithms on hydraulic actuators, initiate development of prognostic algorithms for ceramic components, develop and begin validation of the corrosion damage algorithms, and assess structural damage detection algorithms. Will evaluate sensor and loads monitoring feedback methods for structural diagnostics/prognostics, and reduction of uncertainty in probabilistic methods for life management.		4512	5141
Small Business Innovative Research/Small Business Technology Transfer Programs		386	
Total	27568	35157	37761

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602211A - AVIATION TECHNOLOGY**	**47B**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
47B VEH PROP & STRUCT TECH	4261	4147	4252	4301	4325	4421	4520

A. Mission Description and Budget Item Justification: The Vehicle Propulsion and Structures Technology project investigates engine, drive train, and airframe enabling technologies for Department of Defense (DoD) rotorcraft in support of the Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. The intent is to significantly increase strategic and tactical mobility/deployability, increase reliability, reduce maintenance costs, and increase combat sustainability - all focused on a large reduction in the vehicle's logistics footprint for manned and unmanned rotorcraft. Problems being addressed in propulsion technology include increased fuel efficiency and reduced propulsion systems weight. Technical barriers include temperature limitations for materials, accurate modeling for flow physics, and accurate prediction of propulsion system mechanical behavior. The problem being addressed in structures technology is the inadequacy of current analytical tools to design for acceptable reliability and durability, which leads to heavier, more costly designs, and poor life cycle management. Technical barriers include inadequate structural analysis design tools, inadequate structural dynamics modeling methods for the rotating and fixed system components, inadequate modeling of rotor aeromechanical phenomena, incomplete and non-parametric loads data, and inaccurate inspection and tracking methodologies. Technical solutions are pursued through propulsion and structures research - with a focus on applications towards heavy lift technologies while supporting both manned and unmanned vehicle requirements. Propulsion research is focused on fluid mechanics, high temperature materials, and mechanical behavior for significantly improved small airflow turbine engines, transmissions, gears, bearings, and shaft components for advanced drive trains at significantly reduced weight and cost. This propulsion research supports the goals of the DoD Versatile Advanced Affordable Turbine Engine (VAATE) program. Structures research is focused on the effects of aerodynamic loads, aeroelastic interactions, integrated composites, structural integrity, low cost manufacturing, and crashworthiness that provide improved rotor and airframe structure subsystems. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Rotor and Structure Technology: This effort devises 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. The FY07 funding was used to validate rotor wake modeling analysis using particle-based vortex tracking method and explore computational prognostic and diagnostic methods to support innovative Army reliability initiatives for the Future Force. In FY08, improve analytical tools of rotor/body and wake flow predictions, investigate aeromechanics design tools to enable the evaluation of new small-scale unmanned air vehicles and micro-scale flapping-wing air vehicles. In FY09, will evaluate new multi-functional structural concepts based on biological systems that are key enablers for future microsystems development. In FY09, will conduct wind-tunnel test on an experimental rotor system (in collaboration with Bell Helicopter and NASA).	1562	747	852
Propulsion and Drive Train Technology: This effort investigates 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. In FY07, defined thermal behavior and lubrication technologies of high speed, high performance gears, including loss of lubricant conditions, using modeling and a representative high-speed gear train; evaluated heavy-fuel concepts for potential fuel cell applications; completed performance and endurance tests of innovative non-contacting air-to-air seal technology for military helicopter and UAV class	2699	3400	3400

engines. Experimentally evaluated a low conductivity thermal barrier coating system for metals to improve reliability and durability of engine components. In FY08, assess and quantify the baseline performance of model-based diagnostic methodology to accurately detect, determine trends, and isolate engine faults and experimentally evaluate mechanical properties of advanced gear materials to assess their feasibility for use in rotorcraft transmissions. In FY09, will assess the durability of advanced environmental barrier coatings to improve the design of hot section engine components and will experimentally evaluate variable speed transmissions sub-scale components that will enable improvements in rotorcraft maneuverability and noise reduction.			
Total	4261	4147	4252

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602270A - Electronic Warfare Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	30458	30013	16611	16822	16954	17331	17722
442	TACTICAL EW TECHNOLOGY	11272	9342	9506	9620	9693	9909	10132
475	ELECTRONIC WARFARE COMPONENT TECHNOLOGIES (CA)	11717	13709					
906	TAC EW TECHNIQUES	7469	6962	7105	7202	7261	7422	7590

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, for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. 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. Project 442 funds efforts related to the design, development, and application of electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft, and the dismounted Soldier. In addition, this project offers improvements to Current Force EW sensors and ECM systems to further protect high-value ground targets, aircraft, and the Soldier from threat surveillance and tracking systems; imaging systems; and advanced RF/EO/IR missiles, artillery, and smart munitions. Improvements to the next generation EW protection sensors augment the classic intelligence, surveillance, and reconnaissance (ISR) sensors by providing multi-functional capabilities for on-board and off-board situational awareness (SA), targeting, and combat identification. 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. Project 906 funds 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 in accordance with concepts for Future Force intelligence operations. Specifically, its technologies focus on detecting threat sensors and emitters associated with weapon systems, targeting systems and command, control, communications, computers, and intelligence (C4I) systems and networks.

Efforts in this PE are 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). Project 475 funds congressional special interest efforts. 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, Fort Monmouth, NJ.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602270A - Electronic Warfare Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	30972	16411	16605
Current BES/President's Budget (FY 2009)	30458	30013	16611
Total Adjustments	-514	13602	6
Congressional Program Reductions		-198	
Congressional Rescissions			
Congressional Increases		13800	
Reprogrammings	33		
SBIR/STTR Transfer	-547		
Adjustments to Budget Years			6

Six FY08 congressional adds totaling $13800 were added to this PE.

($1600) Battlefield Connectivity, Multi-Level Secure Networks
($1600) Integrated Information Technology Policy Analyses Research
($2000) Electromagnetic Gun Initiative
($2400) Dominant Military Operations on Urbanized Terrain Viewer
($3000) Knowledge Integration and Management
($3200) Silver Fox and Manta Unmanned Aerial Systems

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - Electronic Warfare Technology**	**442**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
442 TACTICAL EW TECHNOLOGY	11272	9342	9506	9620	9693	9909	10132

A. Mission Description and Budget Item Justification: This project designs, develops, and applies 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 with the goal of embedding the maximum capability in the Current Force, and systems to minimize Future Force vehicle weight, cost, logistics, and fielding. Additionally, this project designs and develops EO technologies and countermeasures technologies against laser-aided and electro-optically directed gun or missile systems. Finally, this project will look at those Electronic Support (ES) technologies used against non-communications signals for targeting and tactical 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 is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, developed adaptive array processors for use in tactical settings to counter problems associated with multipath, co-channel, and co-site interference that plague current systems. In FY08, develop digital wideband receiver capability for the detection and denial across the entire threat band; refine system design and begin integration of complementary capabilities such as time difference of arrival geolocation and electronic attack based on geolocation; integrate wideband antennas into an adaptive array; integrate algorithms into government off the shelf hardware. In FY09, will integrate capabilities into a net-centric solution that combines jamming and detection/location/neutralization capabilities; will complete fabrication of adaptive processing arrays; will complete algorithm development and validation. Related work is also being accomplished under PE/Project: 0602270A/906; 0603270A/K15; 0603270A/K16.	2228	3496	1986
Suite of Sense Through the Wall Systems (STTW) for the Future Force: This effort provides users with the ability to detect visibly obscured targets up to the objective stand off distance, operate on the move, and accurately geo-locate targets in the presence of clutter with an intuitive user interface. In FY07, began development of integrated personnel detection/concealed weapons detection/concealed explosive detection systems with greater standoff capability and increase probability of detection; conducted lab testing of individual STTW sensors against multiple wall types, and formulated techniques for detection of stationary personnel through multiple wall types; and evaluated and tested hand held STTW prototype in the Future Force Warrior demonstration. Related work is also being accomplished under PE/Project: 0603772A/243.	3497		
Fusion Based Technologies: This effort develops an advanced knowledge generation capability to answer warfighting commanders	1474	2214	

priority intelligence requirements (PIRs) 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 FY07, tested an initial toolset to support the brigade intelligence officer in directly building/editing of knowledge required for analysis and inferencing against multiple PIRs in a realistic scenario; created a subset of modeling and simulation (M&S) capabilities needed to support research, development, and testing of Levels 2-5 fusion technologies required for PIR answering. In FY08, develop 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; develop and evaluate in a pre-engagement mode, an initial toolset for evaluating and selecting the most capable and relevant collection assets given PIRs and contextual information; develop another increment of M&S software that provides 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/Project: 0602120A/H15; 0602270A/906; 0603772A/243.			
Next Generation Electronic Warfare Technology for Survivability: This effort develops 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 FY07, initiated hardware-in-the-loop electro-optic/ infra-red (EO/IR) countermeasure exploitation/evaluation of next generation EO/IR threats; designed and developed photonic gap multiband optical fibers, beam switching, beam steering, and pointing devices. In FY08, integrate/interface Navy's Distributed Aperture Infrared Countermeasures multiband laser prototype with optical fibers and pointing/switching/steering technologies and lab demonstrate against next generation threats; demonstrate next generation countermeasures techniques against advanced EO/IR threats. Related work is also being accomplished under PE/Project: 0603270A/K16.	1943	3432	
Cueing Sensor: 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. In FY07, developed and optimized threat classification algorithms and signal processing for the active protection system cueing sensor. In FY08, optimize focal plane arrays design; enhance sensor, electronics, and algorithms for on-the-move (OTM) environment. Related work effort is also being accomplished under PE/Project 0602120A/H15; 0603270A/K16; 0603772A/243.	2130	98	100
Multispectral Threat Warning: This effort develops affordable EO/IR countermeasure system concepts with multispectral detectors, multiband laser, advanced countermeasure architectures, and will exploit next generation threats to develop advanced EO/IR countermeasure techniques that will effectively defeat laser guided munitions, surface-to-air, air-to-air, and anti-tank threats. In FY09, will develop and evaluate new algorithm techniques to exploit signals in background clutter to increase detection, identification, and threat classification capabilities.			4130
Advanced Tactical Electronic Support Measures: This effort supports development of non-communication 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. In FY09, will begin development of 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.			2020
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 the new wideband threat weapon systems that use advanced radar processing techniques. In FY09, will begin development of 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 that will be common to both air and ground platforms			1270

Small Business Innovative Research/Small Business Technology Transfer Programs		102	
Total	11272	9342	9506

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602270A - Electronic Warfare Technology**	**906**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
906 TAC EW TECHNIQUES	7469	6962	7105	7202	7261	7422	7590

A. Mission Description and Budget Item Justification: This project designs, develops, and applies key electronic warfare (EW) technologies to intercept and locate current and emerging threat communications and non-communications emitters 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 contributes to the commanders ability to see the enemy, both as a unit and as part of a complex, adaptive organization, allowing a "See First, Understand First, Act First" standard of operations. This project investigates radio frequency (RF) collection and mapping technologies to offer real time emitter detection, location, and identification. Efforts include adding an autonomous RF collection capability and algorithms into tactical software defined radios to detect, locate, and display enemy RF emissions. It also evolves electronic attack (EA) components into smaller, lower power, lightweight, common modules that counter modern threat Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems. 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.

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 program element (PE) is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, collected target vulnerability data, continued development of adaptive array processors for use in a tactical setting to counter problems associated with multipath, co-channel, and co-site interference and provided a precise geolocation capability; developed more effective techniques using broad range of target focused information operations (IO) algorithms based on individual target transmission parameters rather than brute force techniques; began development of effects based IO deception techniques to influence a potential targets plan of action. In FY08, continue 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 selection; expand algorithm development for larger range of targets; continue deception and effects algorithm development. In FY09, will investigate and develop techniques to engage emergent communications technologies for inclusion into IO techniques database; will 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/Project: 0602270A/442; 0603270A/K15/K16.	6175	6950	4100
Fusion Based Technologies: 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 FY07, developed modeling and simulation tools to support identification and tracking of aggregates, and simpler cases of inferring enemy objectives. In FY09, will develop final set of	1294		3005

representations for different types of enemy tactics to handle more complex and asymmetric behaviors such as ambushes, vehicle-borne explosive devices, and sniper attacks; will demonstrate capabilities to automatically identify and link human-specified critical entities and activities to PIRs, and reveal emerging actionable intelligence; will 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/Project: 0602120A/H15; 0602270A/442; and 0603772A/243.			
Small Business Innovative Research/Small Business Technology Transfer Programs		12	
Total	7469	6962	7105

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602303A - MISSILE TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	66141	60935	48174	48194	49097	43327	44247
214	MISSILE TECHNOLOGY	46032	52689	48174	48194	49097	43327	44247
223	AERO-PROPULSION TECHNOLOGY	10749	4768					
G02	Army Hypersonics Applied Research	2000						
G04	AIR DEFENSE TECHNOLOGIES (CA)	1598						
G05	MISSILE TECHNOLOGY INITIATIVES (CA)	4164	3478					
G06	UNMANNED SYSTEMS TECHNOLOGIES (CA)	1598						

A. Mission Description and Budget Item Justification: This applied research program element (PE) designs and develops advanced component technologies for missiles, rockets, and launch systems for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The overall objectives of the PE are to develop technologies which 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. A major cross-cutting theme is developing missile technologies that are smaller, lighter weight, and more affordable. Major technology areas include missile guidance systems, multi-spectral seekers, high fidelity simulations, missile aerodynamics and structures, missile propulsion (including efforts to help solve the insensitive munitions requirements for missiles), hypersonic/hypervelocity missile efforts, and the development of a common high-gravitational force (high-G), low cost, Micro Electro-Mechanical System (MEMS) Inertial Measurement Unit (IMU). The major efforts include the high-G MEMS IMU program (which is designing and developing affordable, reliable precision guidance components for missiles and guns at a significantly lower unit cost and smaller size than current systems) and integrating a GPS receiver with the IMU in a deeply-integrated guidance and navigation unit (DIGNU). The performance and small packaging goals enable the components to meet the requirements of 90 percent of Department of Defense guided munitions and missiles. The high-G MEMS IMU/DIGNU program is a collaborative project between the US Army Armament Research, Development, and Engineering Center (ARDEC) and US Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC). Another major thrust in the PE is to investigate and develop small, lightweight force protection technologies needed to cost effectively counter the rocket, artillery, and mortar (RAM) threats to the Current and Future Force. The Extended Area Protection and Survivability (EAPS) program investigates and develops the interceptor and fire control technologies necessary to provide the Future Force with an active defense against RAM. In addition, the Smaller, Lighter, Cheaper (SLC) Tactical Missiles effort explores technologies to reduce the cost and logistics burden of precision munitions. This program's goal is to reduce the cost per kill of precision guided missiles and munitions, through the innovative application of technology in concert with more efficient production and integration processes. An important thrust is developing new approaches to ensure future tactical missiles can meet insensitive munition (IM) requirements. This helps insure the safety of Soldiers from unintentional detonation of munitions and missiles. This project is also funding sensor technologies for integration with ARDEC warhead and fuze technologies for both missile and gun applications. The Army Hypersonics Applied Research program explores and developes the critical technologies required for force protection against Unmanned Aerial Vehciles and rotary wing aircraft. Projects 223 and G05 support Congressional special interest items. This PE contains no duplication with any effort within the Military Departments. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center,

Redstone Arsenal, AL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602303A - MISSILE TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	77276	53038	48324
Current BES/President's Budget (FY 2009)	66141	60935	48174
Total Adjustments	-11135	7897	-150
Congressional Program Reductions		-403	
Congressional Rescissions			
Congressional Increases		8300	
Reprogrammings	-9431		
SBIR/STTR Transfer	-1704		
Adjustments to Budget Years			-150

FY07 funds were reprogrammed to higher priority efforts.

Five FY08 congressional adds totaling $8300 were added to this PE.

($800) LENS XX Hypervelocity Ground Testing
($1000) Materials Application Research Center
($1000) Novel Lgtwt Armor Material f/Insensitive Munitions
($1500) Jam Resistant Technology for INS/GPS Precision
($4000) MARIAH II Hypersonic Wind Tunnel Develpment Program

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602303A - MISSILE TECHNOLOGY**	**214**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
214 MISSILE TECHNOLOGY	46032	52689	48174	48194	49097	43327	44247

A. Mission Description and Budget Item Justification: This project focuses on missile and rocket technologies that support lightweight, highly lethal weapons concepts with greatly reduced logistics requirements for Future Modular Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Major technology areas investigated are missile guidance systems; 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. Program objectives are to develop enabling technology that enhances the survivability of launch systems, provides greater effectiveness under adverse battlefield conditions, increases kill probabilities against diverse targets, and provides advanced simulation and virtual prototyping analysis tools. A major effort in this project is to design and develop the high-gravitational force (high-G), low cost Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU), and to design, develop, and integrate a GPS receiver with the IMU in a deeply-integrated guidance and navigation unit (DIGNU). The Army is the service lead in the development of low-cost MEMS IMUs capable of supporting precision guidance requirements of Department of Defense's missile and gun launched precision munitions programs. This is a collaborative effort with the US Army Armament Research, Development, and Engineering Center at Picatinny Arsenal. The DIGNU effort is to develop and demonstrate an Inertial Sensor Assembly (ISA) with the same 1.0 deg/hr, and greater than 20,000G survivability requirements of the initial IMU program with an additional "deeply-integrated" or "deeply-coupled" Selective Availability and Anti-Spoofing Module (SAASM)-based GPS military receiver. The goal of the DIGNU incorporates a single microprocessor architecture and integrated hardware and software anti-jam (AJ) capability. The Smaller, Lighter, Cheaper (SLC) Tactical Missile effort focuses on component technology to reduce the cost and logistics burden of precision munitions. This effort's goal is to reduce the cost per kill of precision guided missiles and munitions, through the innovative application of technology in concert with more efficient production and integration processes. The SLC effort includes a partnership with the Defense Advanced Research Projects Agency (DARPA) on the design and proof of principle of the Close Combat Lethal Recon (CCLR) system, a 5 lb, Soldier-launched, loitering munition (two minute duration/two km radius) for use over and around buildings and other obstructions in non-line-of-sight environments. The DARPA portion of the CCLR effort is funded under PE 0603766E. Guidance Electronics Miniaturization (GEMS), is working to significantly reduce the size, weight, and cost of guidance electronics. GEMS incorporates commercial electronics miniaturization (die stacking, wafer thinning, etc.) and seeks to develop technologies to use the electronics substrate as the chassis, wiring harness, and printed wiring board for the electronics. Each of these elements is being incorporated into a series of Integrated Guidance Units (IGU) which consist of a guidance computer and an IMU. An important thrust is developing new approaches to ensure future tactical missiles can meet insensitive munition (IM) requirements. This helps insure the safety of Soldiers from unintentional detonation of munitions and missiles. Solid propellant formulations along with improved, high performance rocket case materials, and rupture mechanisms are being investigated. Also included in this project is the Extended Area Protection and Survivability (EAPS) program, which develops the component technology necessary to provide the Future Force with an active defense capability against rockets, artillery, and mortars (RAM). Major products of this PE generally transition to PE 0603313A (Missile and Rocket Advanced Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
High-G Micro Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU): In FY07, continued to investigate methods to	4475	3100	

get tactical grade performance across all environments. Increased built-in-test capabilities, iterated IMU design to get improved performance under vibration, iterate gyro, and accelerometer design to handle canard shock, improved processes to increase sensor yields, and increased automation of test and calibration capabilities. In FY08, perform bench testing and a missile and munition flight test of the final Phase 3 IMUs and analyze and evaluate their performance.			
Embedded Deeply Integrated Guidance & Navigation Unit (eDIGNU) Technology Advancements: The DIGNU is being developed in phases with performance being increased and size being decreased for each successive phase. In FY07, designed and developed a partial system-on-a-chip (SOC) to give DIGNU Phase 3 the smallest volume. Miniaturized GPS receiver and AJ hardware, added frequency excision AJ, miniaturized SAASM, and migrated to an improved microprocessor. In FY08, perform field tests and laboratory characterization on DIGNU Phase 3s including anti-jam capability; further miniaturize the anti-jam module. The DIGNU Phase 3s test against the following parameters: gyro bias less than one deg/hr, volume less than six cubic inches, acceleration bias less than one milli-G, greater than 90 db J-to-S and gun-hardened to 20,000G. In FY09, Will test different platforms, dynamics, and mission envelopes. Will test flight scenarios with hardware-in-the-loop. Will conduct government test and evaluation on inertial sensor, deep integration algorithms, DIGNU anti-jam capability, GPS receiver, and interaction of all these pieces. Phase A deliveries include twelve IMUs and two DIGNUs.	5104	5731	6630
Smaller, Lighter, Cheaper (SLC) Tactical Missiles: SLC reduces precision missile cost per kill and logistics burden via innovative technology application. In FY07, completed Multi-Purpose Warhead (MPW) design and began testing against each target type. Initiated design of miniaturized electronics for automated fuze timing to maximize lethality against different target sets without launcher system modifications. Completed architecture studies for miniaturized Guidance Electronic Unit (GEU) initial designs for Close Combat Lethal Recon (CCLR), Javelin Block II GEU, and Command Launch Unit (CLU). Supported and evaluated DARPA_s development of the CCLR system (5 lb Soldier-launched, loitering munition) including initial warhead, safe and arm (S&A) design, and performed trade studies for adding an uncooled non-gimbaled IR seeker, and assessment of handheld viewer functionality. In FY08, complete component sled testing of the MPW designs support system tandem testing, Finalize design, fabricate, and test miniaturized GEU and seeker technologies for application and insertion into future precision weapon systems. Identify requirements, conduct COTS trade studies, and complete a rate sensor design package for a form, fit and function upgrade to the TOW Gyro. Complete design of uncooled non-gimbaled IR seeker, if trades show feasibility. Finalize design, develop, and fabricate CCLR warhead and S&A, continue to demonstrate and evaluate technologies and system concepts for CCLR requirements. In FY09, will leverage latest in nanotechnology and electronics packaging to achieve small, light, missile form factors to meet urban and emerging threats. Will conduct trades, build prototype designs and test SLC components in relevant environments. Will mature SLC technologies to transition PM Close Combat Weapon System (CCWS) family of missile systems. Will Test small, low cost, ungimbaled see	5900	7000	5500
Missile Guidance Systems and Seeker Technology: In FY07, evaluated uncooled IR concepts and demonstrated prototype configurations. Fabricated and tested passive phased sub-array from optical phase shifters and initiated transition to provide lower cost IR seekers. Integrated countermeasure algorithms and optics in a seeker and performed hardware-in-the-loop testing. Spiraled in die stacking/thinning into Block 2 Inertial Guidance Unit (IGU); built, tested, and compared to IGU baseline performance. Transitioned new vehicle target algorithm to Non-Line-of-Sight Launch System prime contractor for Precision Attack Missile (PAM) target tracker. In FY08, spiral upgrade vehicle target algorithm and initiate Human Tracking Technology (HTT) development for anti-personnel weapon systems. Transition initial HTT to the Close Combat Lethal Recon (CCLR) system. Build and test Phased Arrays for Tactical Seekers (PATS) sub-arrays. In FY09, will transition upgraded HTT to CCLR. Will incorporate physics-based versatile/accurate models of threat targets and environments simulation scenes for enhanced algorithm development, tracker, and Automatic Target Acquisition/Recognition (ATA/R) optimization. Will fabricate an IR seeker with strap-down electronically stabilized imager. Will transition quantitative determination of	12984	13404	12332

Automatic Target Detection (ATD)/Automatic Target Recognition (ATR) performance versus Synthetic Aperture Radar (SAR) image resolution to UAS and tactical missile developers.			
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. In FY07, completed a hybrid patch approach for clutter statistics in order to progress simulation technology toward a fully predictive scene generation capability that provides accurate and high fidelity simulated scenes for missile seeker simulations. Extended aerodynamic predictive techniques by validation of Navier-Stokes equation solvers with detailed measurements of supersonic, reacting airflows. In FY08, complete infrared solar spectrum requirements analysis and feasibility studies to fill the gap that exists in missile solar exposure simulation and testing. Install and test HWIL simulation control software in a range of simulation capabilities and will extend aerodynamic prediction techniques for evaluating novel aerodynamic shapes. In FY09, will complete initial spectral and optics/platform designs and begin IR radiation component development for solar exposure simulation and test. Will extend HWIL simulation control software to improve user capabilities and extend aerodynamic prediction techniques to address fully turbulent, short correlation length, unsteady flows.	2780	3431	3334
Smart, Stealthy, Smokeless Missile Propulsion, Smart Structures and Enhanced Lethality: In FY07, completed testing of Variable Area Nozzle (VAN) motors and updated design concepts and subsystem integration test to demonstrate projected increase in performance and decrease in sensitivity of the motor. Demonstrated a compact combined effects warhead which has been integrated into a tandem warhead missile system against a state-of-the-art target set. Investigated and evaluated the integration of warhead concepts into tactical missile systems. In FY08, investigate new propellant formulations that operate efficiently over extreme temperature ranges. Demonstrate a fully integrated dynamic Hardened Combined Effects Warhead with enhanced blast and fragmentation characteristics against heavy armor and MOUT targets. Design, fabricate, and test 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 (APS). In FY09, will formulate propellant candidates designed to operate efficiently in extreme temperature ranges in coordination with PE 602624 (Scalable Technologies for Adaptive Response). Will evaluate multi-mode warhead characteristics using multi-point initiation concepts to control the energy deposited on the target in order to determine/characterize optimum fuzing scheme against specific classes of threats. Will perform initial investigation and analysis of variable yield warhead/explosive technologies to vary the effects on target and minimize collateral damage.	6226	8240	7278
Insensitive Munitions (IM) Research: In FY07, evaluated existing and new energetic ingredients for beneficial insensitive munition characteristics. Conducted formulations studies for emerging oxidizers, thermal additives, and nitramine replacements. Applied emerging materials/concepts to canister/case design. In FY08, conduct ballistic/aging evaluation on new formulations. Develop integrated passive venting designs and characterize performance of lightweight barrier concept to impact and thermal threats. In FY09, will demonstrate mitigation of IM response to impact threats of a high performance motor through the use of lightweight barrier. Will 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. Will demonstrate improved IM response to thermal threats of high performance motor with new propellant formulation and integrated venting.	1300	1100	1100
Defense Against Rockets, Artillery and Mortars (RAM) - Interceptor Development: In FY07, completed designs and fabrication and test propulsion subsystem. Completed fabrication, and testing of the interceptor sensors and control systems. Updated system simulations and developed interceptor performance specification. In FY08, complete testing of sensors and control systems, update system simulations, develop integrated interceptor design, and begin integrating prototype component technologies. In FY09, will fully integrate component technologies into prototype interceptors and perform hardware-in-the-loop testing. Will incorporate the results of all testing into update-error budgets and system level simulations. Will exercise the simulations to evaluate interceptor performance in expected operational	4000	9700	7000

scenarios. This project transitions into Defense Against RAM efforts in PE 0603313A Project 263.			
Defense Against Rockets, Artillery and Mortars (RAM) - Fire Control and Systems Architecture: In FY07, began fabrication and bench and field testing of critical short range surveillance and fire control sensor technologies. Transitioned these technologies to PE 0603313A (Missile and Rocket Advanced Technology), Project D704.	3263		
Multi-Role Missile Engine and Missile Component Design - In FY09, will design and develop new ground and air defense missile concepts based on the integration of breakthrough component tests. Will demonstrate critical underlying component technologies (e.g. seeker, propulsion, and lethal mechanisms) in laboratory and field environments.			5000
Small Business Innovative Research/Small Business Technology Transfer Programs		983	
Total	46032	52689	48174

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602307A - ADVANCED WEAPONS TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	25996	32705	19664	19499	20218	20669	21134
042	HIGH ENERGY LASER TECHNOLOGY	21252	19194	19664	19499	20218	20669	21134
NA5	Advanced Weapons Components (CA)	4744	13511					

A. Mission Description and Budget Item Justification: This applied research program element (PE) investigates advanced technologies for Future Force High Energy Laser (HEL) weapons technology. The major effort under this PE is the development of multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory device technologies as part of the Joint High Power Solid State Laser (JHPSSL) effort that can be integrated into HEL weapon systems to provide increased ground force protection. The JHPSSL effort is co-funded by the Army, Air Force, and the High Energy Laser Joint Technology Office (HEL JTO). HEL systems are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At 100 kW weapon system power levels, SSL technology has the potential to address the following Army capability gaps: 1) Defeat In-Flight Projectiles such as rockets, artillery, mortars, unmanned aerial systems, anti-tank guided missiles, and man-portable surface-to-air missiles; 2) Ultra-Precision Strike with little to no collateral damage; 3) Disruption of Electro-Optical (EO) and Infra-Red (IR) sensors; 4) Neutralizing surface-laid mines and other ordnance from a stand-off distance; and 5) Ultra precise lethal / non-lethal effects against a wide variety of targets. This SSL technology effort 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. Project NA5 funds congressional special interest items. Work in this PE is related to, and fully coordinated with, efforts in PE 0602890F and PE 0603924F (HEL JTO), PE 0605605A (DoD High Energy Laser Systems Test Facility (HELSTF)), PE 0602120A (Army Research Lab Laser Work), and PE 0603004 (Weapons and Munitions Advanced Technology), Project L96. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602307A - ADVANCED WEAPONS TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	24061	19342	19791
Current BES/President's Budget (FY 2009)	25996	32705	19664
Total Adjustments	1935	13363	-127
Congressional Program Reductions		-237	
Congressional Rescissions			
Congressional Increases		13600	
Reprogrammings	2613		
SBIR/STTR Transfer	-678		
Adjustments to Budget Years			-127

FY 2007 +2.6M reprogramming for High Energy Laser Technology Demonstrator

Four FY08 congressional adds totaling $13600 were added to this PE.

($1000) Remote Video Weapn Sight, USSOCOM Phase III
($1600) Unmanned Systems Technology Development
($5000) Army Missile and Space Technology Initiative
($6000) Missile Aero-propulsion Computer System (MACS) Modernization

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602307A - ADVANCED WEAPONS TECHNOLOGY**	**042**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
042 HIGH ENERGY LASER TECHNOLOGY	21252	19194	19664	19499	20218	20669	21134

A. Mission Description and Budget Item Justification: This applied research project investigates advanced technologies for Future Force High Energy Laser (HEL) weapons technology. The major effort under this project is the development of multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory device technologies as part of the Joint High Power Solid State Laser (JHPSSL) effort that can be integrated into HEL weapon systems to provide increased ground force protection. This SSL technology effort 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 testing and analysis against a variety of targets; and effectiveness against low-cost laser countermeasures. Initially, a 100 kW SSL and additional HEL technology components will be refined and upgraded to transition into an integrated SSL weapons system demonstrator that will be developed in PE 0603004A, project L96. A secondary effort in this project assesses future laser designs that utilize eye-safe fiber optic lasers. Fiber optic lasers provide excellent beam quality, greater than 35 percent electrical to optical efficiency, and allow for compact packaging that enables integration on 20-30 ton combat vehicles. This effort is also developing adaptive optics technologies and advanced components to increase the defended area that a HEL weapon system could protect. This project also supports laser lethality and propagation assessments against various targets in different environments at tactical ranges both at the High Energy Laser Systems Test Facility (HELSTF) and other laser test facilities, using appropriate lasers and existing assets to support validation of performance and propagation models for SSL simulations. SSL efforts continue to leverage other funds provided by the Office of the Secretary of Defense (OSD) HEL Joint Technology Office (JTO), the Air Force, and the Navy to develop multiple technical approaches to reduce program risk and maintain competition. Work in this project is related to, and fully coordinated with, efforts in PE 0602890F and PE 0603924F (High Energy Laser Joint Technology Office), PE 0605605A DOD High Energy Laser Systems Test Facility (HELSTF), PE 0602120A (Army Research Lab Laser Work), and to PE 0603004 (Weapons and Munitions Advanced Technology), Project L96. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Solid State Laser Effects: In FY07, laser lethality assessments were conducted on an expanded target set representative of identified capability gaps. Began integration of validated models into approved Army war-gaming models. In FY08, perform lethality studies of advanced fuses of candidate Rockets, Artillery, and Mortar (RAM) targets. In FY09, will perform lethality studies of advanced warhead and fuses and Unmanned Aerial System (UAS) components.	1437	1500	1500
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 in terms of size, weight, efficiency, affordability, reliability, maintainability, supportability, environmental acceptability (air, land, and maritime), and ruggedness for tactical weapon applications. In FY07, fabricated remaining components, integrated subsystems into laser breadboards, and conducted preliminary performance tests towards integration of two complete 100 kW SSL breadboards. Analyzed best mix of directed energy and kinetic energy technologies against rocket, artillery, and mortar (RAM) targets. Completed the system engineering activities for a System Functional Review of multiple SSL designs that will be incorporated into the High Energy Laser Technology Demonstrator. In FY08, continue laboratory performance testing and increase power output in order to evaluate laser	19815	17156	12164

characteristics and achieve medium power (25 to 50 kW) laser output. In FY09, leveraging joint and other Service funding, as well as technology progress, will complete integration and testing in order to achieve 100 kW performance for evaluation; will select the most promising laser and component technologies for the High Energy Laser Technology Demonstrator (HEL TD); and support systems engineering and ruggedization of the selected SSL Phase 3 technology for use on the mobile HEL TD platform. In FY09, a JHPSSL Phase 3 device will be utilized with an existing beam director at HELSTF to continue evaluation of high power SSL performance at tactical ranges of interest.			
Adaptive Optics and Advanced Component Development: In FY09, the Army, in cooperation with the HEL Joint Technology Office (JTO) and other Services, will research and demonstrate Adaptive Optic (AO) components that would be suitable as a candidate technology for integration into an existing beam control system. This includes development of deformable mirrors (DMs) with high stroke and bandwidth, high power eye-safe illuminators, low-absorbing HEL window and mirror coatings at eye-safe wavelengths, shared aperture optics, and on and off-axis beam director concepts specifically designed for high energy fiber optic laser systems.			5000
High Power Fiber Laser Development: In FY09, will design components for a 25 kW high fidelity fiber laser breadboard. This will be the basis for developing high efficiency (>35%) SSLs that are compatible for integration on future combat system class tactical vehicles, with a goal of demonstrating greater than 100 kW of power in the lab by FY16 at eye-safe wavelengths.			1000
Small Business Innovative Research/Small Business Technology Transfer Programs		538	
Total	21252	19194	19664

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	23921	22903	17048	17603	17969	18376	18794
C90	Advanced Distributed Simulation	9744	10778	11121	11497	11735	11997	12267
D01	PHOTONICS RESEARCH	3486	3974					
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	5365	5767	5927	6106	6234	6379	6527
D14	Advanced Modeling and Simulation Initiatives (CA)	5326	2384					
HB4	IMMERSIVE ENVIRONMENT APPLIED RSCH INITIATIVE (CA)							

A. Mission Description and Budget Item Justification: This program element (PE) funds applied research in modeling and simulation technologies used for training, instrumentation, testing, and demonstration for the Future Force (FF) and the Current Force. It focuses on 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 creation of this electronic battlefield environment requires advanced computer based, mobile, distributed independently or attached with other technologies, embedded and behavioral simulation technologies, and the ability to share these simulations in complex ways such as networking of models, complex data interchange, and collaborative training. The application of this electronic battlefield environment to support training requires applied research in modeling, simulation, and training technologies. This environment helps the Army investigate and refine new warfighting concepts, including the next generation of tactics, doctrine, training techniques, soldier support systems, and system upgrades. Project C90 focuses on advancing component technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by refining technologies for advanced distributed interactive simulation. Project D02 provides applied research in immersive training and learning environments at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California, which leverages the entertainment and game industries in advancing the Army's modeling and simulation technology and applications. This program ensures the transition of the research results of the ICT into the Army technology base and future Army training products. 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 and Simulation Systems), PE 0601104A, (University and Industry Research Centers), and PE 0603007A, (Manpower, Personnel, and Training Adv 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, Orlando, FL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	25001	16654	17131
Current BES/President's Budget (FY 2009)	23921	22903	17048
Total Adjustments	-1080	6249	-83
Congressional Program Reductions		-151	
Congressional Rescissions			
Congressional Increases		6400	
Reprogrammings	-377		
SBIR/STTR Transfer	-703		
Adjustments to Budget Years			-83

Three FY08 congressional adds totaling $6400 were added to this PE.

($800) Development and Simulation for Advanced Troop Protection Concepts in Urban Warfare
($1600) Mobile Medic Training Program
($4000) Boston University Photonic Center

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**	**C90**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
C90 Advanced Distributed Simulation	9744	10778	11121	11497	11735	11997	12267

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. It enhances the use of modeling and simulation as an acquisition and training evaluation tool by providing that 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. Such environments permit the evaluation of new system concepts, tactics, and doctrine, and test requirements with a warfighter-in-the-loop throughout the acquisition life cycle at a reduced cost and in less time. This project develops technologies to support embedded simulation, intelligent forces representation, rapid and cost-effective generation of synthetic environments, simulation interface and linkage technologies, advanced immersive dismounted technologies, intelligent tutoring technologies, and complex data modeling. This project leverages and coordinates 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, Orlando, FL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Live, Virtual, Constructive (LVC) Simulations: In FY07, extended research on rapid creation of complex urban environments including underground structures and game-based environments for training, mission planning, and rehearsal; developed devices required to provide high-fidelity tracking needed for LVC embedded training; developed and integrated into Ground Soldier System prototypes software to add embedded training, mission planning, and rehearsal capability. In FY08, design database scaling and distribution to support embedded training on small footprint computers of current force vehicles; integrate embedded training databases and tracking systems into dismounted Soldier embedded training prototype to support LCV embedded training; design and conduct lab and field demos of small, accurate, low cost, low power tactical engagement simulation sensors to demonstrate LVC embedded training functionality on dismounted Solider systems. In FY09, will integrate live sensors and a virtual/constructive mission rehearsal capability on a current Soldier system prototype; will conduct a field demonstration of integrated LVC embedded training to mitigate risks associated with weight, size, and battery life limitations of Soldier systems.	3012	3000	3383
Modeling and Simulation Training Technologies: In FY07, designed new severe trauma simulation capabilities including advances in the look, feel, and smell of simulated soft tissue, orthopedic, and organ casualties that support combat medic training with realistic battlefield injuries; developed low cost embedded training devices for use on Soldier systems; designed intelligent and adaptive behaviors to represent autonomous systems and enhance the human-intelligent agent team training. In FY08, complete prototype patient trauma simulations in collaboration with Army medical trauma research utilizing advances in material sciences to include realistic skin, flesh, blood, bone, fluids and organs, sensor technologies, and simulated fluid loss technologies; design the use of man-worn immersive systems and reconfigurable mobile immersive systems; conduct experiments using man-worn systems for immersive environments; and conduct experiments using autonomous systems to enhance the human intelligent agent team training. In FY09, will test demonstrators in the	2993	3597	3719

current program of instruction to assess Army medical training effectiveness; will design and develop a mobile immersive training environment that includes the appropriate mix of man-worn systems, locomotion systems, intelligent tutors, human computer interfaces, and the ability to control autonomous agents for team training.			
Collaborative and Immersive Environment Technologies: In FY07, researched an immersive asymmetric warfare training environment for Joint, Interagency, Intergovernmental Multi-National (JIIM) distributed training, mission planning, and rehearsal; conducted experiments to validate the metrics, tools, and methods of the single-user framework and extend it to accommodate a macro-level module for senior level command training; identified methods to represent cultural behaviors/effects within an adaptive learning environment; researched multi-sensory environments to capture and measure human performance to increase learning effectiveness. In FY08, extend JIIM simulation environment for mission planning/rehearsal; integrate geo-specific environments and virtual human agents; enhance the tools and methods of single-user and macro-level training modules; integrate representative cultural behaviors/effects within adaptive learning environments; conduct experiments using multi-sensory environments, virtual humans, and effects for leader and critical thinking development; develop adaptive learning environments for non-kinetic warfare focused training using social simulations. In FY09, will conduct experiments utilizing game based technologies to support a JIIM environment to evaluate training methods and mission planning/rehearsal tools; will expand multi-sensory environment to enable virtual human and intelligent decision support entities to incorporate awareness of trainee actions; will expand training development tools to rapidly portray additional representative cultures; will expand non-kinetic simulation to squad/team level for training and battle command.	3739	3959	4019
Small Business Innovative Research/Small Business Technology Transfer Programs		222	
Total	9744	10778	11121

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**	**D02**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	5365	5767	5927	6106	6234	6379	6527

A. Mission Description and Budget Item Justification: This project enables the transfer and development of simulation and training research results to the Army from program element (PE) 0601104A, Project J08 (Institute for Creative Technologies). The goals for this project are to make training applications widely available and enhance the Army's ability to train any time and any place by researching modeling, simulation, and training technologies for individual and team training and leadership development. Efforts in this project leverage the capabilities of industry and the Research and Development (R&D) community through the synthesis of creativity and technology. This projects designs, develops, and assesses coaching and mentoring tools, social simulations, and the application of emerging photo-realistic rendering algorithms and 3-dimensional signal processing techniques to advanced learning applications. 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. This project leverages and coordinates with 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, Orlando, FL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Immersive Technology Environments: In FY07, conducted concept evaluations of leader training environments with enhanced virtual humans and integrated feedback into design for virtual human component technologies. In FY08, develop and evaluate methods for the portrayal of dynamic effects in mixed reality environments and assess the use of new and emerging display technologies; assess methods to capture trainee physical and emotional responses in the environment. In FY09, will 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 common view of the environment for high fidelity training environments; will design and develop new and flexible display technologies for development of new training environments.	2559	2663	2834
Immersive Technology Techniques: In FY07, designed techniques for creating a learning environment integrating a large-scale social simulation; advanced computer generated coaching and mentoring tools (artificial intelligence) into an immersive simulation environment; assessed concepts and began to design the tool sets that allow training developers to rapidly create or modify immersive learning scenarios; advanced explainable artificial intelligence technology in computer coaches that detect learner impasses and provide advice and corrections to learners as they use training systems; designed tools for rapid simulation development. In FY08, mature intelligent tutoring, computer coaching, and rapid simulation development tools; integrate virtual humans with large-scale social simulations; create simulation environment in which social and anthropological data and knowledge is used to affect virtual human behavior and hence shape the educational experience for a trainee to achieve the defined learning objectives established for a program of instruction. In FY09, will explore techniques for developing distributed asymmetric tutoring and coaching methods to support team training, performance	2806	2943	3093

assessment and, team after action reviews; will expand single student tutoring capabilities to distributed multi-student and team assessments and reviews.			
Small Business Innovative Research/Small Business Technology Transfer Programs		161	
Total	5365	5767	5927

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	88749	93622	55234	59496	64024	65210	64449
C05	ARMOR APPLIED RESEARCH	9155	9387	15489	18883	21940	22168	20416
H77	ADV AUTOMOTIVE TECH	13922	13902	14226	14400	14517	14862	15219
H91	TANK & AUTOMOTIVE TECH	30142	29709	25519	26213	27567	28180	28814
T26	Ground Vehicle Technologies (CA)	11030	21255					
T31	NAT'L AUTO CENTER APP RES INIT (CA)	24500	19369					

A. Mission Description and Budget Item Justification: This program element (PE) researches develops, and applies combat vehicle and automotive component technologies that enhance survivability, mobility, sustainability, and maintainability of Army ground combat and tactical vehicles. As combat vehicle systems become smaller and lighter, and tactical vehicles are more often exposed to combat conditions, one of the greatest technological and operational challenges is providing adequate crew protection without reliance on heavy passive armor. This challenge will be met using a layered approach that includes long-range situational awareness, advanced lightweight opaque and transparent armors, active protection, and multi-spectral signature reduction. Project C05 focuses on designing, fabricating, and evaluating performance of add-on lightweight armor packages as well as improving heavy integrated armor on current force platforms (i.e. Abrams). Lightweight armor is designed as (A-kits and B-kits) where the A-kits provide structural support to carry the minimum automotive loads and B-kits are added to the A-kit as an armor system to provide appropriate ballistic protection and can be upgraded over life time of vehicle. Lightweight armors and improved integrated armors are needed to provide both tactical wheeled and combat vehicles protection against Chemical Energy (CE) , Kinetic Energy (KE), and landmine threats with less than one fourth the weight of current heavy armor. Armor components are developed and demonstrated for application to the Future Force combat and tactical wheeled vehicles and offer transition opportunities for the Current Force platforms as described in PE 0603005A (Project 221). Project H77 funds the National Automotive Center (NAC). The goal of the NAC is to leverage large commercial investments in automotive technology, research, and development by pursuing automotive-oriented technology programs that have potential benefit to military ground vehicles. Project H91 assesses a variety of enabling technologies in the areas of hybrid electric propulsion, mobility, thermal management, intelligent systems, vehicle diagnostics, fuels/lubricants, and water purification. Future Force combat and tactical wheel vehicles are being designed with hybrid electric architectures, advanced high power density engines, and auxiliary power units that provide power for propulsion, control systems, communications, life support systems, electromagnetic (EM) armor, Soldier battery charging, as well as exportable power for other systems. Project H91 also develops and evaluates hybrid electric propulsion and electronic vehicle component technologies, which are key enablers for achieving Future Force and enhanced Current Force capabilities. In the near term, Project H91 designs and fabricates components and conducts experiments to determine/validate performance of these devices and various subsystems used in Future Force vehicles and, where possible, as improvements in current combat and tactical vehicles. Project H91 conducts modeling and simulation (M&S) of Hybrid Electric Vehicle (HEV) performance on tactical wheel vehicles during realistic military missions (duty cycles); designs and evaluates components for improved vehicle performance and mobility including active suspensions, motors, regenerative brakes, vehicle electronics, generators, controllers, hybrid electric architectures, inverters, and lightweight metallic and segmented track. Project H91 performs design and fabrication of components for high temperature/power electronics, high energy density energy storage devices, JP-8 reformation and desulphurization as a fuel source for fuel cells, and Pulse Forming Networks (PFNs) (batteries, switches, inductors, and capacitors) required for electric vehicle mobility and survivability. Over the far term, this effort focuses on components that increase vehicle energy and power levels to accommodate advanced electric weapons (such as lasers, high power microwaves, and electro-magnetic guns) and advanced electric-based protection systems. Project H91 designs and develops ground vehicle diagnostics and

prognostics systems to improve vehicle reliability and maintenance (condition based maintenance). Project H91 also assesses the use of augmented and virtual reality technologies for incorporating data available from local unmanned system assets to enhance the Soldier's local situational awareness and vehicle control in dynamic environments. It assesses the effects of vehicle motion on the Soldier during combat or tactical vehicle operations and how these effects can be mitigated. Project T26 funds congressional special interest items. The PE is coordinated with PE 0602618 (Project H80), the U.S. Marine Corps through the Naval Surface Warfare Center for work on future tactical wheeled vehicles and with other ground vehicle developers within Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation. Products of this program primarily transition to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) for maturation and incorporation into demonstration platforms/vehicles. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE 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. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	91483	53342	49321
Current BES/President's Budget (FY 2009)	88749	93622	55234
Total Adjustments	-2734	40280	5913
Congressional Program Reductions		-620	
Congressional Rescissions			
Congressional Increases		40900	
Reprogrammings	-942		
SBIR/STTR Transfer	-1792		
Adjustments to Budget Years			5913

FY09 increased to develop and demonstrate armor components for ground combat and tactical vehicle against advanced emerging threats.

Twenty FY08 congressional adds totaling $40900 were added to this PE.

($800) Digital Engine/Hydraulic Valve Actuation Technology
($800) Nano-Engineered Multi-Functional Transparent Armor
($1000) Extreme-Condition Vehicle Tribology for Military Vehicle Technology at Northwestern University
($1200) Secure Mobile MANET System (HAC); Teamline Secure Mobile MANET System (HASC)
($1600) Automotive Research Equipment Purchase
($1600) Center for Advanced Vehicle Design and Simulations
($1600) Rapid Up-Armor Synthesis and Crashworthiness Design for Improved Soldier Survivability
($1600) SkyPure-Water from Air
($2400) Institute for Advanced Materials and Manufacturing Strategies (IAMMS)
($2800) Development of Logistical Fuel Processors to Meet Army/TARDEC/TACOM Needs
($2800) Quick Reaction Advanced Tactical Vehicle Technology
($3200) DoD Hydrogen PEM Fuel Cell Medium/Heavy Duty Vehicle Demonstration Program
($1000) Light Utility Vehicle
($1600) Advanced Manufacture of Lightweight Materials and Components
($1600) Military Fuels Research
($2000) Advanced Digital Hydraulic Hybrid Drive System
($2400) Globally Accessible Manufacturing and Maintenance Activity (GAMMA)
($2400) Tactical Metal Fabrication System (TacFab)
($4000) Hydraulic Hybrids, Advanced Materials, and Multi-fuel Engine Research (HAMMER) program

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**C05**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
C05 ARMOR APPLIED RESEARCH	9155	9387	15489	18883	21940	22168	20416

A. Mission Description and Budget Item Justification: This project investigates, designs, and evaluates advanced armor materials, advanced structural armors, ballistic defeat mechanisms, and armor packaging concepts to achieve lightweight, ballistically-superior armors/structures that provide the last line of defense for the Future Force vehicles and Current Force combat and tactical vehicles. The effort also provides analysis, modeling, and characterization of advanced armor solutions designed to protect against existing and emerging threats, including collateral damage from residual debris generated by Active Protection Systems (APS) threat defeat mechanisms. The Vehicle Armor Protection for Lightweight Combat Systems effort designs, fabricates, and evaluates performance of integrated and add-on lightweight armor packages (A-kits and B-kits) or vehicle protection treatments that reduce weight, reduce space claims, and lower the cost for protection against medium Kinetic Energy (KE) projectiles, Chemical Energy (CE) warheads, Explosively Formed Penetrators (EFPs), and blast fragments from mines. These will be used in Future Force vehicles as well as spun out to Current Force vehicles. Goals are to provide base armor to defeat heavy machine guns and residual fragments from APS intercept events at 20 lbs/sq.ft. (or less); armor packages to defeat limited rocket propelled grenades (RPGs) and medium caliber KE at 40 lbs/sq.ft. (or less); and novel frontal armors to defeat heavier threats at 80 lb/sq.ft. for Future Force Vehicles (reducing this to 60 lb/sq.ft. for future insertion/upgrades). The Armor for Tactical Wheeled Vehicle (TWV) Survivability effort designs, fabricates, and evaluates structural and add-on armors for tactical vehicles and investigates and characterizes effects of mine blasts on lightweight vehicles. Work conducted in this project provides armor components that are matured and demonstrated in the TWV Survivability effort described in PE 0603005A (Project 221), focusing on armor for protection from small arms and countermine applications, where possible, as add-on enhancements/upgrades. International cooperative research in mine blast characterization and vehicle response is also conducted. The armor technologies designed and fabricated in this project complement innovative non-armor survivability capabilities funded in Project H91. Efforts are fully coordinated with and complementary to work performed under program element (PE) 0602618A (Ballistic Technology) and PE 0602105A (Materials Technology). Products from this project generally transition to PE 0603005 for advanced demonstration. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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, MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Vehicle Armor Protection for Lightweight Combat Systems: In FY07, evaluated performance of future armor concepts for ballistic protection; demonstrated candidate armors against FCS objective threats to include small arms, medium caliber KE, and fragment defeat; applied and validated modeling and simulation tools; continued electromagnetic armor evaluations; and conducted experiments to determine the best solutions for integrating ballistic, signature management, and related survivability technologies. In FY08, demonstrate optimized third 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 Force combat vehicles; conduct ballistic tests to verify final armor designs and integrate into second generation full sized concept vehicle structure (spaceframe demonstrator). In FY09, will develop enhancements to ground vehicle armor and mine kits to reduce weight and meet objective and emerging threats. Conduct and report armor space and weight trade studies to support next generation add-on armor solutions. Assess blast modeling and simulation tool(s) capability for full platform level simulation with a human response component.	8542	8522	8876

Armor for Tactical Vehicle Survivability: In FY07, evaluated advanced armor materials for tactical vehicles; evaluated performance of a lightweight blast/fragmentation add-on armor under live-fire conditions. In FY08, continue assessment of new armor solutions for implementation in the associated PE 0603005A TWV Survivability effort. In FY09, will conduct final armor assessments of potential candidates for spiral insertion.	613	642	647
Armor Materials: In FY09, will assess Reactive Armor and Electromagnetic Armor designs developed by ARL under PE 0602618 (Project H80) for defeat of emerging KE and CE threats. Demonstrate tools and techniques for Non Destructive Evaluation (NDE)/Non Destructive Inspection (NDI) tools for dissimilar material joints. Assess M&S tools for vehicle level analysis to harden combat vehicles to collisions and blast threats.			5966
Small Business Innovative Research/Small Business Technology Transfer Programs.		223	
Total	9155	9387	15489

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**H77**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H77 ADV AUTOMOTIVE TECH	13922	13902	14226	14400	14517	14862	15219

A. Mission Description and Budget Item Justification: This project funds the National Automotive Center (NAC), which leverages commercial investments in automotive technology research and development. NAC conducts shared government and industry technology programs that focus on benefiting military ground vehicle systems. Component technologies being developed in this project support the combat and tactical vehicles in the Army's Current and Future Modular Force. Improvements in the Current Force are expected to rely heavily on leveraging commercial technologies for advances in operational capabilities and reduced cost. The NAC serves as a catalyst, linking industry, academia, and government agencies in the development and exchange of automotive design and component technologies. The NAC core program is focused in two primary areas: Advanced Automotive Technology (AAT), and the Future Tactical Truck System (FTTS) Advanced Concept Technology Demonstrator (ACTD). A major effort in AAT is the application of Hybrid Electric Drive (HED) for tactical and light combat vehicles to improve fuel economy and mobility. Another major effort in AAT is fuel cell research, addressing fuel cell design and the equipment required to convert battlefield hydrocarbon fuels into hydrogen that is needed for fuel cell operation. AAT also includes efforts that address fuel efficiency, vehicle modernization (suspension and structures), crew safety, maintenance, reliability, diagnostics and prognostics, network centricity, wireless communications, logistics improvement and manufacturing innovation with an overall goal of improving performance and endurance of ground vehicle fleets and reducing vehicle design, manufacturing, production, operating, and support costs. The FTTS ACTD, completed in FY07, implemented and evaluated a number of advanced automotive technologies, which the Army and commercial sector have matured over the last decade, into tactical support vehicles. The FTTS ACTD test results validated performance models, refined user requirements for tactical trucks, and reduced risk of insertion of certain advanced technologies into current and future tactical vehicle platforms such as the Joint Light Tactical Vehicle (JLTV). Some activities of the NAC are supported by other government agencies via Memoranda of Agreement (MOA) and Memoranda of Understanding (MOU). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Advanced Automotive Technology: In FY07, implemented embedded diagnostics on current tactical vehicle platforms; integrated wireless sensor capabilities to provide oil analysis, tire pressure, and battery analysis; initiated integration of hybrid-hydraulic technology on TWV; developed inline oil sensing technology to provide condition data including viscosity, oxidation, lubricant contaminants; initiated vehicle integration efforts for fuel cell Auxiliary Power Unit (APU). In FY08, develop thermoelectric power modules using waste exhaust heat to power low current sensing devices on relevant TWV platforms; develop inline oil sensing technology to provide condition data including viscosity, oxidation, and lubricant contaminants; expand hybrid-hydraulic hybrid technology effort to include demonstration on a light tactical vehicle platform; expand fuel cell Auxiliary Power Unit (APU) development to include on-vehicle demonstration. In FY09, will evaluate the FY08 thermoelectric power modules on relevant TWV platforms; conduct technology evaluation of fuel cell APU; expand mobile micro-grid technology development program with large scale technology demonstration; continue crash modeling and safety design for TWV's. Conduct qualification experiments for alternative fuels program for ground vehicle systems. Assess available automotive industry suspension technologies for axels and structural support improvements for ground combat and tactical wheeled vehciles.	12922	13709	14226

Future Tactical Truck System (FTTS) ACTD: In FY07, finalized safety certification testing for the Utility Variant (UV); completed the Military User Assessment (MUA) with both the Maneuver Sustainment Variant and UV vehicles; supported the MSV and UV vehicles during a residual phase during which further user evaluation was conducted. Results of the FTTS ACTD fed requirements for development of the JLTV.	1000		
Small Business Innovative Research/Small Business Technology Transfer Programs.		193	
Total	13922	13902	14226

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**H91**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H91	TANK & AUTOMOTIVE TECH	30142	29709	25519	26213	27567	28180	28814

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 current and future combat and tactical vehicles. Future Force vehicles and new tactical vehicle designs include hybrid electric architectures, advanced high power density engines, and non-primary power systems that provide power for propulsion, control systems, communications, life support systems, electric-based weapons and protection systems, Soldier battery charging, and exportable power. The Hybrid Electric Vehicle (HEV) Components effort designs, fabricates, and evaluates critical components for energy storage (batteries), power distribution and power management, and conducts experiments to determine/validate performance of the components and various subsystems for potential use in FCS, future tactical vehicles, and, where possible, as improvements in current combat and tactical vehicles. Components developed under this effort are often incorporated into the Power & Energy Systems Integration Laboratory (P&E SIL), funded in PE 0603005A, Project 441, for system maturation. The HEV Experimentation and Assessment effort develops a technical approach to quantify battery state of charge within 5 percent error and the evaluation of the impacts of various power management strategies on fuel economy. The Pulse Power efforts focus, in the near to mid-term, on providing compact, high frequency/high energy/high power density components and devices for Pulse Forming Networks (PFNs) and Pulse Power Supplies (PPS), which are enablers for several advanced electric-based weapon systems, including electro-magnetic gun. The JP-8 Reformation for Military Fuel Cells effort focuses on JP-8 reformation and desulphurization to provide hydrogen on which fuel cells can operate. The goal of the Propulsion-Prime Power/Non-primary Power System (NPS) effort is to design engines and generators and their components with significantly improved performance characteristics, efficiencies, and power densities. The Mobility effort for manned and unmanned vehicles focuses on improving drive component performance and reliability (e.g., running gear, tracks, and suspensions), fuels and lubricants, minefield clearance, counter obstacle bridging, and gap-crossing technologies to reduce logistics burdens associated with sustainment of manned and unmanned combat and tactical vehicles. The Vehicle Survivability effort provides advanced component technologies that contribute to a layered vehicle survivability approach to address emerging threats. This effort includes design and evaluation of active protection and hit-avoidance components, signature reduction materials, tracking/detection components for unmanned systems, and laser protection materials. The Water Generation, Recovery, and Purification effort focuses on reducing the logistics footprint by leveraging emerging technologies. The program designs enhanced water production technology, which can be embedded in combat and tactical platforms to support the individual Soldier and/or create distributed modular water production units. The Intelligent Systems Technology Research effort assesses improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems. It performs applied research in control technologies incorporating drive-by-wire and autonomous mobility in combat and tactical vehicles; use of augmented and virtual reality to help the Soldier better control vehicles in highly dynamic environments; innovative approaches for extreme mobility of small to medium Unmanned Ground Vehicle (UGV) systems to include legged locomotion; minimizing vehicle motion effects for combat and tactical vehicle crews. The Diagnostics/Prognostics for Condition Based Maintenance effort will focus on developing the tools to gather data from ground vehicles that would allow maintainers to diagnose problems more accurately and lead to being able to predict failures before they occur. 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Hybrid Electric Vehicle Components: In FY07, validated significant performance and capability enhancements to SiC components (20 percent increase for inverters and a 100 percent increase for DC-DC conversion in power density) and special high-power/high-energy Li-ion batteries (20 percent increase in power density), allowing for integration into a complete, compact hybrid power management system; designed and fabricated SiC Metal Oxide Semiconductor Field Effect Transistor (MOSFET) motor drive and conducted experiments determining whether components, sub-systems, and systems can operate successfully at the required 110 degrees C without degradation in vehicle performance. This was a collaborative TARDEC and ARL effort. In FY08, design and fabricate high power density DC-DC converter (8kW/l) using SiC MOSFET; demonstrate innovative thermal management technique achieving heat rejection rates of 300 W/cm2 and high inlet coolant temperatures (1100 C) compatible with SiC technologies; conduct computational fluid dynamics analysis on cooling systems to optimize their integration in vehicle platforms.	8995	4684	
Hybrid Electric Vehicle Experimentation and Assessment: In FY07, investigated impacts of various power management strategies on fuel economy including variations to the battery management system. Using battery management system, optimized battery charge state to maximize the recapturing of energy during recharge cycles; exercised the test methodology to provide data for the TWV program; developed and validated M&S tools that predict hybrid electric drive cycle performance with analysis of data on relevant performance characteristics to supports potential TWV HEVs and the TWV Fleet Modernization Strategy. M&S also supported test operating procedure development with simulation excursions and provided data to quantify duty cycles. Additionally M&S was used to analyze the Joint Light Tactical Vehicle variants and determined the optimal set of advanced propulsion system architectures to meet variant Mission Profile requirements in support of the Army/Marine Corps next generation tactical vehicle.	4997		
Pulse Power: In FY07, refined component designs, integrated, and tested to validate performance enhancement and size reduction goals for SiC solid-state switches, pulse charger inverter/rectifier circuits, fast-discharge, high-voltage capacitors, and advanced thermal management technologies. In FY08, increase pulse width of Si and SiC switches by 10X, increase power density of converters by 3X, and increase 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. In FY09, will evaluate first generation pulse switches, power converters, and power, and energy storage. Will 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.	5206	2177	3294
JP-8 Reformation for Alternative Power Sources: In FY07, integrated system components into a functional brass board and tested fuel cell power modules, Proton Exchange Membrane (PEM), High Temperature PEMs (HTPEM), and Solid Oxide Fuel Cells, as well as identified technology gaps in thermal management, load following capabilities, power management, system integration, and overall system requirements. In FY08, optimize and integrate JP8 reformer to transportable system and interface with fuel cell toward meeting the size and signature requirements of the Army. In FY09, will complete integration of JP8 reformer; begin test plan and preliminary fuel cell/reformer system integration for endurance test; begin 1000 hour endurance test on JP8 reformer connected to fuel cell to produce power. Complete addition 250 hour test to include military environmental requirements. Follow on programs will integrate the JP-8 reformers developed with fuel cells to meet auxiliary power and light robotic platform propulsion requirements.	1627	5806	3921
Propulsion-Prime Power/Non-primary Power System (NPS): In FY07, began fabrication of an Opposed Piston Opposed Cylinder (OPOC) engine. In FY08, complete fabrication of the OPOC engine and perform optimization, performance testing and 50 hour NATO durability test demonstration. Initiate concept analyses and designs for low heat rejection, oil cooled, high speed, and high power density engine design. Initiate concept analyses and design of a closed loop controlled fuel injection system for heavy fuel operation to achieve constant power. In FY09, will perform hybrid electric power component test and evaluation for tactical wheeled vehicle; optimize control	2381	7594	9978

strategy for high power density engine design. Will develop, verify, and validate power and thermal management models and simulations; design and begin development of intelligent power and thermal components; generate test and evaluations of intelligent power and thermal management; develop optimal hybridization strategy combining energy storage and power generation components into a non-primary power system.			
Mobility: In FY07, worked with industry to assess the technical and economic barriers to develop a single lubricant; identified key test and evaluation requirements to understand and verify technical barriers; collected relevant economic information; and conducted initial cost analysis. In FY08, complete technical investigations, conduct final cost analysis; complete technical and economic feasibility report for single lubricant technology, develop additives, and identify synthetic base stocks for making a single lubricant that can meet multi-functionality requirement. In FY09 will reformulate, model, redesign, and fabricate high performance bushings using improved materials; install the improved bushings onto standard Abrams track for relative evaluation and conduct vehicle test of the augmented Abrams track to validate track system durability improvements.	1366	1374	1000
Vehicle Survivability (Active Protection/Ballistic Protection /Laser Protection /Minefield Clearance): In FY07, matured countermine mission module prototypes, developed interface/platform baseline requirements, and conducted advanced trials; performed simulation and modeling of advanced survivability technologies for tactical vehicles. In FY08, purchase long lead materials and begin fabrication of advanced survivability technologies, to include active, passive, and laser protection, to address emerging threats.	3584	3142	
Force Projection: In FY07, conducted field experimentation and modeling and system analysis of water from air device. In FY08, develop and test alternative disinfection technology and analyze rate and transformation of water contaminants in order to reduce health risks and improve water quality. In FY09, will integrate water from air system on a mobile platform and demonstrate water production on the move; will assess in-line and hand held water monitoring technology	1730	2070	2870
Intelligent Systems Technology Research: In FY07, conducted M&S to assess improvements to the mobility and local situational awareness tasks of manned ground vehicles resulting from the application of sensing and autonomy technologies; began an analysis based on user requirements for a small robot incorporating legged locomotion to support dismounted operations in complex terrain. In FY08, determine design approaches for displays involving a mix of live video and computer generated graphics, and solutions for the transfer of mobility control between manned driving and autonomous driving modes for manned vehicles, complete the analysis of a small-legged robotic system, and conduct modeling and simulation to explore design approaches; develop and evaluate embedded real-time dynamic mobility models to predict manned and unmanned vehicle responses to prevent unsafe mobility situations while under robotic control.	256	2619	
Diagnostics/Prognostics for Condition Based Maintenance: In FY09, will develop diagnostic and prognostics systems capabilities to monitor/anticipate incipient failures, isolate faults, and identify root-cause of failures for critical power train components on current force ground combat vehicles (i.e. Abrams and Bradley engine and transmission). Will evaluate and identify commercially available monitoring sensor capabilities wired to existing databus technologies. Investigate capability to integrate additional sensors to provide higher resolution as well as architecture to integrate into wireless networks to enable remote monitoring capability.			4456
Small Business Innovative Research/Small Business Technology Transfer Programs.		243	
Total	30142	29709	25519

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602618A - BALLISTICS TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	62516	68899	71550	75526	78694	75831	68118
H03	ROBOTICS TECHNOLOGY	15767	15078	16403	15985	15867	16221	16586
H75	ELECTRIC GUN TECHNOLOGY	4098	3942	4050	4085	4107	4209	4316
H80	BALLISTICS TECHNOLOGY	35872	34640	51097	55456	58720	55401	47216
HB1	SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)	6779	15239					

A. Mission Description and Budget Item Justification: This program element (PE) provides funding for ballistic technologies required for armaments and armor to support the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Projects within this PE will enable lethality and survivability technologies for the Future Force. These technologies will permit US dominance in future conflicts across a full spectrum of threats in a global context. Project H03 focuses on applied research for advanced autonomous mobility technology for future land combat systems. Project H75 focuses on technologies for electric armaments that offer the potential to achieve leap-ahead lethality capability by providing hypervelocity and hyperenergy launch well above the ability of the conventional cannon. It also includes work in hypervelocity penetrator effectiveness that will greatly increase anti-armor capabilities. Project H80 is focused on lethality and survivability technologies, including 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 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).

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

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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602618A - BALLISTICS TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	58568	55014	55736
Current BES/President's Budget (FY 2009)	62516	68899	71550
Total Adjustments	3948	13885	15814
Congressional Program Reductions		-1455	
Congressional Rescissions			
Congressional Increases		15340	
Reprogrammings	4825		
SBIR/STTR Transfer	-877		
Adjustments to Budget Years			15814

FY09 increased to research and investigate armor solutions for Soldier and ground combat and tactical vehicle against advanced emerging threats.

Eight FY08 congressional adds totaling $15340 were added to this PE.

($500) Small Unmanned Aerial Vehicles (UAVs) and Sensors
($800) Beneficial Infrastructure for Rotorcraft Risk Reduction Demonstrations (BIRRRD)
($1200) Multi Mission Armored Watercraft (MMAW) Project
($1600) Advanced Composite Materials Research for Air and Ground Vehicles
($1840) Flexible Solar Cell for Man-Portable Power Generator
($3000) Advanced Composite Armor for Force Protection
($3200) Laser Based Explosives and Chem/Bio Standoff and Point Detector
($3200) Super High Accuracy Range Kit - 105mm Artillery Technology

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602618A - BALLISTICS TECHNOLOGY**	**H03**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H03 ROBOTICS TECHNOLOGY	15767	15078	16403	15985	15867	16221	16586

A. Mission Description and Budget Item Justification: Research in this project advances autonomous mobility technology for the Future Force. The research focuses on investigation of robotics technology critical to the maturation of future Army systems, including unmanned elements of the Future Force and crew aids for future manned systems. It provides the basis for the Collaborative Technology Alliance (CTA) in robotics, which is 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 technologies. Achieving these goals will provide future land combat forces with significant new operational capabilities permitting paradigm shifts in the conduct of ground warfare thereby providing significantly greater survivability and deployability. Technical efforts are focused on advancing perception for autonomous ground mobility, intelligent vehicle control and behaviors; and human supervision of unmanned ground systems. Research products will enable both semi-autonomous and near autonomous unmanned ground vehicles (UGVs) with products transitioning to advanced development efforts. Research 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 Robotics Program and each of the Services. Research supports collaborative efforts with Defense Advanced Research Projects Agency (DARPA).

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

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, developed multi-sensor fusion approaches towards improved perception in dynamic and urban environments and permitted meaningful collaboration by autonomous vehicles (including mixed air and ground assets) utilizing the scout reconnaissance mission as the focus for technology development. In FY08, research improved object recognition and feature detection to enable tactical behavior and initiate creation and integration of mechanisms to adapt to intelligent adversaries. In FY09, will develop technology for scene understanding and autonomous tactical behavior in the context of reconnaissance mission scenarios.	7310	7000	7495
Develop perception and intelligent control technologies required to meet objective capabilities for the armed robotic vehicles and transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle Advanced	4460	3939	4921

Technology) project 515 for integration into test bed systems. Leverage DARPA sponsored research, e.g., Software for Distributed Robotics, for control of collaborating agents to enable mixed teams (manned/unmanned) to conduct military missions. In FY07, conducted research on perception and control technologies that permitted unmanned ground vehicles to safely maneuver in dynamic environments at increasing speeds. In FY08, develop 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, will develop robotics technology that will permit unmanned vehicles to adapt to dynamic situations found in tactical environments.			
Integrate technology on unmanned ground vehicle test beds and conduct extensive field exercises for experimentation, technology characterization, and show 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 experimentation at Ft. Indiantown Gap, PA, and other military facilities to stress technology in complex environments to further focus CTA sponsored research, assess performance, and provide the opportunity for US Army Training and Doctrine Command to initiate early development of the tactics, techniques, and procedures required for successful utilization of unmanned systems in future conflicts. In FY07, evaluated technologies for safe operation of unmanned vehicles in dynamic on- and off-road environments. In FY08, evaluate technologies to enable collaborative operation of near-autonomous unmanned systems, including networked air and ground unmanned vehicles, managed by a single Soldier. In FY09, will evaluate the ability of unmanned ground vehicles to autonomously adapt to dynamic tactical environments.	3997	3750	3987
Small Business Innovative Research/Small Business Technology Transfer Programs		389	
Total	15767	15078	16403

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602618A - BALLISTICS TECHNOLOGY**	**H75**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H75 ELECTRIC GUN TECHNOLOGY	4098	3942	4050	4085	4107	4209	4316

A. Mission Description and Budget Item Justification: This project funds applied research for the Army Electromagnetic (EM) Gun Program. Future combat vehicles will require more lethal, yet compact, main armament systems with significant enhancements in survivability, reductions in logistics footprint and decreases in system signature. 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 EM system technical barriers, in particular 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. In the area of pulsed power, evolve the high strength composite materials critical for compact pulsed alternators. For the launcher, establish and mature technologies needed to incorporate high strength, low density materials necessary for a long life, field-worthy EM cannon. In the area of launch projectiles, 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. The research is conducted at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. The resulting developments are moved directly into the Armament Research, Development, and Engineering Center (ARDEC) where they are being incorporated by industry into an EM gun demonstration system.

Work in this project is performed by ARL.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Pulsed Power: In FY07, established optimal active cooling of high speed pulsed alternator rotors and developed high conductivity materials. In FY08, prove high-strength, low-density, high-conductivity conductor technology and investigate high current switch materials. In FY09, will show capabilities of advanced materials (bandings, conductors, and switches) to reduce pulsed alternator size and mass.	1179	1397	1600
Launcher: In FY07, experimentally validated performance of three meter long 500 kilojoule (kJ) composite electromagnetic launcher with long bore life and transitioned technology to ARDEC.	800		
Projectile: In FY07, launched fully-functional NKEP at 2 megajoules (MJ). In FY08, establish technologies to eliminate arcing at the projectile/launcher interface. In FY09, will demonstrate large-caliber (>5 MJ) kinetic energy and multipurpose projectiles launched from an EM gun.	1032	1300	1300
Full-Scale Hypervelocity Lethality: In FY07, compared reactive material (RM) and high explosive fills at hypervelocity and validated performance of deploying NKEP against realistic targets. In FY08, experimentally validate prototype RM multipurpose round at 2 MJ muzzle energy. In FY09, will demonstrate full scale (>5MJ muzzle energy) RM warhead and transition to ARDEC.	800	800	800
Analysis: In FY07, devised techniques to incorporate EM gun-equipped hybrid vehicles into force-on-force models. In FY08, analyze	287	368	350

utility of EM guns on the battlefield. In FY09, will define the guidance and control parameters needed to increase hypervelocity hit probability.			
Small Business Innovative Research/Small Business Technology Transfer Programs		77	
Total	4098	3942	4050

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602618A - BALLISTICS TECHNOLOGY**	**H80**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H80 BALLISTICS TECHNOLOGY	35872	34640	51097	55456	58720	55401	47216

A. Mission Description and Budget Item Justification: The goal of this project is to provide key technologies required for armor and armaments that will enable US dominance in future conflicts across a full spectrum of threats. The program supports the Army vision by focusing on more lethal and more deployable weapons and on survivability technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The challenge is to ensure combat overmatch and survivability while achieving rapid deployability in a lighter weight platform. Specific technology thrusts include: lightweight armors (Soldier/vehicle) and structures to defeat existing and emerging ballistic threats; universal Active Protection (AP) to defeat/degrade threats before they reach the combat platform; crew and component protection from ballistic shock, mine-blast, and fuel or ammunition fires; insensitive high energy propellants/munitions to increase lethality of compact weapon systems and to reduce propellant/munitions vulnerability to attack; novel kinetic energy (KE) penetrator concepts to maintain/improve lethality while reducing the size/mass of the penetrator; novel multi-function warhead concepts to enable defeat of full-spectrum of targets (anti-armor, bunker, helicopter, troops); affordable precision munitions technologies for launch, flight, and precision strike; and physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies for improved ballistic lethality and survivability. The work is conducted at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD, and provides required technologies for advanced development programs at the Armaments Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, NJ; the Tank and Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

Work in this project is performed by ARL.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies for transition to current and Future Force (FF) vehicle designers (e.g. Joint Light Tactical Vehicle (JLTV) and Future Combat Systems (FCS)). In FY07, experimentally validated integrated add-on ballistic protection technologies that made tactical combat vehicles more survivable; designed and validated armor configurations for Future Force Objective threats. In FY08, develop passive armor designs with lower densities that defeat tactical vehicle threats; experimentally validate optimized second generation armor and structure configurations for Future Force threats; explore novel electrical protection system (EPS) mechanisms for full spectrum defeat. In FY09, will prove passive armor designs that defeat future tactical vehicle threats with further density reductions; experimentally show objective threat defeat at goal vehicle weights; couple modeling and simulation with ballistic characterization to validate third generation armor concepts for Future Force threats.	6300	9408	11808
Develop mine blast, ballistic shock mitigation, and crew protection technologies to enable survivability of current and Future Force platforms, ground tactical vehicles, and the individual Soldier. In FY07, provided design guidance and proven anti-tank (AT) mine blast protection structure/crew system to vehicle designers for ground tactical vehicles; validated technologies to improve flexibility of protection equipment (torso, extremities, neck) for individual Soldier. Accelerated underbody protection to meet objective threat	8607	3500	3550

requirements for future force combat and tactical wheeled vehicles. In FY08, design lightweight, easily installed blast-penetrator protection (to include better seat designs) for occupants of current and Future Force vehicles. In FY09, will devise models for mine protection using Advanced-Electromagnetic Armor (A-EMA) and support experimental 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.			
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&C) technologies to enable smaller, cheaper, and lighter low-collateral-damage precision munitions for future asymmetric operations in Military Operations on Urban Terrain (MOUT). In FY07, modeled and validated extended area active protection system (EAPS) subcomponent technologies by performing integrated critical flight demonstrations of candidate subsystems; developed subcomponent technologies to enable smaller, lighter, cheaper munitions components. In FY08, perform an integrated flight demonstration of a supersonic medium-caliber interceptor; experimentally validate smaller, lighter, cheaper munitions components and transition to development community. In FY09, will address technology that enables precision fires for small unit MOUT operations.	4100	4350	4400
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 Force gun/missile systems and warheads. In FY07, validated selected system using advanced energetic material with tuned energy release (gun/rocket propulsion/multi-purpose warhead) with increased performance while meeting insensitive munitions requirements and applied emerging numerical tools to novel insensitive munitions. In FY08, utilize reactive materials, novel energetics, and nano-structured materials to enhance propellant, igniter, explosive performance, reduce sensitivity, and provide increased multipurpose applications; formulate, evaluate, and characterize propulsion and detonation performance of common low-cost novel insensitive formulations; employ experiments, modeling, and simulation to reduce munitions vulnerability and enhance performance and effectiveness. In FY09, will 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 reduced 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.	5106	4650	4650
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 Force platforms. In FY07, transitioned optimized universal counter-munitions to TARDEC, ARDEC, and AMRDEC; provided database of blast warhead technology versus shaped charge threats. In FY08, develop enhanced explosive warhead technology and experimentally validate the warhead technology versus KE and shaped charge threats.	1529	1600	
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 Force lethality. In addition, investigate technology options for scaling warhead lethality to enhance MOUT war fighting including control of collateral damage. In FY07, conducted full-scale experimental validation of terminal ballistic performance; investigated weapons effects in MOUT environment; experimentally evaluated scalable warhead component technologies and down-selected best technology candidates. In FY08, perform end-to-end validation of Multi-Threat Objective Projectile (M-TOP) warhead; transition M-TOP technologies (including analytic and numerical models for weapons effects) to ARDEC and AMRDEC; develop scalable warhead component technologies and prepare for	4450	4175	3775

possible technology transitions. In FY09, will prove integrated scalable warhead technology for blast, fragmentation, and penetration effects in urban environments.			
Devise state-of-the-art survivability/lethality/vulnerability (SLV) methodologies to dynamically model the interaction of conventional ballistic threats versus Future Force systems. In FY07, completed validation of Operational Requirements-Based Casualty Assessment System (ORCA) for blast and bullets; incorporated improved modeling of bullets, structure debris, and personnel injury metrics into ORCA; proved capability to assess blast loading and target effects using Modular UNIX-based Vulnerability Estimation Suite (MUVES); devised methods to assess multi-hit effects on ceramic armor performance; proved automated analysis capability of APS engagement and residual effects on target; enhanced SLV analysis visualization capability. In FY08, develop methodologies to analyze emerging technologies and survivability in a networked, system of systems context and validate for production use. In FY09, will develop novel blast and combined-effects methodologies for non-traditional, emerging synergistic threats; demonstrate an early MUVES 3 analysis capability, and deliver advanced crew-casualty metrics for assessing body armor.	5780	6733	6938
Armor Materials: In FY09, research and investigate composite ceramic materials to increase body armor performance while reducing weight. For ground combat vehicles, will design and develop reactive armor and electromagnetic armor solutions for defeat of emerging KE and chemical energy threats. Will assess new explosive materials for reactive armors with modeling, simulation, and experiments to characterize performance as well as sensitivity. Will conduct modeling and simulation and experiments of lightweight brass board electromagnetic armor solutions using advanced materials developing in program element (PE) 0602105A to include hybrid armor designs that provide dual threat protection capability. Body armor solutions will utilize material technologies from PE 0602105A, Project H84 and will be assessed and refined in PE 0602786A, Project H98. Reactive armor and electromagnetic armor design solutions will utilize material technologies from PE 0602105A, Project H84 and be assessed and refined in PE 0602601A, Project C05.			15976
Small Business Innovative Research/Small Business Technology Transfer Programs		224	
Total	35872	34640	51097

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602622A - Chemical, Smoke and Equipment Defeating Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	12665	8976	2295	2324	2362	2415	2468
552	SMOKE/NOVEL EFFECT MUN	2158	2220	2295	2324	2362	2415	2468
BA1	Protection Technologies (CA)	10507	6756					

A. Mission Description and Budget Item Justification: The goal of this program element (PE) is to research and investigate smoke and obscurant technologies to increase personnel and platform survivability. This PE funds applied research in materials science and dissemination methodologies and mechanisms to counter enemy weapon target acquisition systems and/or degrade enemy surveillance capability. The obscurant materials and dissemination systems are designed to be effective, safe, and environmentally acceptable. Modeling and Simulation (M&S) tools are developed and used to analyze the ability of newly developed obscurant materials to increase survivability of Soldiers and platforms. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0603004, Project L97. This work is performed by the Army Research, Development, and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602622A - Chemical, Smoke and Equipment Defeating Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	12762	2235	2301
Current BES/President's Budget (FY 2009)	12665	8976	2295
Total Adjustments	-97	6741	-6
Congressional Program Reductions		-59	
Congressional Rescissions			
Congressional Increases		6800	
Reprogrammings	229		
SBIR/STTR Transfer	-326		
Adjustments to Budget Years			-6

Four FY08 congressional adds totaling $6800 were added to this PE.

($1200) Rapid and Accurate Pathogen Identificatlon/Detection (RAPID) Program
($1600) Paint Shield for Protecting People from Microbial Threats
($1600) Systems Biology Biomarker Molecular Toxicology initiative
($2400) Enhanced Vapor Aeration Capabilities (EVAC)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602622A - Chemical, Smoke and Equipment Defeating Technology**	**552**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
552 SMOKE/NOVEL EFFECT MUN	2158	2220	2295	2324	2362	2415	2468

A. Mission Description and Budget Item Justification: Project 552 researches and investigates smoke and obscurant technologies with potential to enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. It investigates advanced infra-red (IR) and multi-spectral obscurant materials with potential to provide effective, affordable, and efficient screening of deployed forces, while being safe and environmentally acceptable. Other efforts within this project advance dissemination, delivery, Modeling and Simulation (M&S), and vehicle protection technology through the use of obscurants and how it spreads to expand survivability options through increased standoff and threat protection. A major effort on dissemination of advanced infrared (IR) obscurants is making improvements to a high performance IR obscurant so the material can be effectively used in smoke pots and grenades. M&S tools are investigated to predict performance and analyze strategic use of obscurants on the battlefield. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Advanced Obscurants: In FY07, refined the loading techniques of IR materials into munitions and evaluated these techniques for their effect on smoke dissemination; evaluated performance of these materials in a laboratory environment. In FY08, perform Modeling and Simulation to determine the survivability increase achieved over current smoke systems; conduct a technology evaluation of selected prototype grenade. In FY09, will expand existing theory to cover entire spectrum of interest, examine alternate theoretical approaches, determine particle characteristics based upon theory, and solicit industry for technological solutions for new high performing, low toxicity visual obscurants. Will conduct studies of spectrally-selective obscurant concepts.	1195	1286	1400
Obscurant Enabling Technology for other smoke capabilities (non IR obscurants): In FY07 investigated novel non-thermal dissemination methods for visual smoke, assessed the impact of contrast reduction on the effectiveness of obscurant materials using modeling and simulation. In FY08, conduct studies to examine performance improvements in low toxicity visual obscurant and new bispectral obscurants. In FY09, will conduct studies of dissemination techniques for low toxicity bispectral obscurants and new bispectral obscurants.	963	900	895
Small Business Innovative Research/Small Business Technology Transfer Programs		34	
Total	2158	2220	2295

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602623A - JOINT SERVICE SMALL ARMS PROGRAM**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	6012	6962	7531	7747	7995	8389	8787
H21	JT SVC SA PROG (JSSAP)	6012	6962	7531	7747	7995	8389	8787
S50	SMALL ARMS APPLIED RESEARCH (CA)							

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops individual and crew-served weapon technologies that enhance the fighting capabilities and survivability of dismounted battlefield personnel in support of all Services. The technology enhancement efforts of this PE assure that the next generation of small arms weapons systems overmatch the evolving threat and address the needs of the Future Force, and, where practical enhance the Current Force. Project H21 funds the development of technologies to improve small arms lethality, utility, and technical fire control via new projectile designs, warheads and target locating, and aiming devices. Joint user requirements for small arms evolved with an emphasis on increased lethality and range accuracy on moving targets. Project S50 funds congressional special interest items. All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), the Joint Capabilities Integration Development System's Small Arms Analyses, and the resulting Capabilities Development Documents of the Services. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This program is managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ. Work conducted under this PE is not duplicated under any other PE but is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), and PE 0603607A (Joint Service Small Arms Program). Transition paths are established in coordination with Program Executive Officer (PEO) Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, USMC PM Infantry Weapons, and PEO Special Operations Forces Warrior (SOF) Programs, U.S. Special Operations Command (SOCOM).

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602623A - JOINT SERVICE SMALL ARMS PROGRAM**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	6178	7008	7571
Current BES/President's Budget (FY 2009)	6012	6962	7531
Total Adjustments	-166	-46	-40
Congressional program reductions		-46	
Congressional rescissions			
Congressional increases	-17		
Reprogrammings	-149		
SBIR/STTR Transfer			
Adjustments to Budget Years			-40

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602623A - JOINT SERVICE SMALL ARMS PROGRAM**	**H21**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H21	JT SVC SA PROG (JSSAP)	6012	6962	7531	7747	7995	8389	8787

A. Mission Description and Budget Item Justification: This project designs and develops individual and crew-served weapon technologies that enhance the fighting capabilities and survivability of dismounted battlefield personnel in support of all the Services. The technology enhancement efforts of this PE assure that the next generation of small arms weapon systems continue to overmatch the evolving threat and address the needs of the Future Force, and where practical, enhance Current Force capabilities. Major efforts in H21 included light-weight small arms technologies, advanced bullet designs and studies, surveillance and tag/ mark munitions, and the assessment of other small arms capabilities. Beginning in FY08, Advanced Lethality Armaments Technology for Small Arms and Advanced Fire Control Technology for Small Arms tasks began. These two tasks each contain emerging applied research efforts improving small arms for the Services warfighters. All Joint Service Small Arms Program (JSSAP) efforts are based upon the Joint Service Small Arms Master Plan (JSSAMP), the Joint Capabilities Integration Development System's Small Arms Analyses, and the resulting Capabilities Development Documents of the Services. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This program is managed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ. 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). Transition paths have been established in coordination with Program Executive Officer (PEO) Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, US Marine Corps PM Infantry Weapons, and PEO SOF Warrior Programs, US Special Operations Command (SOCOM).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Lightweight Small Arms Technologies (LSAT): In FY07, completed weapon and ammunition component evaluation and conducted laboratory testing; tested integrated weapon and ammunition component technologies into weapon system; integrated subsystem 3-D models into a fully functioning system level model for both cased telescoped and caseless ammo applications; maximized modularity of components to facilitate future upgrades.	6012		
Advanced Lethal Armament Technology for Small Arms: In FY08, develop advanced small arms lethality designs; evaluate technology design concepts; model technology improvements for individual warfighter bursting projectiles in conjunction with advanced fuzing techniques; create low weight recoil reduction designs and lab prototype; evaluate and assess technological improvements and their relationship to soldier capabilities through warfighter modeling and simulation tools. In FY09, will assess and apply best technology improvements to FY08 designs; will determine combination of most promising improvements in projectile payloads, control and fuzing; will evaluate proof of principle recoil reduction concepts; will analyze individual and combinatorial improvements of technologies via warfighter modeling and simulation tool set.		3294	3815
Advanced Fire Control Technology for Small Arms: In FY08, determine and develop the best technical approaches for improvements in warfighter rapid range finding against stationary targets; evaluate short time exposure range-finding improvements and their relationship to soldier capabilities through warfighter modeling and simulation tools. In FY09, will evaluate improved ranging accuracy concepts, mounted on individual weapons, against moving targets; will develop concepts to consolidate energy supply of multiple sighting and other devices mounted on the current rail systems;will assess the improvements in automated target location correction for very short time target		3500	3716

exposures; will assess warfighter effectiveness with modeling and simulation tools.			
Small Business Innovative Research/Small Business Technology Transfer Programs		168	
Total	6012	6962	7531

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602624A - Weapons and Munitions Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	120794	102681	30576	30384	30455	31224	31517
H18	ARTY & CBT SPT TECH	12591	14500	12164	14457	17084	17631	17692
H19	CLOSE COMBAT WEAPONRY	7316	5421	7276	4495	1985	2029	2074
H1A	WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	82838	65487					
H28	MUNITIONS TECHNOLOGY	18049	17273	11136	11432	11386	11564	11751

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops improved weapons and munitions technologies to enable combat overmatch for the Future Force and, where feasible, for Current Force enhancements. Efforts in this PE result in increased system lethality and survivability with the potential for lower weight, reduced size, and improved affordability. Project H28 supports the warhead development efforts for the Kinetic Energy Active Protection System (KEAPS), which develops countermeasures for Active Protection Systems (APS) to enhance survivability for lightly armored vehicles. Projects H18 supports the Common Smart Submunition effort, which designs and develops component technologies for next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems. Project H18 supports the Fuze and Power for Advanced Munitions efforts, which enables tailorable warhead effects for increased functionality and develops new on-board munition power systems with increased energy/power densities that extend the range and increase the lethality of future munitions. Another major effort in project H18 is the Insensitive Munition (IM) Technologies Initiative, which focuses on reducing unplanned/accidental detonation of munitions. This work is related to and fully coordinated with IM work at the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD, (Program Element (PE)/Project 0602618/H80) and the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL, (PE 0602303/214). Project H18 also supports Non-Lethal High Powered Microwave (HPM) technology development. Projects H18 and H19 support Multi-mode HPM and Laser Induced Plasma Channel Technology which develops and miniaturizes key directed energy (DE) technologies and subsystems to support DE weaponization with the potential to field leap-ahead capabilities. Projects H18 and H28 develop a scalable warhead yield and propellant technologies for advanced gun launch and thrusters to deliver a broad spectrum of effects ranging from low to high lethality against threat personnel and targets while reducing collateral damage. Project H28 focuses on the design and evaluation of advanced warheads (shaped charge and Explosively Formed Penetrators (EFPs); novel energetics/explosives; and high impetus, low flame temperature propellants to reduce wear on gun tubes. Most products of this PE transition to PE0603004A (Weapons and Munitions Advanced Technology) for maturation and demonstration. Project H1A funds congressional special interest items. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is primarily performed by the Army Armament Research, Development, and Engineering Center at Picatinny Arsenal, NJ, as well as the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	118331	40469	30663
Current BES/President's Budget (FY 2009)	120794	102681	30576
Total Adjustments	2463	62212	-87
Congressional Program Reductions		-3708	
Congressional Rescissions			
Congressional Increases		65920	
Reprogrammings	5307		
SBIR/STTR Transfer	-2844		
Adjustments to Budget Years			-87

Twenty-six FY08 congressional adds totaling $65920 were added to this PE.

($800) Effects Based Operations Decision Support Services (EBODSS)
($1000) Strategic Technology Development and Integration for the Joint Munitions and Lethality Life Cycle Management Command
($1360) CZT-Based Liquid Explosives Detections Systems
($1400) Long Range Initiator
($1600) Advanced Rarefaction Weapon Engineered System
($1600) Hospital Emergency Planning and Integration (HEPI) Letterkenny Army Depot and Chambersburg Hospital
($1600) Ripsaw Unmanned Ground Vehicle Weaponization
($1600) SLEUTH Tungsten Heavy Ailey Penetrator and Warhead Development
($1840) Research for Army Cannon Systems
($2000) Center for Borane Technology
($2000) Renewable Energy Testing Center
($2400) Armament System Engineering and Integration Initiative (ASEI2)
($2400) Development and Demonstration of Multi-use/Urban Operations Joint Training System at Fort Dix
($2400) Electrolytic Super-Capacitor
($2400) Exploding Foils Initiators with Nanomaterial-based Circuits
($2400) Green Armament / RangeSafe Technology
($2400) Mitigation of Energetics Single Point Failures
($2640) Fatigue Odometer for Vehicle Components and Gun Barrels Project Cannon Systems
($3000) Engineered Surfaces for Weapons Life Extension
($3200) Rapid Response Force Protection System (Remote Weapons Platform)
($3200) Remotely Operated Weapons and Sensor Technology

($3280) Army Center of Excellence in Acoustics
($4000) Developmental Mission Integration
($4000) Energetic Formulation and Fabrication
($5600) Advanced Materials & Process for Armament Structures (AMPAS)
($5800) Electroconversion of Energetic Materials

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H18**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H18	ARTY & CBT SPT TECH	12591	14500	12164	14457	17084	17631	17692

A. Mission Description and Budget Item Justification: This project conducts applied research on technologies to enable advanced munitions, submunitions, smart munitions, networked fires, fire control, combat support systems, and cannon fires in support of the Future Force and, where feasible, to enhance Current Force capabilities. Improved smart munitions are pursued to enhance Non Line-of-Sight (NLOS) and area denial capabilities. These munitions can be delivered by a wide range of munition/missile systems with significant increases in lethality effectiveness and number of kills per individual munition/missile to reduce logistic burden. Major efforts include: Common Smart Submunition (CSS), which designs and evaluates component technologies for a next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems; and an Insensitive Munition (IM) Technology initiative, which focuses on identifying, maturing, and applying technologies that will reduce unplanned, accidental, and/or sympathetic detonation of munitions in order to meet IM requirements. The focus of the IM effort conducted within this project is on designing barrier and venting technologies for existing and future gun propulsion systems and developing high energy, IM gun propellants for emerging gun programs. The IM effort also investigates venting mechanisms and IM liner technologies for existing and future explosive projectiles. In addition, it develops predictive models and simulations for IM technologies. Other efforts in this project include: Fuze and Power for Advanced Munitions, which researches and evaluates technologies that reduce munition size and add tailorable effects for advanced munitions; Future Force Gun and Munition Technology, which matures leap-ahead concepts for future armaments, munitions, and energetics and exploits novel nano-structured metal/ceramic materials; High Powered Microwave (HPM) technology for use in non-lethal weapons; the development of propellant technologies for advanced gun launched munitions and thrusters that deliver a broad spectrum of effects ranging from low to high lethality against threat personnel and targets while reducing collateral damage; and Multi-mode HPM and Laser Induced Plasma Channel Technology which develops and miniaturizes key directed energy (DE) technologies and subsystems to support DE weaponization with the potential to field leap-ahead capabilities. Work in project H18 is related to, and fully coordinated with, efforts in projects H19 and H28 (also in program element (PE) 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0600304A (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 U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Common Smart Submunition (CSS): In FY07, conducted full up integration of components/subsystems into prototype tactical munition; executed Technology Readiness Level (TRL) tests to evaluate and establish baseline performance in these critical areas: 1) sensors and algorithms (Autonomous Target Recognition - ATR, Simulated Computer Lab runs, Captive Flight Test - CFT); 2) Orientation and Stabilization (O&S) spin/stability performance (helicopter drop/spin tests); and 3) High-G survivability (shock tests, Soft Recovery System [SRS] tests). Evaluated Modeling and Simulation (M&S) analyses for carrier/submunition packaging, dispense, engagement, and effectiveness. Evaluated Electronic Safe and Arm Device (ESAD) to define optimal interface (timing and location) between fuze and ammunition. In FY08, quantify and baseline post-test operational performance metrics as entrance criteria for 2nd System Design Review in Dec 2008; specifically the sensor transmit/receive performance, algorithm/ATR discrimination capability, 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; develop interface for submunition electronics, sensors, and warhead; conduct	2844	3068	

structural integrity testing and Captive Flight Test (Phase 1) to facilitate development of Form Factored components; evaluate tactical hardware and dynamic environment through modeling and simulation and verification testing. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s) 0602624/H19 and PE/Project 0603004/232.			
IM Technologies Initiatives: In FY07, designed full scale warhead venting; conducted experimental characterization and bullet impact/fragment impact (BI/FI) modeling of Non-Line-of-Sight Launch System (NLOS-LS) warhead; downselected most promising formulations and conducted subscale demonstration of best warhead for ballistic and IM performance. In FY08, show high lethality in a full scale prototype warhead venting and reactive liner design; conduct sympathetic detonation (SD) modeling and experimental characterization of low order behavior. In FY09, will complete SD/BI modeling of NLOS-LS warhead including low order response.	3001	1019	250
Fuze and Power for Advanced Munitions: In FY07, integrated Micro Electro-Mechanical System Safe and Arm Devices (MEMS S&As) and Electronic Safe And Arm Devices (ESADs) with submunition proximity sensors and continued laboratory, flight test of proximity technologies; evaluated integrated system to validate models. In FY08, evaluate performance and safety of ESAD and MEMS sub-assemblies. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	3292	2911	
Nanotechnologies for FF Armaments and Munitions: In FY07, investigated/characterized nanomaterial based powders for use with low energy initiation (LEI) concepts. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624/H28.	424		
High Powered Microwave - Non-Lethal (HPM-NL): In FY07, evaluated a non-explosive HPM payload capable of being fired from a Line-of-Sight (LOS), Non-Line-of-Sight (NLOS), and Beyond-Line-of-Sight (BLOS) platform and cause temporary or permanent electronic disruption with reduced collateral effects; conducted trade studies to establish design parameters; evaluated various HPM source technologies; established target defeat metrics; modeled various launch methods and subsequent performance characteristics. In FY08, model component behavior and fabricate individual components of the system; conduct component experiments for antenna, primer power, pulsed power, and microwave source and in collaboration with Department of Energy, model effects on infrastructure targets; integrate results from infrastructure targets with battlefield effectiveness models; evaluate G-Hardened design of NL munition to address structural integrity in a gun launch environment; model iterative exterior, interior, and terminal ballistics for various delivery methods; perform a design of experiment with the goal of the elimination of temperature dependence on a high power system that focuses energy in a narrow band. In FY09, will commence integration of individual components and will model the integration of the combined system; will perform mechanical High-G design and electrical analyses in tandem to address electrical shielding effectiveness; will commence laboratory effects testing of an integrated laboratory prototype against relevant electronic materiel; will feed battlefield models with results of testing to achieve improved battlefield modeling fidelity.	3030	5745	6932
Novel Propulsion Technology for the Future: In FY08, design and develop advance propulsion and ignition technologies for gun launched munitions; evaluate existing M&S tools for advanced propellants, igniters and thrusters for scalable & adaptive applications; develop and characterize advanced novel propellants for igniter based upon M&S results. In FY09, will fabricate novel igniters and demonstrate them against current baseline igniters; will optimize propulsion technologies at the component level for integration into scalable & adaptive response munitions. Will develop M&S tools for scalable & adaptive propulsion prediction capabilities across the full range of munition applications. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624/H28 and PE/Project 0603004/232.		1512	2017
Pulsed Laser technologies: In FY09, laser induced plasma channel (LIPC) modeling and simulation will define the optimum filament geometries for effective energy transmission; laboratory studies will investigate the interaction of various directed energy fields in custom waveguides; verification tests for LIPC plasma channels will provide insight to expected increases in performance in directed energy weapons; development of pulse power and antenna technology needed for a Multi Mode DE System will be performed; a parallel effort in			2965

reducing the size and footprint of existing Solid State HPM sources will also be conducted. A down selection will be made based on technology maturity and will be packaged into a lightweight portable counter-IED system demonstrator. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624/H19 and PE/Project 0603004/232.			
Small Business Innovative Research/Small Business Technology Transfer Programs		245	
Total	12591	14500	12164

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H19**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H19	CLOSE COMBAT WEAPONRY	7316	5421	7276	4495	1985	2029	2074

A. Mission Description and Budget Item Justification: This project focuses on conducting applied research and designing technologies for maneuver and fire support cannon armament systems in support of the Future Force and, where feasible, to enhance Current Force capabilities. The project develops enabling technologies that result in significantly greater lethality at longer ranges with more accurate delivery, significantly reduced logistics footprint, and reduced life cycle costs for ground combat platforms. Both hardware and analytical tools (software) are refined and used to assess performance, identify problem areas and formulate solutions. This project develops components for advanced multi-mode fuzes and directed energy weapons and munitions. Efforts include Countermine/threat neutralization which exploits Laser Induced Plasma Channel (LIPC) to defeat surface laid and buried mines and other threats; Non-Lethal Payloads for Personnel Suppression, which enables personnel suppression and area denial at BLOS ranges; Near Autonomous Unmanned Systems effort, which designs and evaluates a remote weapon station optimized for high-reliability on an unmanned vehicle; Multi-mode High Powered Microwave (HPM) and Laser Induced Plasma Channel (LIPC) Technology which develops and miniaturizes key directed energy (DE) technologies, conducts system engineering designs, and evaluates power and energy demands required for weaponizing LIPC onto a hybrid platform. Ground Based Munitions Technologies which begins in FY09 optimizes smart ground based munitions for the urban and complex fight. Work in project H19 is related to, and fully coordinated with, efforts in projects H18 and H28 (also in program element (PE) 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0600304A (Weapons and Munitions Advanced Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This work is performed by the U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Non-Lethal Payloads for Personnel Suppression: In FY07, verified effectiveness of the NL payload and its dissemination technique at the target area via a system flight test demonstration in relevant environments.	1725		
Mine Neutralization: In FY07, integrated brass board laser with directed energy (DE) system(s) to develop laser guided energy (LGE) technology; conducted laboratory testing to verify laser integration parameters and perform low level target effects testing for countermine. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	3144		
Common Smart Submunition: In FY07, integrated component technologies (Multiple Explosively Formed and Single Explosively Formed Projectiles) and conducted dynamic warhead tests using novel energetics in the combined effects warhead design; completed Airborne Test Bed (ATB) modification and fabrication enabling sensor/sublet suspension from helicopter and cabling of electronics wiring harness for Captive Flight Tests (CFTs) and Captive Carry Tests (CCTs); rapid downloading of test data for playback/goodness check hardware and processes were analyzed, decided, and incorporated into test program; completed tower testing for sensor development; began developing Form Factored electronics; conducted warhead testing for Single Explosively Formed Penetrator (SEFP) with favorable results; continued to develop Multiple EFP through iterative testing process. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and 0603004/232.	695		
Near Autonomous Unmanned Systems (NAUS): This effort addresses the safe weapon operations and self security risk areas of NAUS.	1752	1911	1989

In FY07, completed detailed design of concept; fabricated and assembled breadboard components including the active magazine and weapon mechanism; conducted laboratory experiments to validate simulations and models of the robotic weapon and ammo handling subsystems; designed and developed system architecture and emulator. In FY08, fabricate prototype robotic weapon and ammo handling system; conduct laboratory evaluations to assess interface and functionality of subsystems; and, simulate functionality via hardware in the loop emulation. In FY09, will fabricate and integrate critical sub-systems; will conduct baseline system level tests. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602601/H91; 0602618/H03; 0602120; and, 0603005/515.			
Pulsed Laser Technologies: In FY08, develop and miniaturize key directed energy (DE) technologies and subsystems to support DE Weaponization with the potential to field leap-ahead capabilities in effectiveness and suitability; perform target vulnerability analysis based on target modeling and follow on live-fire validation testing against simulated targets to demonstrate effectiveness; develop compact and frequency agile sources to reduce overall system footprint and volume as well increase effectiveness and tactical suitability. In FY09, will characterize and optimize high voltage and radio frequency sources to produce multiple target effects; will characterize and optimize RF sources to determine buried or surface threat susceptibility. Efforts described here are coordinated and complimentary to related efforts in PE/Projects 0602624/H18 and 0603004/232.		3395	2063
Ground Based Munitions Technologies: In FY09, will evaluate urban technologies for ground based munitions for use with the Intelligent Munitions System (IMS) (PE 654808/D016); will optimize a set of sensor suites for the urban environment and will evaluate merging sensor modalities; will 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/Project 0603004/232.			3224
Small Business Innovative Research/Small Business Technology Transfer Programs		115	
Total	7316	5421	7276

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H28**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H28	MUNITIONS TECHNOLOGY	18049	17273	11136	11432	11386	11564	11751

A. Mission Description and Budget Item Justification: This project advances the state of the art for enabling munitions technologies supporting the Future Force and, where feasible, to enhance Current Force capabilities. The project focuses on achieving increased lethality using smaller and lighter weapon systems with smaller and lighter armaments. Novel warhead architectures, new propellant techniques, and advanced material technologies are applied to produce smaller, lighter, more effective, multi-role warheads with advanced warhead liners to more efficiently defeat existing and projected targets. High-energy, high-density explosives are designed to increase lethality and optimize munition performance. New improved energetic materials provide increased lethality and offer numerous transition opportunities for weapon system upgrades. High-impetus propellant formulations, when coupled with technologies such as electrothermal chemical ignition, offer increased muzzle kinetic energy, precision ignition, and repeatability. This project funds the Novel Energetic Materials for the Future Force effort which matures advanced energetic materials with the ability to control energy release for precision munition and counter-munition applications and the Hardened Combined Effects Penetrator Warhead Technology effort which provides overmatch lethality using a single warhead capable of defeating armor, bunkers, personnel, and Unmanned Air Vehicles (UAVs). The Future Force Guns and Munition Technology effort designs and evaluates technologies for lighter weight 120mm gun components, lightweight nano-materials for UAVs, and the Common Smart Submunition effort which is coordinated with and complementary to the work performed in H19 and is focused on warhead performance. Other efforts include the development of warhead and fuze safe and arm technology necessary for the Kinetic Energy Active Protection System (KEAPS) countermeasure development; Extended Area Protection and Survivability, which demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery, and mortar rounds; and G-Hardened Sensor Technology for Munitions, which develops ground sensors hardened to resist the forces of gun-launch and ground impact. This project also supports the development of scalable and adaptive explosives and reactive materials technology for weapon and munitions either gun or missile launched that deliver a broad spectrum of effects with reduced collateral damage and develops capabilities to detect/locate hostile shooters before a shot is fired. Work in project H28 is related to, and fully coordinated with, efforts in projects H18 and H19 (also in program element (PE) 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0600304A (Weapons and Munitions Advanced Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This work is performed by the U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD. The APS countermunition efforts are developed and collaborated 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 060313A.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Novel Energetic Materials for the Future Force: In FY07, bounded the pressure and temperature characteristics of the novel energetic materials for warheads through additional testing and modeling of selected multi-purpose warhead designs; conducted analysis to determine performance/survivability characteristics compared to current systems with conventional energetics; conducted experiments with best-performing energetic materials in multipurpose warheads.	6581		
Hardened Combined Effects Penetrator Warhead Technology: In FY07, evaluated test results and then refined and optimized warhead designs accordingly; repeated in-process testing and confirmed performance of optimized warheads; performed advanced hardening	4114	4170	

design, advanced fragmentation/multipurpose energetic, and unitary hardened shaped charge ERA defeat test investigations. In FY08, test and evaluate optimized blast fragmentation, optimize warhead penetration, and blast/frag 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/Project 0603004/232.			
Future Force Gun and Munition Technology (Lightweight Armaments Enhancement Program-LAEP): In FY07, completed testing of LAEP gun components to TRL 6; successfully executed firing test which included blast overpressure and target impact dispersion tests. Nanotechnologies for Future Force Armaments and Munitions: In FY08, conduct advanced concept investigations for direct write technologies (including lab demonstrations). (Direct Write Technologies involves placing a thin line of explosive (i.e., writing) onto a surface or chip for the purposes of reducing the size and weight of an explosive train/detonator.) In FY09, will integrate the best candidate technologies from the FY08 investigation into actual UAV Systems; will investigate integration of developed direct write technologies into actual armaments systems and subsystems. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H19, and PE/Project 0603004/232.	361	1244	3020
Kinetic Energy Active Protection System (KEAPS): In FY07, baselined blast warhead design through modeling & simulation (M&S) and verification tests; evaluated warhead performance in near tactical configuration; completed breadboard fuze safe & arm (S&A) design and initial testing; generated initial interface control documentation between warhead/fuze S&A device and countermeasure. In FY08, refine warhead/fuze S&A interfaces with countermeasure; evaluate critical warhead parameters in near tactical environments; evaluate integrated warhead and fuze S&A interface through testing; evaluate integrated fuze S&A and countermeasure performance in near tactical environments. In FY09, will finalize warhead/fuze S&A interfaces with KEAPS interceptor; will evaluate near tactical warhead and fuze S&A through M&S and verification testing against all classes of threats; will evaluate integrated warhead, fuze S&A and countermeasure performance in near tactical environment. Efforts described here are coordinated and complimentary to related efforts in PE/Project 063004/232 and are developed and collaborated with efforts in PE/Project 063005/221 and 063313/550.	4606	6810	3575
Extended Area Protection and Survivability (EAPS): In FY07, analyzed and modeled advanced warhead and fuze designs; fabricated and tested against static targets. In FY08, evaluate the effectiveness of a lethality round (the standard projectile envelope configured for an advanced 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/Project 0603004/232 and 0603313.	1284	2918	
G-Hardened Sensors Technology for Munitions: In FY07, continued experimentation (begun in FY06 in 602624/H18) and baselined designs to ensure survivability of the more fragile sensor modalities such as acoustic and electro-optical; hardened sensor elements to withstand impact during deployment; categorized integrated sensor packages and began design and integration of a multi-modal sensor suite into a 40mm grenade form factor. In FY08, conduct lab experiments and demonstrate survivability of individual and integrated component technologies in > 20kG environments based on metrics developed earlier; develop architecture for networking sensors from different G-hardened nodes for target localization; conduct fabrication of hardware and demonstrate ruggedness of sensors through testing conducted with air gun experimentation; perform initial demonstration of miniaturized highly-integrated components imbedded in munitions to include 40mm grenades. In FY09, will refine integrated design approach and G-hardened packaging; will demonstrate survivability of individual and integrated component technologies in > 30kG and demonstrate (through live fire of munitions) the remote deployment of fully integrated prototypes packaged into mortars and 40mm grenades; will implement architecture for distributed, low complexity, and power efficient decentralized network fusion of multiple G-hardened nodes for target localization.	1103	1787	1601
Scaleable Warhead Technology: In FY09, will conduct modeling and simulation studies of warhead concepts for evaluation of scaleable			2940

baseline performance against multiple target set configurations. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.			
Small Business Innovative Research/Small Business Technology Transfer Programs		344	
Total	18049	17273	11136

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	80621	105492	45278	46940	46874	47362	48869
EM4	Electric Component Technologies (CA)	14065	21160					
EM6	HEATING AND COOLING TECHNOLOGIES (CA)	2664	3378					
EM7	POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	27721	37850					
H11	BATTERY/IND POWER TECH	11387	13572	13165	12801	11900	10644	10882
H17	FLEXIBLE DISPLAY CENTER	4653	6026	6562	7114	7126	7242	7360
H94	ELEC & ELECTRONIC DEV	20131	23506	25551	27025	27848	29476	30627

A. Mission Description and Budget Item Justification: This program element (PE) funds enabling capabilities for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities by researching and investigating technologies in areas such as electronic components, power components, frequency control and timing devices, and display technologies. The objective of the program is provide technologies to perform precision deep fires against critical mobile and fixed targets; to provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft; and enhanced communications and target acquisition for current and future Army systems. Project H11 funds research on advanced portable power technologies (batteries, fuel cells, hybrids, engines, chargers, and power management) that enable: safe, reliable, and cost effective power sources; reduced system power requirements and logistics burden; increased mission duration. Project H94 funds research in the physical sciences essential to all land combat systems that contain any of the following component technologies: electronics, photonics, flexible displays, micro electromechanical systems, imaging laser radar (LADAR), magnetic materials, ferroelectrics, microwave and millimeter-wave components, and electromechanical systems (engine generator sets). Project H17 supports research at the Flexible Display Center to enhance battlefield situational awareness, increased vehicle mobility, survivability, and lethality, while reducing acquisition and support costs. Supported capabilities include 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. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. Projects EM4, EM6, and EM7 fund congressional special interest efforts.

Work in this PE is related to and fully coordinated with efforts in PE 0602120A (Sensors & 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). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by the Army Research Laboratory and the Army Communications and Electronics Research Development, and Engineering Center, Fort Monmouth NJ.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	81773	43391	45365
Current BES/President's Budget (FY 2009)	80621	105492	45278
Total Adjustments	-1152	62101	-87
Congressional Program Reductions		-699	
Congressional Rescissions			
Congressional Increases		62800	
Reprogrammings	614		
SBIR/STTR Transfer	-1766		
Adjustments to Budget Years			-87

Thirty-two FY08 congressional adds totaling $62800 were added to this PE.

($800) Improved Energy Density Battery
($800) Large Format Li-Ion Battery
($800) Non-Flammable, High Energy Density, Low temperature Warrior Battery
($800) Soldier Fuel Cell System
($1000) Ceramic Membrane - 10(X) More Energy for Battery Systems
($1000) Enzyme Biofuel Cell (SEBC)
($1000) Miniature Cooling Unit for Electronic Devices
($1200) Bio-Battery
($1500) Renewable Energy for Military Applications
($1600) Advanced Portable Power Institute (APPI)
($1600) Blast Risk Analysis and Mitigation Application (BRAMA)
($1600) Manufacturing Technology Development of Advanced Components for High Power Solid-State Lasers
($1600) Mega-Capacity Hybrid Chemistry Lithium Primary Portable Batteries
($1600) Micromachined Switches in Support of Transformational Communications Architecture
($1600) Portable Hydrogen Generator and Hybrid Power Source
($1600) Revolutionary Self-Seating Plastic Enclosure for Military Batteries
($1600) Roll-to-Roll Microelectronics Manufacturing in Support of the Flexible Display Initiative
($1600) Self-Powered, Lightweight, Flexible Display Unit on a Plastic Substrate
($1600) Silicon Carbide MOSFETs for Electric Power Systems
($2000) Advanced Wearable Microcell Power System Process Development
($2000) Defense Modernization and Sustainment Initiative, Rochester Institute of Technology

($2000) Novel Zinc Air Power Sources for Military Applications
($2400) Cogeneration for Enhanced Cooling and Heating of Advanced Tactical Vehicles
($2400) High-Frequency, High-Power Electronic and Optoelectronic Devices on Aluminum Nitride (AIN)
($2400) Thin Lithium-Iron Disulfide Primary Batteries
($2480) Advanced, Integrated Portable Power Generation and Charging System
($2500) ONAMI Miniature Tactical Energy Systems Development
($2800) Low Signature Portable Fuel Cell Power Systems
($3920) Advanced Lithium-Carbon Monoflouride Combat Portable Batteries
($4000) Lithium Ion Metal Battery
($4000) Soldier Portable Solid Fuel Hydrogen Generator Cartridge
($5000) PEM Fuel Cell Tactical Generators

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H11**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H11 BATTERY/IND POWER TECH	11387	13572	13165	12801	11900	10644	10882

A. Mission Description and Budget Item Justification: The focus of this project is on applied research to identify, advance, and enhance emerging power generation, energy storage, and power management technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. 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. There is a critical need for ultra-lightweight man portable power, chargers, and power management for the dismounted Soldiers. The Soldier Hybrid Power and Smart Chargers effort investigates high energy and high power density hybrid power source components including rapid recharging methods using smart chargers, fuel cell systems, and smart rechargeable batteries. It also investigates novel power management methods through low power design tools and software operating system dynamic power management. The Silent Mobile power effort funds research in power sources that are smaller and more fuel-efficient and in advanced cooling systems enabling tactical sustainability and survivability. Both efforts will provide future Soldiers and other future force platform applications low weight and volume, safe, reliable, cost-effective power sources, reduced system power requirements, increased mission duration and reduced cost and logistics burdens.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Soldier Hybrid Power and Smart Chargers: Develop and evaluate hybrid power sources, rapid battery chargers, and power management technologies in order to decrease soldier load, increase power capabilities, and decrease battery costs. In FY07, investigated system-level smart chargers integrated with a quiet power source, including Stirling engines and fuel cells, for stand-alone charging; designed and demonstrated ruggedized Soldier hybrid power source for 72 hour mission; investigated micro-reformer components for logistic fueled manportable power source. In FY08, evaluate methanol fueled Soldier hybrid fuel cell power source for 72 hour mission at 700 watt-hours per kilogram; investigate rugged JP-8 burners for solid oxide power sources. In FY09, will demonstrate JP-8 fueled Soldier hybrid solid oxide fuel cell; will demonstrate manportable 160 watt JP-8 linear free piston Stirling engine power source weighing less than 10 kilograms; will evaluate 250 watt reformed JP-8 fuel cell for battery charging.	7402	7383	6694
Silent Mobile Power: Investigate component and system level power technologies that will provide higher energy, reduced weight, quiet, more fuel and cost efficient power generation sources, including silent mobile power sources, cogeneration cooling systems, and tactical power management systems. In FY07, evaluated components for 2 kilowatt (kW) fuel processing system operating on high sulfur fuel (>300 parts per million sulfur); evaluated a preliminary prototype of a 1-2 kW Stirling engine generator system on JP-8. In FY08, demonstrate controlled operational testing in a laboratory environment of 1-2 kW Stirling engine generator on JP-8 fuel; demonstrate controlled operational testing in a laboratory environment of 2 kW fuel cell generator on JP-8 fuel; demonstrate a preliminary prototype cogeneration cooling system using waste heat from a quiet power source. In FY09, will mature system integration and controls in order to demonstrate 2 kW solid oxide fuel cell generator and 1-2 kW Stirling engine generator in relevant field environment; will demonstrate	3985	3886	3471

integrated power/cooling cogeneration system.			
Lithium Air Battery: Develop and investigate advanced materials, material processes, and electrochemical components that will produce a high energy density (>1,000 Watt-hours/kilogram) lithium air power source for soldiers. In FY08, investigate lithium organic and inorganic materials and processes to produce highly conductive electrolytes to achieve greater than 0.5 mill-Amps/square centimeter current densities; demonstrate prototype lithium air cells/batteries having energy densities greater than 800 Watt-hours/kilogram; demonstrate material stability of lithium air cell components to achieve high shelf life (greater than one year). In FY09, will develop material and cell fabrication processes to produce high energy density, stable, safe lithium air battery; will demonstrate prototype lithium air cells/batteries having energy densities greater than 1,000 Watt-hours/kilogram.		2000	3000
Small Business Innovative Research/Small Business Technology Transfer Programs		303	
Total	11387	13572	13165

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H17**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H17	FLEXIBLE DISPLAY CENTER	4653	6026	6562	7114	7126	7242	7360

A. Mission Description and Budget Item Justification: This project funds the Army's Flexible Display Center (FDC). The objective of this project is to mature flexible display technologies toward Army applications thereby providing leap-ahead technology to our Soldiers. Flexible displays are inherently rugged (no glass), light weight, conformal, potentially low cost, low power, and hence offer enhanced and new capabilities across a broad spectrum of Army applications. Areas of investigation include: lightweight, low power, and rugged flexible displays.

Work in this project is performed by the Army Research Laboratory (ARL). Note: This project was previously funded in PE 0602705A project H94 and is a restructuring of ongoing research into a distinct project for visibility and management oversight.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
The objective of this research is to mature flexible display technology for future vehicle and future Soldier applications. The research is being conducted at the Flexible Display Center (FDC) at Arizona State University. Management will be conducted by ARL in collaboration with Natick Soldier Research and Development Center, the FDC, industry, and other university partners. In FY07, designed and fabricated 4" diagonal active matrix reflective and emissive displays with enhanced resolution and functionality and began to qualify the pilot line for displays up to 15" diagonal. In FY08, the FDC develops and delivers reflective displays up to 10" diagonal from the pilot line for the next generation Soldier systems. The FDC begins full color designs. In FY09, the FDC will develop and deliver up to 10" diagonal reflective and emissive displays from the pilot line with increasing performance for next generation platforms.	4653	4860	5062
Flexible display partnerships funded through the U.S. Diplays Consortium (USDC) for tools, process, and materials development that directly support the FDC. In FY08, establish programs through the USDC that support the FDC with existing tool modifications, processes, related material, and device development. The programs directly support the FDC and the Army's mission to develop flexible displays and manufacturing technology for flexible displays. In FY09, will mature the USDC programs that directly support the FDC and the Army's mission to develop flexible displays and manufacturing technology for those displays.		1000	1500
Small Business Innovative Research/Small Business Technology Transfer Programs		166	
Total	4653	6026	6562

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H94**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H94 ELEC & ELECTRONIC DEV	20131	23506	25551	27025	27848	29476	30627

A. Mission Description and Budget Item Justification: The objective of this project is to conduct applied research in 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 for the Future Force. This research supports thrusts aimed at enhanced battlefield situational awareness; increased vehicle mobility, survivability, and lethality; reduced acquisition cost; and reduced operations and support costs. 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 for individual Soldier and platform applications. The fabrication of novel structures on new electronic materials, such as langasite for oscillators or molecular beam epitaxy (MBE) of semiconductor superlattices and the hybridization of opto-electronic (OE) devices with electronics will be key enablers for more affordable opto-electronic devices with new capabilities. These fabrication techniques require a more complete understanding of fundamental properties, growth techniques, and processing of new materials. These new materials and structures also require the development of new design and layout techniques, more sensitive and flexible test and analysis capabilities, and new means of packaging to protect the devices and promote control of heat and atmosphere while enabling transport of signals and power. These challenges can only be overcome with judicious application of a basic understanding of the physics and chemistry of the electronic and opto-electronic processes. These projects serve to enhance the survivability, lethality, and mobility of future Army platforms by enhancing their survivability electronics suite; increasing ranges while decreasing time lines for target acquisition sensors; and evolving more efficient, controllable power sources, and displays. 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 Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Design and mature 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 prototype designs. Among the issues addressed in this antenna development are scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability. In FY07, designed Satellite Communication on the Move (SOTM) and Terrestrial communication antennas and evaluated early prototypes. Evaluated high sensitivity mmW microbolometer detector array. In FY08, validate that these antenna prototypes can be integrated into Army platforms through simulations and laboratory validation. In FY09, will mature these designs based on the measured laboratory data and transition the work to Communications and Electronics Research, Development, and Engineering Center (CERDEC).	2366	2662	2507
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 for the Future Force. In FY07, initiated investigations of 1/f phase noise perturbations and dual-	2320	3420	3702

mode resonators for stabile oscillators; initiated fabrication of wafer-level packaging with a MEMS phase shifter process for multifunction RF applications; conducted characterization of stabilized oscillator dual-mode crystals with low hysteresis temperature effects. In FY08, devise a process for wafer-level packaging with a MEMS phase shifter for multifunction RF applications and complete investigation of 1/f phase noise perturbations and dual-mode resonators for stabile oscillators. In FY09, will investigate approaches for a wafer level antenna. Prepare and integrate passive RF electronics with ARL's RF MEMS switch fabrication process.			
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 circuits (MMICs), to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range in future systems, unmanned aerial vehicles (UAVs), Electronic Warfare (EW), radar, and Soldier systems. In FY07, initiated characterization, analysis, and evaluation of high power (80 W) Ka-band MMPM; and initiated design and characterization of GaN power amplifier modules. In FY08, complete efforts on Ka-band MMPM and GaN modules. Design GaN amplifier integrated in mini-package and analyze thermal properties for high power packaged amplifiers. In FY09, will design and fabricate integrated high power package for antenna array.	2415	3497	3205
Investigate eye-safe, scanner-less, 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 Future Force electro-optic (EO) vision systems from damage from laser threat devices. In FY07, used the image tube LADAR to evaluate obscured target detection through 3-D LADAR imagery in simulated UAV and ground-to-ground scenarios; transitioned LADAR architecture to CERDEC for integration into UAV EO payloads; showed large-dynamic-range, broadband optical limiting in a tandem limiter configuration chosen to match that of the Tank and Automotive Research, Development, and Engineering Center (TARDEC) system demonstrator with single Charge Coupled Device (CCD) sensor; transitioned selected broadband nonlinear limiting material to TARDEC for integration into the system demonstrator. In FY08, utilize TARDEC testing results on the system demonstrator to further maximize performance of materials for CCD protection and fabricate an integrated solid-state version of the LADAR architecture for transition to CERDEC and Armaments Research, Development, and Engineering Center (ARDEC). In FY09, will retro-fit the solid-state version of the ladar receiver into the image tube to obtain improved performance required by Aviation and Missile Research, Development, and Engineering Center (AMRDEC).	2728	1835	1132
Investigate 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) substrates for both the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral region to significantly decrease the cost and to allow the development of large area arrays. Design and fabricate arrays for higher operating temperature. In FY07, researched MWIR and LWIR FPAs with high operating temperatures of 180 Kelvin for MWIR and 120 Kelvin for LWIR. In FY08, investigate multicolor (Short Wave IR (SWIR)/MWIR/LWIR) FPAs for enhanced range and detection. In FY09, will research polarization sensitive data collection and analysis for improved target classification and identification and explore FPAs with on-chip processing.	2250	2139	2170
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 compact 3-D imaging. In FY07, explored possible chip-level technologies (Quantum/Interband Cascade Lasers, MEMS microphones, and MEMS actuators) for incorporation into MEMS photoacoustic chemical sensing system. In FY08, characterize current biomimetic recognition elements using several laboratory analytic methodologies; evaluate olfactory sensor based on integrated MEMS photoacoustic system; characterize efficacy of molecular recognition elements devised using rapid directed evolution methodologies and investigate multi-band IR 2-D arrays for scene generation. In FY09, will assess recognition elements as alternative biologically-inspired methods to produce advanced photonic and electronic structures and investigate hybrid techniques incorporating novel recognition elements and spectroscopic	505	2642	4056

inspection and investigate highly compact OE transceivers for 3-D imaging.			
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 FY07, designed and fabricated reclaimed energy systems for small engines; investigated methods to integrate MEMS based fuel/air delivery devices into small engines; and designed and fabricated cooling systems that provide 500 W/cm2. In FY08, investigate advanced MEMS cooling systems, demonstrate MEMS components on a small system and l fabricate MEMS valves for high flow applications. In FY09, will fabricate a heteroscopic turbine cooler; and will investigate improved MEMS rotary pumps, MEMS valves, and high flow low power atomizers.	4557	3319	4248
Investigate and evaluate prognostics and diagnostics (P&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. In FY07, initiated reduction of MEMS switch reset voltage and designed initial package; initiated evaluation of fault identification criteria and determined physics of failure modes. In FY08, fabricate experimental core module applied to specific commodities. Module entails a coded algorithms transceiver, core sensors, processor, and remote sensor interface. Conduct preliminary experimentation on networked RF link and incorporate fault algorithms. In FY09, will implement cross-correlated algorithms in an open architecture P&D system and will conduct fault prognostic tests enhancing algorithms and user interface in an open architecture environment.	2643	2853	2954
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 and mature silicon carbide (SiC) power module technologies to enable compact high temperature (up to 150°C heat sink temperature) and high power density converters for motor drive and pulse power applications for the Future Force. In FY07, provided improved electrolyte for low temperature Li-ion batteries and sulfur-tolerant catalysts for logistic fuel processing for fuel cells. In FY08, explore new technology for reserve batteries and more stable sulfur tolerant catalysts. Investigate and mature high-temperature (90° - 120°C) SiC power modules implemented in voltage-controlled SiC power devices for low power hybrid electric vehicle (HEV) power conversion. In FY09, will explore higher energy reserve battery materials and higher power Li-ion battery materials. Will investigate and mature high-temperature (90° - 120°C) SiC power modules for medium power conversion.	347	1009	1577
Small Business Innovative Research/Small Business Technology Transfer Programs		130	
Total	20131	23506	25551

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602709A - NIGHT VISION TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	35324	34924	25647	26381	26905	26929	26974
H95	NIGHT VISION & EO TECH	23023	24194	25647	26381	26905	26929	26974
K90	NIGHT VISION COMPONENT TECHNOLOGY (CA)	12301	10730					

A. Mission Description and Budget Item Justification: This program element (PE) researches, designs, and applies core night vision and electronic sensor technologies to improve the Army's capability to operate in all battlefield conditions. The technologies funded in project H95 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). These technologies support Future Combat Systems (FCS), the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. This project will fund efforts that will determine the benefits of using fused long wave infrared (LWIR) and very near infrared (VNIR) imagery for the dismounted Soldier in all day/night visibility conditions and research component technology for transition to future Soldier systems. Techniques to be explored include: super resolution, non-uniformity correction, image fusion, analog to digital conversion, region of interest (windowing) and motion detection, all contained in a single chip, and low power electronics for both cooled and uncooled infrared. This project will fund efforts to perform research to dramatically reduce the time necessary to acquire targets, and collect intelligence data. Additional efforts include providing the capability to incorporate lightweight laser designators on small unmanned aerial vehicle (UAV) and unmanned ground vehicle (UGV) platforms and portable Soldier systems, and research new infrared (IR) FPA technologies for both cooled, high performance IR FPAs and uncooled, low cost IR FPAs. Sensor models will be created to accomplish trade studies, performance predictions, and also support constructive simulation/wargaming for analysis of alternatives. In addition, this project will focus on sensor modeling and simulation technology maturation in critical areas such as; modeling target acquisition tasks of search, detection, recognition, and identification for currently inadequate representations in military operations in urban terrain, specific targets, and moving targets; modeling representations for advanced sensor technologies. Multispectral sensor simulations will support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. This project will assess and evaluate laser materials to produce a covert ladar system. Project K90 funds congressional special interest items.

Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602709A - NIGHT VISION TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	36203	24391	25662
Current BES/President's Budget (FY 2009)	35324	34924	25647
Total Adjustments	-879	10533	-15
Congressional program reductions		-267	
Congressional rescissions			
Congressional increases		10800	
Reprogrammings	-323		
SBIR/STTR Transfer	-556		
Adjustments to Budget Years			-15

Eight FY08 congressional adds totaling $10800 were added to this PE.

($800) Personal Miniature Thermal Viewer (PMTV)
($800) Robotics Workforce and Military Curriculum
($1000) Miniaturized Sensors for Small and Tactical Unmanned Aerial Vehicles (MINISENS)
($1000) Next Generation Communications System
($1600) Enhanced Micro-Image Display Technology
($1600) Hyperspectral Sensor for UAV Surveillance/Targeting
($1600) Small Business Infrared Materials Manufacturing - Silicon Alternatives
($2400) Power Efficient Microdisplay Development for US Army Night Vision

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602709A - NIGHT VISION TECHNOLOGY**	**H95**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H95 NIGHT VISION & EO TECH	23023	24194	25647	26381	26905	26929	26974

A. Mission Description and Budget Item Justification: This project funds the design, and development of core night vision and electronic sensor technologies and components to improve the Army's capability to operate in all battlefield conditions. The technologies funded in project H95 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). These technologies support the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. The Soldier Mobility Vision System effort determines the benefits of using fused long wave infrared (LWIR) and visible near infrared (VISNIR) imagery for the dismounted Soldier in all day/night visibility conditions and researches component technology for transition to future Soldier systems. Techniques to be explored that enhance SA include: super resolution, non-uniformity correction, image fusion, analog to digital conversion, region, of interest (windowing) and motion detection, all contained on a single low power chip for both cooled and uncooled infrared. The Distributed Aided Target Recognition (AiTR) effort develops the ability to dramatically reduce the time necessary to acquire targets and collect intelligence data. The Lightweight Laser Designator effort pursues technologies that enable the incorporation of lightweight laser designators on small unmanned aerial and ground vehicle platforms and portable Soldier systems. In an attempt to satisfy the Warfighter needs for persistent surveillance and threat warning, increasingly complex sensors (e.g. large (2000 by 2000 pixel) single color focal plane array (FPA), and multi-spectral) are required resulting in higher cost sensors systems. Mercury Cadmium Telluride (HgCdTe), the only mature material technology that can operate in the infrared from ~1-30 microns, is currently deposited on small-size, very costly Cadmium Zinc Telluride (CdZnTe) substrates, which are solely available from one foreign source. Depositing HgCdTe on low cost substrates, e.g., silicon, enables very large format FPAs, and multi-spectral sensors at costs not attainable with current technology. In addition efforts focus on sensor, modeling, and simulation technology maturation in the following critical areas: target acquisition tasks of search, detection, recognition and identification in urban terrain; and accurate representations for advanced sensor technologies. Multispectral sensor simulations support end-to-end predictive modeling and evaluation of new technologies in virtual combat simulations; advanced multifunction laser efforts assess and evaluate laser materials to produce a covert ladar technology. High Performance Small Pixel Uncooled Infrared FPA efforts demonstrate the feasibility of smaller pixel, lower cost, uncooled technology for short range ground, and unmanned aerial vehicle sensors, head-mounted thermal imaging, and thermal weapon sights, cost effective targeting systems, distributed aperture sensor systems, driver vision sensors, and sensors for precision attack munitions.

Work in this project is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Soldier Vision System Components: In FY07, evaluated low power, high performance, large format night imagers for head mounted applications; developed an image enhancing processor for a head mounted high definition color display; designed and evaluated prototype multi image architecture components and alogithms for head mounted opto-mechanical configuration; conducted field studies on several Micro Channel Plate Complementary Metal Oxide Semiconductor /electron bombarded active pixel sensor system.	3953		

Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence: In FY07, conducted phenomenology study of fusing multiple ground based sensors against man-made and natural highly cluttered environments for stationary and mobile target detection, and identification. In FY08, conduct field tests to determine the effectiveness of fusing multiple ground based sensors against man-made and natural cluttered environments. In FY09, will complete data collection efforts (archive and ground truth data); will evaluate data collected to determine optimal sensor fusion techniques.	1389	1257	1235
Lightweight Laser Designators: In FY07, developed and evaluated three brassboard compact lasers with possible application for small unmanned aerial system (UAS); assessed the power consumption and component weight.	3631		
Low Cost High Resolution Focal Plane Arrays (FPA): In FY07, demonstrated long-wave HgCdTe array in a 640 by 480 format with greater than 96 percent operability; demonstrated a 640 by 480 uncooled array, with a 5 ms time constant and a 35 mK noise equivalent temperature difference (e.g. to improve image quality/crispness). In FY08, develop and evaluate 2-color midwave infrared /longwave infrared (MWIR/LWIR) arrays with joint operability of greater than 90 percent and 96 percent respectively for both threat warning and enhanced situational awareness. In FY09, will integrate and refine sensor development to achieve an operability of greater than 95 percent/98 percent; will design FPA (image enhancing device) for mini-UAS applications.	6549	4698	4969
Modeling, Measurements and Simulation Applied Research for Sensor Design and Evaluation: In FY07, completed development and validation of third generation forward looking infrared simulation; updated the ACQUIRE family of sensor design models with metrics for the detection and discrimination of concealed weapons, and developed more robust detection and discrimination of personnel in urban environments. In FY08, design, validate and deliver an aided target recognition performance model for use in combat simulations; develop a flash signature library and discrimination model for sensor design and combat simulations. In FY09, will develop and validate sensor performance model improvements to more accurately address moving targets, environmental effects such as glint (reflective components), weather, and complex clutter (foliage and urban structures); begin design of performance models for distributed and networked imaging sensor systems.	4732	5028	5043
Advanced Multifunction Laser Technology: In FY08, assess and evaluate laser designs and materials for a multi-function laser system, including laser designation and range finding. In FY09, will develop and validate performance of the laser designator/laser rangefinder components in a relevant environment.		3002	3174
High Performance Small Pixel Uncooled Focal Plane Array: In FY07, designed and fabricated pixel structures to verify design parameters; tested and evaluated the pixel structures to verify sensitivity and noise predictions. In FY08, fabricate and test 17 micron read out integrated circuit (ROIC) (compact micro processor chip for high resolution imagery); test and evaluate the various components and verify results via modeling and simulation. In FY09, will integrate the high resolution FPA device to optimize the digital output with the ROIC and perform validation test and evaluation for advanced thermal weapon sight performance.	2769	3588	3360
Soldier Sensor Component and Signal Processing: In FY08, fabricate, assess and evaluate co-location of sensor focal plane array and processing resources on the same chip; assess and evaluate high resolution low power pixel mosaic structure display for infrared, hyperspectral, and visible sensors; conduct evaluation and design trade study of advanced adaptive light weight optics. In FY09, will 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; will complete design and fabricate demonstrator of advanced pixel mosaic, high resolution, low light visible sensor display; will fabricate and evaluate prototype advanced adaptive optics.		6419	7866
Small Business Innovative Research/Small Business Technology Transfer Programs		202	
Total	23023	24194	25647

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602712A - Countermine Systems**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	26332	30294	21815	22050	22223	22719	23232
H24	COUNTERMINE TECH	18467	18854	18962	19168	19319	19750	20195
H35	CAMOUFLAGE & COUNTER-RECON TECH	2684	2797	2853	2882	2904	2969	3037
HB2	COUNTERMINE COMPONENT TECHNOLOGY (CA)	5181	8643					

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops applied technologies to improve countermine, signature management, and counter-sensors capabilities for the Future Force and where feasible, exploits opportunities to enhance the Current Force. Project H24 focuses on concepts and technologies with potential to improve detection and neutralization of mines and other threats both conventionally and electronically triggered from a safe distance using ground and air platforms. The goal of this project is to increase mine detection search rates, reduce false alarm rates, and achieve precision neutralization capabilities in support of sustaining the high operational tempo needed in Future Force operations. Working in conjunction with the US Army Engineering, Research, and Development Center (ERDC), this project also examines countermine phenomenology of surface and buried mines and booby traps. In addition, this project matures wide area airborne countermine sensor concepts for higher altitude, wider area coverage, higher probability of detection, and lower false alarm rate for airborne minefield detection operations. Project H35 examines signature management techniques for tactical operation centers (camouflage) and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries as well as techniques to harden our own sensors against laser exploitation and damage. Project HB2 funds congressional special interest items. This PE supports DoD's Center of Excellence for Unexploded Ordnance which coordinates and standardizes land mine signature models; maintains a catalogue of mine signatures; and supports the evaluation of mine detection sensors and algorithms.

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 will be performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/ Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA; the Army Corps of Engineer, R&D Center, Vicksburg, MS; and the Armaments Research, Development, and Engineering Center, Picatinny, NJ.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602712A - Countermine Systems**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	27135	21795	21922
Current BES/President's Budget (FY 2009)	26332	30294	21815
Total Adjustments	-803	8499	-107
Congressional Program Reductions		-201	
Congressional Rescissions			
Congressional Increases		8700	
Reprogrammings	-137		
SBIR/STTR Transfer	-666		
Adjustments to Budget Years			-107

Two FY08 congressional adds totaling $8700 were added to this PE.

($3200) Standoff Improvised Explosive Device Protection Program
($5500) Hawaii Undersea Military Munitions Assessment

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602712A - Countermine Systems**	**H24**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H24 COUNTERMINE TECH	18467	18854	18962	19168	19319	19750	20195

A. Mission Description and Budget Item Justification: This project develops new countermine technologies that use man-portable, ground-vehicular, and airborne platforms for detection, discrimination, and neutralization of individual mines, minefields, and other threats. These technologies support the Future Force, and where feasible, are exploited to enhance Current Force capabilities. The goal of this project is to detect threats with a high probability, reduce false alarms, and increase operational tempo. This goal is achieved by performing data collection and evaluation of detection technologies to assess the effectiveness of various sensor combinations and signal processing/fusion algorithms. This project supports the Center of Excellence for Unexploded Ordnance, established to coordinate and standardize land mine signature modeling; maintain a catalogue of mine signatures; support the evaluation of mine detection sensors and algorithms; and support the work effort on the countermine environment with the Corps of Engineers. Countermine neutralization efforts increase the potential for sustained rapid movement of tactical forces using stand-off neutralization technologies such as explosively formed projectiles (EFP), high power pulsed electro-optics for high order neutralization, or low-order deflagration, high power focused microwaves, and other emerging technologies. Area airborne minefield detection efforts characterize promising airborne sensor technologies, tested in a variety of environmental conditions, to support wide area minefield detection and phenomenology studies provide the ability to predict and improve the performance of airborne and vehicular countermine systems across all operational environments using models that predict countermine sensor performance and Automatic Target Recognition (ATR) performance. Explosive detection efforts provide short range standoff capabilities to detect explosives using chemical sensing methods in urban environments and route clearance scenarios.

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; the Corps of Engineers RD&E Center, Vicksburg, MI; the Armaments Research, Development, and Engineering Center, Picatinny, NJ; and the CERDEC Intelligence and Information Warfare Directorate, Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Center of Excellence for Unexploded Ordnance (UXO): In FY07, continued to establish standards for testing, modeling, and evaluating Counter UXO technologies and ensured that requirements are current and accurate, ensured that opportunities for leveraging technologies were identified and exercised, ensured that duplicative programs were identified and eliminated, and information on programs and progress was shared. In FY08, coordinate programs across the joint services on the models being developed by respective DOD elements. In FY09, will review and evaluate standards for testing and modeling of UXO technologies.	478	492	497
Wide Area Airborne Minefield Detection: In FY07, researched and completed brassboard sensor design and software development for a prototype unmanned aerial system payload sensor; assessed technical performance against an operational environment; developed sensor design/specifications, automatic target recognition algorithms, and performance models for subsequent system prototyping.	7221		
Countermine Neutralization: In FY07, integrated multiple standoff mine localization and neutralization technologies onto a platform; conducted field experiments against mines and other threats in realistic on- and off-route environments; assessed the effectiveness of the combined detection and neutralization technologies; and evaluated high powered microwave technologies developed by the Army	4281		

Research Laboratory as a neutralization candidate.			
Countermine Phenomenology Studies: Countermine Phenomenology Studies identifies the key geo-environmental parameters such as weather conditions, soil composition, soil moisture, soil electromagnetic properties, ground cover, etc. that affect mine/minefield detection and false alarm rates for various sensor modes. The improved understanding of the geo-environmental effects transitioned to countermine sensor and aided target recognition (AiTR) developers and modelers to support improved clutter rejection. In FY07, completed computational test bed validation for electro-optic/infrared sensor modality; developed an electromagnetic sensor modality simulation capability in the computational test bed.	4528		
Sensors for Explosive Detection: In FY07, conducted lab and field experiments of new Soldier-portable or vehicular mounted chemical detectors and evaluated performance. In FY08, evaluate emerging technologies and compare results to sensor metrics (sensor sensitivity objectives, speed, explosive compound selectivity); investigate and evaluate promising technologies (e.g., ion mobility, laser induced breakdown spectroscopy ,and standoff explosive sensors operating in the terahertz spectrum region) for explosives and weapon cache detection.	1959	1985	
Standoff Mine/Threat Neutralization Technology: In FY08, assess and test the effects of high power long pulse drilling laser on mine and other threats; measure and develop the power, energy, and laser requirements for the drilling laser to determine its feasibility and practicality for use in neutralizing threats in varying surface, overburden, and buried conditions; design and begin enhancements to precision munitions that can be used for threat neutralization in existing and new developed weapon systems. In FY09, will improve standoff capability for threat neutralization by developing and demonstrating advanced directed energy techniques (burst lasers, focused high powered microwaves, plasma channel high voltage) and/or explosively formed munitions to achieve increased accuracy with reduced collateral damage and logistics burden.		6741	6175
Anti-personnel/Anti-Tank Mine False Alarm Reduction: In FY08, investigate new sensor and signal processing component technology, such as low-cost, compact radar sensors, electro-optic sensors, and standoff acoustic technologies for ground based and airborne systems that 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. In FY09, will investigate, integrate, and evaluate new low-cost sensor products and phenomenologies including multispectral electro-optical sensors/detectors, scalar and vector magnetometers, and ground penetrating radars for reducing false alarm rates and improving rate of advance.		7153	7091
Standoff Explosive Detection Systems: In FY09, will conduct studies in the areas of chemical, nuclear, and biosensors applied to the explosive detection problems; will investigate standoff chemical capabilities to selectively detect multiple explosives (RDX, TNT, C4, etc.) in both vehicle borne and stationary environments; will investigate non-contact sensing techniques to extend standoff range to 30 meters (goal).			3170
Phenomenology Sensors: In FY08, extend the electro-optic/infrared (EO/IR) models in the countermine computational test bed to cover full minefield-sized images and selected urban areas; complete large scale validation for the EO/IR models; validate synthetic aperture radar electromagnetic model for small scale imagery. In FY09, will extend synthetic aperture radar (SAR) and the electromagnetic models to full minefield-size images; will 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.		2045	2029
Small Business Innovative Research/Small Business Technology Transfer Programs		438	
Total	18467	18854	18962

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602712A - Countermine Systems**	**H35**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H35	CAMOUFLAGE & COUNTER-RECON TECH	2684	2797	2853	2882	2904	2969	3037

A. Mission Description and Budget Item Justification: This project designs and develops advanced signature management and deception technologies for masking friendly force capabilities and intentions. These technologies support the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Efforts for the protection for third generation sensors investigate new technologies to reduce the susceptibility of third generation dual band forward looking infrared (FLIR) to detection via optical augmentation. Technologies pursued under this effort include measures to reduce the optical cross section of the third generation dual band FLIR both intrinsically within the detector/dewar and externally in the sensor system. Technologies investigated include the decentered field lens, wavefront coding, 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 program element is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Protection for Third Generation Sensors: In FY07, investigated available dual band FPA/dewar technologies for signature reduction and integration into sensors to conduct experiments. In FY08, conduct experiments to select dual band sensor technologies for threat sensing algorithm assessment. In FY09, will evaluate and select algorithm based upon prior analysis and measure performance; will analyze evaluation results and downselect technologies for investigation and fabrication of reduced signature third generation FLIR breadboard.	2203	2239	2356
Camouflage: In FY07, collected ground-to-ground hyperspectral background data, including thermal and thermal spectra of coatings already in the Spectral Camouflage Optimization of Patterns (SCOOP) database; surveyed existing 3-D models (e.g. Paint Map Optimizer and Multi-Service Electro-Optics Signature (MUSES)) for compatibility with SCOOP. In FY08, select 3-D target geometry model and generate or adapt first 3-D computer model for use in SCOOP optimizations; make appropriate modifications to SCOOP to permit use of 3-D target geometry; continue database development for backgrounds and coatings; evaluate means of utilizing satellite spectral data in lieu of ground-to-ground data. In FY09, will generate 3-D camouflage patterns, including visible and near infrared/shortwave infrared/mid wave infrared/longwave infrared for at least one target; will test in a virtual environment; will continue database development for backgrounds and coatings.	481	493	497
Small Business Innovative Research/Small Business Technology Transfer Programs		65	
Total	2684	2797	2853

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	40705	39763	17348	18656	19042	19463	19901
H70	HUMAN FACT ENG SYS DEV	18916	17312	17348	18656	19042	19463	19901
J21	HUMAN FACTORS APPLIED RESEARCH CA	21789	22451					

A. Mission Description and Budget Item Justification: This program funds the investigation and evaluation of aspects of human factors engineering that may limit or improve capabilities of individuals and teams of Soldiers operating in complex, dynamic environments. The knowledge gained through this applied research will enable maximizing the effectiveness of Soldiers and their equipment for mission success. Key research areas 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. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of Soldiers, with particular emphasis on Soldier and equipment interaction. Application of advancements and tools yields reduced workload, fewer errors, enhanced Soldier protection, user acceptance and allows the Soldier to extract the maximum performance from the equipment. Work in this program element (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 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). Project J21 funds Congressional special interest items.

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

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

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	40902	17426	17169
Current BES/President's Budget (FY 2009)	40705	39763	17348
Total Adjustments	-197	22337	179
Congressional Program Reductions		-263	
Congressional Rescissions			
Congressional Increases		22600	
Reprogrammings	508		
SBIR/STTR Transfer	-705		
Adjustments to Budget Years			179

Two FY08 congressional adds totaling $22600 were added to this PE.

($1600) High Optempo Performance Soldier Training
($21000) LWI Training-based Collaborative Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY**	**H70**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H70 HUMAN FACT ENG SYS DEV	18916	17312	17348	18656	19042	19463	19901

A. Mission Description and Budget Item Justification: The goal of this project is to maximize the effectiveness of Soldiers in concert with their equipment, in order to survive and prevail on the Future Force battlefield. 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 for Future Force Systems 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. The barriers to achieving the goal include incomplete Soldier performance data and models of the new missions, organizations, and new and complex technologies transforming the Army. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of Soldiers, with particular attention on Soldier and equipment interaction. 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. 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).

Work is performed by the Army Research Laboratory (ARL).

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 Command and Control (C2) planning and execution. In FY07, validated a suite of tools to improve C2 capabilities in uncertain and urban environments; and conducted cognitive task analysis of multi-player training modules. In FY08, assess team performance while performing multiple concurrent tasks and functions using integrated Intelligence, Surveillance, and Reconnaissance (ISR) technologies. Use field and lab venues to investigate real-time human-system/-network interaction measurement, monitoring and facilitation techniques. In FY09, will determine methods to identify and monitor neural and behavioral markers of pending performance drops; will consider	4637	4095	3855

correlates such as fatigue and system reliability issues. These methods will be incorporated 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.			
Enhance human performance modeling tools to optimize Soldier machine interactions for Future Force. Collect empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models. In FY07, identified and applied analysis metrics aimed at distinguishing performance of teams embedded within system-of-system (SoS) and joint operations; created and distributed a protected web-based repository of human performance models used in Manpower and Personnel Integration (MANPRINT) analyses; modeled terrain-hazard detection that integrated terrain-hazard detection data by human and machine-vision algorithms. In FY08, incorporate stressor algorithms contributed by other Services into Improved Performance Research Integration tool (IMPRINT 8 (Pro)), re-verify and distribute the tool; collect human performance data using head-mounted, dual waveband sensors for room clearing, and other operations in urban environments. In FY09, will verify and distribute linked basic task, cognitive and human motion models to the human systems integration community and platform developers; will validate approach to modeling body size increase due to clothing; will 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.	3160	2909	2574
Investigate effects on Soldier performance from integration of advanced concepts in crew stations designs. Identify, assess, and mitigate the effects of vehicle motion on Soldier performance. In FY07, leveraged lessons learned from Crew-station Integration and Automation Testbed (CAT) experimentation to generate recommendations to improve Soldier performance using drive-by-wire systems and identified and evaluated concepts for advanced visualization and auto-adaptive driving aids. In FY08, explore techniques to improve Soldiers' ability to simultaneously perform visual scanning for targets and mobility-related tasks and transition recommendations to TARDEC. In FY09, will determine Soldier machine interface design recommendations to enable the local area security function and the optimization of performance in mixed autonomous driving environments.	2100	2100	2240
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 FY07, matured physics-based models of human locomotion to predict Soldier mobility and range of motion; investigated individual Soldier physical and cognitive performance using prototype FFW Soldier systems; and linked human performance predictor variables to dismounted Soldier performance metrics. In FY08, explore the effects of advanced technologies, weight distribution, and focusing on small arms shooting performance and incorporate data to refine Soldier small arms shooter model. In FY09, will explore advanced technologies to identify improvements in dismounted squad performance; and will transition the small arms shooter model to the Soldier Program Executive Office.	5009	4538	4879
Improve human robotic interaction (HRI) in a full mission context for aerial and ground unmanned vehicles (UVs). In FY07, addressed Soldier-robotics team performance for mounted-dismounted combined arms missions using models and metrics with the goal of identifying optimal HRI interfaces for particular operational contexts; utilized metrics and diagnostics based on field studies and simulation experiments to determine optimal span of control and adaptive automation for UVs during Future Force missions. In FY08, transition HRI modeling results and design guidelines for automation and interface design and provide empirically-based recommendations for improving teaming performance to TARDEC; contribute to data collection and HRI analysis of TARDEC's field experiments using multiple UVs to validate workload reduction and performance effects. In FY09, will develop multimodal and performance based adaptive automation interfaces to control multiple, non-heterogeneous, aerial, and ground robotic systems.	4010	3668	3800
Small Business Innovative Research/Small Business Technology Transfer Programs		2	

Total	18916	17312	17348

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602720A - Environmental Quality Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	19203	20076	16064	15766	15666	15722	15838
048	IND OPER POLL CTRL TEC	2920	2976	3038	3074	3097	3165	3237
835	MIL MED ENVIRON CRIT	3132	3246	3298	3307	3364	3415	3488
895	POLLUTION PREVENTION	4401	3703	4036	3790	3983	4071	4163
896	BASE FAC ENVIRON QUAL	6910	5779	5692	5595	5222	5071	4950
EM5	ENVIRONMENTAL QUALITY APPLIED RSCH - AMC (CA)		1192					
F35	Environmental Quality Applied Research (CA)	1840	3180					

A. Mission Description and Budget Item Justification: The objective of this applied research program element is to provide 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). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, and supports the Army Strategy for the Environment. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, the Center for Health Promotion and Preventive Medicine located at Aberdeen, Maryland, and the Army Research Laboratory located at Aberdeen, Maryland, execute the work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602720A - Environmental Quality Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	19605	15809	15223
Current BES/President's Budget (FY 2009)	19203	20076	16064
Total Adjustments	-402	4267	841
Congressional Program Reductions		-133	
Congressional Rescissions			
Congressional Increases		4400	
Reprogrammings	-36		
SBIR/STTR Transfer	-366		
Adjustments to Budget Years			841

Three FY08 congressional adds totaling $4400 were added to this PE.

($1200) Propelling Agent for Slurry Gel
($1600) Biowaste to Bioenergy: Phase Two
($1600) Vanadium Technology Program

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**048**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
048 IND OPER POLL CTRL TEC	2920	2976	3038	3074	3097	3165	3237

A. Mission Description and Budget Item Justification: The objective of this applied research project is to 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/field waste. Additional work is focused on environmental risk assessment for ranges. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Industrial Compliance and Pollution Prevention Readiness: In FY07, maximized adhesive and agglomerative properties of cellulosic component and transferred polymer component to reduce barrier/fortification requirements. Developed reductive treatment/transformation studies for Dinitro Anisole (DNAN) and Methyl Nitro para Aniline (MNA), and conducted structural activity analysis to predict fate and treatment effectiveness. Developed improved physics-based algorithms for blast and small arm noises though comprehensive measurements and application of non-linear wave steepening and time/frequency modeling. In FY08, complete development of a Structural Activity Relationship (SAR) Predictive Model for insensitive munitions treatment kinetics and research chemical/physical characteristics of fugitive industrial particulates. In FY09, will conduct research in chemical/physical characteristics of fugitive industrial particulates and develop new sensing modalities using mimicked human physiological responses to detect acutely toxic substances in water.	2920	2935	3038
Small Business Innovative Research/Small Business Technology Transfer Programs		41	
Total	2920	2976	3038

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**835**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
835 MIL MED ENVIRON CRIT	3132	3246	3298	3307	3364	3415	3488

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide 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 U.S. 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, manages execution of the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, identified novel contaminant detection systems and measurement protocols for near-real-time, on-site long term monitoring (LTM) for MCs, integrated a distributed source contaminant transport model into the ARAMS, and further refined computational biology virtual simulations. In FY08, design a laboratory-scale gene signature array microchip sensor, evaluate field negative ion miniature mass spectrometry for detection of MCs, define statistically valid range characterization/sampling protocols for MC sources, construct a toxicogenomic assessment framework as a modeling platform, identify methods for computational chemistry prediction of effects of water dissolved explosives, and identify analytical approaches to characterize nanomaterial properties to support toxicological and remediation approaches. In FY09, will evaluate LTM 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, complete mathematical modeling of toxicity and effects due to existing, well characterized MECs and devise computational chemistry methods for the prediction of reactivity and toxicity of explosives and decomposition products dissolved in water. Will identify exposure quantification metrics for select representative nanomaterials. Will explore a common framework to consolidate tools for comprehensive, multi-stressor range environmental risk assessments.	3132	3171	3298
Small Business Innovative Research/Small Business Technology Transfer Programs		75	
Total	3132	3246	3298

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**895**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
895 POLLUTION PREVENTION	4401	3703	4036	3790	3983	4071	4163

A. Mission Description and Budget Item Justification: The goal of this project is to provide energetics/munitions technologies required to reduce/eliminate the environmental footprint resulting from the manufacture, maintenance, use and surveillance of Army ordnance. This program matures revolutionary technologies to eliminate or significantly reduce the environmental impacts that threaten the sustainment of energetics production and maintenance facilities and training ranges. The project supports the transformation of the Army by ensuring that advanced energetic materials required for the Future Force 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, 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, 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Rocket and Missile Propellants: In FY07, characterized decomposition products and environmental properties of new propellants. In FY08, model performance of propellant-engine combinations. In FY09, will optimize and evaluate performance of propellants in new engine. Conventional Ammunition: In FY07, synthesized and evaluated five new low-toxicity explosives in gram-scale and scaled-up synthesis of select materials for performance and environmental evaluation. In FY08, refine green chemistry synthesis procedures and perform full chemical and physical characteristic evaluation of new explosives. In FY09, will model performance of new environmentally benign explosives in weapons systems. Pyrotechnics: In FY07, evaluated environmental characteristics, performance, and compatibility of pyrotechnic candidates. In FY08, optimize low-toxicity smoke formulations. In FY09, will investigate environmentally sustainable simulators, flares, delays, and signals.	4401	3599	4036
Small Business Innovative Research/Small Business Technology Transfer Programs		104	
Total	4401	3703	4036

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602720A - Environmental Quality Technology**	**896**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
896 BASE FAC ENVIRON QUAL	6910	5779	5692	5595	5222	5071	4950

A. Mission Description and Budget Item Justification: The objective of this applied research project is to 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 to accommodate the Current and Future Force. 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 advanced methods and technologies to restore lands damaged during training activities, allow sustained use of installation facilities and training land resources and maintain readiness by use of improved threatened and endangered species monitoring technology to fully utilize training lands. The project also provides tools and technologies to avoid training restrictions and costs due to training and testing noise. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, and supports the Army Strategy for the Environment. The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Threatened and Endangered Species (TES) Management to Reduce Operational Constraints: In FY07, completed new techniques for preparation of population goals on Army lands to ensure the Army was responsible for its fair share of species recovery. Completed groundwork in improving species at risk detection capability. In FY08, complete projects identifying effects of noise and physiological stress of transient training activities on the Indiana bat and gopher tortoise, conduct research in support of a Candidate Conservation Agreement for gopher tortoise, and enhanced Light Detection and Ranging (LIDAR) applications for habitat assessment. Completion of projects reduces potential constraints on military training associated with the Indiana Bat Recovery Plan currently in revision and under Army review and a possible Endangered Species Act listing petition for the gopher tortoise. In FY09, will evolve research from reactive, single species research applications for currently listed species to a multi-species approach for improved detection of species at risk and predictive synthesis models for effects of military disturbance on species at risk. This will assist the Army in reducing the number of future listed species and their associated constraints on military training.	3000	3077	2949
Predictive Risk Assessment and Management for Army Ranges and Training Lands: In FY07, completed initial groundwork for studies on impacts of discrete noise on ranges to meet new regulatory requirements and matured Army Training and Testing Area Carrying Capacity (ATTACC) protocols to incorporate non-military land and natural resource stressors. In FY08, begin developing and evaluating strategies to mitigate high priority invasive species impact on training, and the cumulative interaction of training activities and multiple use on natural resources. In FY09, will complete initial algorithms for weather and nonlinear effects on sound propagation for determining discrete noise impacts and describing variance in noise level decay with distance.	3910	2702	2743
Total	6910	5779	5692

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602782A - Command, Control, Communications Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	46332	36955	24014	24519	25057	25614	26191
779	C2 & PLAT ELEC TECH	8461	7873	9540	9876	10299	10528	10766
H92	COMMUNICATIONS TECH	10852	14180	14474	14643	14758	15086	15425
TR9	C3 COMPONENT TECHNOLOGY (CA)	27019	14902					

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops advanced communications technologies, Command and Control (C2), and electronics systems/subsystems for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The intent is to provide the Army with enhanced capabilities for secure, mobile, networked communications, assured information delivery, and presentation of information that enables decision-making. This is achieved by improving the command, control, and communication systems (e.g. man-machine interfaces, information management, data analysis, mobility, security, capacity, safety, reliability, and survivability) for both air and ground platforms, including the dismounted Soldier. Commercial technologies are continuously investigated and leveraged where possible. Project 779, C2 and Platform Electronic Technology, funds applied research on infrastructures and 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. This applied research also includes enhancements to the Global Positioning System (GPS) user equipment to provide more robust, anti-jam position and navigation capabilities, and improvements to man-machine interfaces and decision aids for increased operational tempo in an On-the-Move (OTM), network-centric battlefield environment. Project H92, Communications Technology, funds research that provides technologies which allow Current and Future Force field commanders to communicate OTM to/from virtually any location, through a seamless, secure, self-organizing, self-healing, network. Integrated networks of unmanned remote sensors, maneuver and fire support elements, and situational awareness (SA) tools allow the Future Force to achieve overmatch with agility and versatility. In addition, portions of this effort support the Joint Tactical Radio System (JTRS) evolutions. Project TR9 funds congressional special interest efforts.

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

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	48412	22215	24046
Current BES/President's Budget (FY 2009)	46332	36955	24014
Total Adjustments	-2080	14740	-32
Congressional Program Reductions		-260	
Congressional Rescissions			
Congressional Increases		15000	
Reprogrammings	-1092		
SBIR/STTR Transfer	-988		
Adjustments to Budget Years			-32

Nine FY08 congressional adds totaling $15000 were added to this PE.

($800) Research of Advanced Communications Technologies for Enhanced Secure, Mobile, Networked Communications
($1000) Development of a High Performance Computing System Based on a Modem High Speed Switch Fabric
($1000) Dynamically Managed Data Dissemination
($1200) Portable Flexible Communication Displays Devices
($1400) Integrated Lightweight Electronics Shelter
($2000) C4ISR Integrated Digital Environment Service Model (IDESM)
($2000) Intelligent Distributed Command & Control (IDC2)
($2400) Lightweight Theater Transportable TOC
($3200) Advanced 3-D Locator (A3DL) Technology

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602782A - Command, Control, Communications Technology**	**779**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
779 C2 & PLAT ELEC TECH	8461	7873	9540	9876	10299	10528	10766

A. Mission Description and Budget Item Justification: This project designs, develops and applies new concepts and techniques in Command and Control (C2) to achieve enhanced military capabilities for the Future Force, and where applicable for the Current Force. The Future Force requires leaders at all levels to have continuous and accurate situational awareness to make informed and rapid critical decisions to "move shoot, and/or communicate" more quickly than the adversaries. This project performs the applied research that enables commanders at all echelons to have better and more timely information and allows them to command from anywhere on the battlefield. Emphasis is on two critical cornerstones of Battle Command: data management and automated analysis (to provide course of action determination, mission planning and rehearsal, mission execution monitoring and replanning, and precision positioning and navigation). New enabling technologies that support the current thrusts also are explored, such as multi-modal man-machine interactive technology, battle space visualization, automated cognitive decision aids, real-time collaborative tactical planning tools, data transfer, distributed data bases, advanced open system architectures, and integration concepts which contribute to more mobile operations. The Battle Space Awareness and Positioning program 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 environments. The C2 OTM enabling technologies effort designs and develops technologies and decision aids that enable course of action (COA) generation and analysis. The Networked Enabled Battle Command effort designs, develops and evaluates information search, retrieval, and decision models to enable seamless interoperability between tactical battle command and echelons above brigade.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Battle Space Awareness and Positioning: In FY07, developed improvements for Micro Electro Mechanical System (MEMS) navigation sensors for dismounted Soldier and tactical vehicle applications and evaluated human (loco) motion modeling compensation for dismounted Soldier operations in urban areas. In FY08, investigate advanced positioning/navigation (pos/nav) sensor technologies and conduct trade studies to determine applicability of advanced network algorithms and processes within the context of emerging brigade combat team (BCT) architectures; continue the design and assessment of performance improvements in order to improve the accuracy in MEMS Inertial Measurement Units for dismounted Soldier and tactical vehicle applications. In FY09, will downselect the pos/nav sensor suite and will demonstrate advanced pos/nav sensor integration techniques with advanced network algorithms and processes compatible with BCT architectures to enable robust position information for enhanced situation awareness in GPS denied, urban, and other complex environments. Work on this effort is also being accomplished under PE/Project: 0603772A/101.	1932	2893	1995
C2 OTM Enabling Technologies: In FY07, constructed the intelligent agent software toolkit and developed an intelligent agent testbed to integrate, test, and validate all software agents used in C4ISR. In FY08, partner with the Space and Missile Defense Command (SMDC), Space Technology division on an effort to develop intelligent software agents that operate in both 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 in	2133	4952	7545

the operational environments for battle command, intelligence, surveillance, and reconnaissance (ISR), and logistic customers. In FY09, will 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 agent services; will 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; will evaluate machine language translation tools and parsing techniques for the purpose of text-to-text and speech-to-speech translation in order to provide enhanced collaboration among joint coalition forces.			
Network Enabled Battle Command: In FY07, investigated advanced effects-based decision models that automatically match emerging patterns in the common operating picture and the mission to those in the knowledge base of recommended decisions for a given situation; developed automated wargaming tools that allow commanders to project potential effects of decisions and assess sensitivity of alternate options on future battle state; designed a running estimate process for the Joint Tactical Common Operating Picture Workstation that compares a plan with actual situational awareness data and recommends adjustments to the plan. Work on this effort is also being accomplished under PE/Project: 0603772A/101.	4396		
Small Business Innovative Research/Small Business Technology Transfer Programs		28	
Total	8461	7873	9540

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602782A - Command, Control, Communications Technology**	**H92**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H92 COMMUNICATIONS TECH	10852	14180	14474	14643	14758	15086	15425

A. Mission Description and Budget Item Justification: This project designs, develops and applies advanced communications and network technologies to meet the network-centric battlefield needs of the Future Force, including the dismounted Soldier. The strategy is based on leveraging and adapting commercial technology to the maximum extent possible and focusing applied research efforts on those areas not addressed elsewhere (e.g., mobile radio based infrastructures, security in narrowband environments, multiband On-the-Move (OTM) transmit and receive antennas, adaptive protocols, and low probability of interception/low probability of detection). The Modeling and Simulation (M&S) for Network Design effort designs and demonstrates a software tool to conduct computer aided design, assessment and analysis of, multi-tiered, mobile-wireless ad hoc network designs, alternative designs, and design options for large military networks. The programmable encryption technologies effort designs and develops solutions to address emerging requirements for Joint Forces secure and dynamic high speed communications cryptography requirements. The Radio Enabling Technologies and Nextgen Applications (RETNA) effort designs and develops affordable radio components and enabling technologies to improve Joint Tactical Radio System (JTRS) range, throughput, and reliability performance. The Antenna Technologies effort designs and develops low cost, low profile omnidirectional and directional antennas and antenna components for line-of-sight (LOS) and OTM satellite communications (SATCOM). The Tactical Wireless Network Assurance effort funds applied research in network protection, cross security domain information sharing wireless intrusion detection technologies for mobile wireless ad hoc networks and provides safeguards against modern network attacks.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): COMPOSER consists of the following software modules: Communication Effects Simulator (CES), Network Visualizer (NV), Spectrum Manager, and Architecture Framework. In FY07, performed analysis of available radio models and waveforms and integrated the waveforms to test interoperability with COMPOSER tools to dynamically plan, predict, and visualize network communications performance due to maneuver and environmental effects faster than real time and proven through modeling and simulation ; matured spectrum management capability, improved the speed and accuracy of the CES. In FY08, complete enhancements to CES; increase the integration of waveform models to CES; complete spectrum management capability; develop final version of COMPOSER for transition to the Coalition Joint Spectrum Management Planning Tool Joint Concept Technology Demonstrations. Work on this effort is also being accomplished under PE/Project 0603008A/TR1.	1544	296	
Radio Enabling Technologies and Nextgen Applications (RETNA): In FY07, developed Handheld Manpack Small Form Fit Joint Tactical Radio Systems Manpack power amplifier (PA) form-fit brassboard; validated the PAs component performance and associated system-level capability; identified root causes of waveform porting difficulties through failure and risk analyses to software defined radio (SDR). In FY08, perform detailed assessment and evaluation of the hardware/software and porting of waveforms onto JTRS representative SDR platforms; develop capability to reduce the complexity of porting software waveforms onto SDR hardware.	1699	1815	

Antenna Technologies: In FY07, conducted modeling and simulation to validate terrestrial directional antenna (TDA) parameters/link connectivity; developed innovative methods for integrating radio frequency (RF) electronics into X-band antenna assembly; developed methods of integrating Ku and Ka band transmit/receive into one OTM ground antenna system; developed methods of integrating power amplifiers into antenna assemblies; and investigated various low profile antenna technologies. In FY08, complete development of TDA technologies for mobile ground platforms providing air interface for terrestrial directional networking and beam steering protocols; investigate 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. In FY09, will develop and demonstrate a multi-beam low profile OTM SATCOM antenna that functions in two frequency bands (Ka/Q); will develop and demonstrate an integrated Ka/Q band power amplifier.	2907	4591	6904
Programmable Objective Encryption Technologies (POET): POET is a jointly funded effort with US Navy, Air Force, Marine Corps, to develop high speed, 4-channel, remotely manageable, programmable, embeddable crypto device. In FY07, developed and delivered emulator versions of the cryptological embedded chip design to the High Capacity Communications Capability (HC3), the Navy Multiband Terminal (NMT), and the Air Forces Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) program offices; provided testbed verification of the performance specifications of the emulator; performed a critical design review to determine the merits of continuing development effort into the next phase. In FY08, complete development of the Engineering Development Model (EDM) and deliver Non-Certified EDMs for start of Government Lab Evaluation/Test with a simulated host terminal; perform initial NSA Certification testing and implement design changes based on test results. In FY09, will continue Lab Evaluation and certification process, will complete effort with Certified EDM delivery.	815	1477	1526
M&S for Network Designs: In FY07, baselined the network design capability to validate principles and rules that govern the behavior and performance of complex communication networks; assessed and characterized the behavior and performance of the network (higher physical, data link and network layers) through analytical and M&S processes and technologies. In FY08, evaluate the network design capability on a surrogate future force network; interface the network design algorithms with the simulation; characterize detailed end-to-end user performance metrics; and assess the effectiveness of new networking technologies. In FY09, will extend the ad hoc network design tool to include modeling and representation of the C4ISR nodal functionalities; will develop a comprehensive representation of the internal operation and performance of network data dissemination mechanisms; will improve the network traffic characterization model.	2569	2757	3454
Tactical Wireless Network Assurance / wireless information assurance (IA): In FY07, developed advanced IA techniques; expanded wireless intrusion detection to detect attacks against mobile hosts and networks. In FY08, develop software 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; provide the capability to automatically respond and mitigate/recover from the malicious activity; validate the maturity and performance of the technology in a fully scaled 400 node mobile ad hoc emulation environment. In FY09, will develop a suite of IA technologies to enable enhanced tactical battlefield information sharing across multiple security classification domains (i.e., TS/SCI to Unclassified) to meet emerging threats (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 software partioning and kernel technology with controlled interface filtering to enforce push/pull of information across security domains for severely resourced constrained environments); will develop and assess operating system agnostic malicious code detection technology that uses proactive, automated techniques to find vulnerabilities and software flaws via source code analysis and reverse engineering.	1318	3042	2590
Small Business Innovative Research/Small Business Technology Transfer Programs		202	
Total	10852	14180	14474

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602783A - COMPUTER AND SOFTWARE TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	6602	9803	5495	5591	5686	5838	6018
Y10	COMPUTER/INFO SCI TECH	3745	5332	5495	5591	5686	5838	6018
Y11	COMPUTER & INFORMATION SCIENCE APPLIED RES CA	2857	4471					

A. Mission Description and Budget Item Justification: This program element (PE) funds research and application of information and communications technology to enhance the understanding and speed the decision cycle for mounted and dismounted commanders and leaders operating in the mobile dispersed environment envisioned for the Future Force. Focus is on a spectrum of command and control (C2) solutions for lower echelon teams. This program investigates and matures command, control, communications and computer (C4) technologies to increase Future Force lethality and survivability through improved commanders' decision making and situational awareness and, where feasible, exploits opportunities to enhance Current Force capabilities. The goals of this program element are to develop information processing technologies to automate the delivery of local/global information for decision making (planning, rehearsal, and execution) so that it is synchronized, parallel, real-time, and to devise 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. Challenges for this program include developing automated tools to support the discovery of services within an unreliable ever-changing network topology as well as providing methods for end-users to understand the tactical significance of events generated from both local and global tactical sensors. Technologies addressed in this work will enable a spatial and temporal explanation of the situation through graphical and narrative based multi-media reporting for the commander. 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). Project Y11 contains congressional adds only.

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

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

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602783A - COMPUTER AND SOFTWARE TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	6719	5368	5510
Current BES/President's Budget (FY 2009)	6602	9803	5495
Total Adjustments	-117	4435	-15
Congressional Program Reductions		-65	
Congressional Rescissions			
Congressional Increases		4500	
Reprogrammings	10		
SBIR/STTR Transfer	-127		
Adjustments to Budget Years			-15

One FY08 congressional add totaling $4500 were added to this PE.

($4500) Ruggedized Cylinders for Expandable Mobile Shelters

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602783A - COMPUTER AND SOFTWARE TECHNOLOGY**	**Y10**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Y10 COMPUTER/INFO SCI TECH	3745	5332	5495	5591	5686	5838	6018

A. Mission Description and Budget Item Justification: This project funds research and application of information and communications technology to enhance the understanding and accelerate the decision cycle time for mounted and dismounted commanders and leaders operating in the mobile dispersed environment envisioned for the Future Force. Focus is on a spectrum of command and control (C2) solutions for lower echelon teams. Research within this project investigates and matures command, control, communications, and computer (C4) technologies to increase Future Force lethality and survivability through improved commanders' decision-making and situational awareness and, where feasible, exploits opportunities to enhance Current Force capabilities. The goals of this project are to develop 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 to devise 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. Challenges for this program include developing automated tools to support the discovery of services within an unreliable ever-changing network topology as well as providing methods for end-users to understand the tactical significance of events generated from both local and global tactical sensors. Technologies addressed in this work will enable a spatial and temporal explanation of the situation through graphical and narrative based multi-media reporting for the commander. Work in this project 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).

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

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Enhance information processing techniques through the interactive and automated fusion of distributed local and global information sources in order to inform and protect the force from imminent threats. User directed fusion techniques that combined with techniques 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 C2 operations. The integrated technology will be matured for Distributed Common Ground Station-Army (DCGS-A) and Future Force assessment. In FY07, mined marked-up Resource Description Framework (RDF) and Ontology Web Language (OWL) based data-stores for events/associations across disparate data sources. In FY08, implement ontology to formalize the representation, attributes, and transforms necessary to track a soft target using various data sources. Integrate soft target tracking algorithms as small, self-contained fusion services that support the Intelligence Analyst in interpreting battlefield events. In FY09, will develop and transition fusion services to CERDEC for integration into DCGS-A.	1100	1075	1090
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	961	1033	1040

technologies. In FY07, implemented and evaluated cooperative algorithms for detecting sophisticated attacks involving multiple colluding nodes against Mobile Ad Hoc Network (MANET) routing protocols. Evaluated clustering algorithms for creating and maintaining a dynamic hierarchy of cooperative intrusion detection components in MANETs. Implemented a prototype network protocol that increased current efficiency of media-access control. In FY08, investigate and evaluate an integrated distributed wireless intrusion detection system (IDS) capable of detecting multiple classes of intrusions from multiple simultaneous intruders. Enhance network protocol to provide a more efficient healing process. In FY09, will 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).			
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 FY07, using a Distributed Interactive Semi Automated Forces (DISAF) simulation, evaluated the ability of the distributed agent infrastructure to provide a tactically relevant picture of the local operational environment through a series of time sequenced events. In FY08, use social networking concepts to develop soft target tracking algorithms that can be used to identify relevant changes in the tactical environment. In FY09, will integrate cross-security-level information exchange algorithms to insure tactically relevant information is presented to the user in a minimally intrusive manner.	1135	1100	1135
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. In FY07, enhanced the underlying framework to include the ability to extract the metrics required for evaluation of text based machine translation engines. Developed the underlying software framework to integrate the best microphone and two-way speech technologies. In FY08, implement optical character recognition (OCR), machine translation and name extraction via web services in Deployable Harmony DOCEX System (DHDS) and DCGS-A test beds. In FY09 will evaluate use of prototype document image processing tools operating through web service on noisy and handwritten foreign language documents.	549	541	545
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 experimental verification of mobility, channel, topology models, and of convergence of adaptive protocols, guide development of the theoretical 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. In FY08, acquire software and hardware, including network monitoring tools, and setup emulation and in-the-lab/field experiments to gather network performance data, based on algorithms developed in this PE/Project. In FY09, will 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 RF channel conditions and sophistication of the adaptation). Theoretical work will be validated against the acquired data.		1497	1685
Small Business Innovative Research/Small Business Technology Transfer Programs		86	
Total	3745	5332	5495

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	50817	58693	52066	53087	53773	55249	56699
855	TOPOGRAPHICAL, IMAGE INTEL & SPACE	11154	14622	15122	15809	16562	17494	18433
H71	ATMOSPHERIC INVESTIG	6701	6632	6728	6961	7016	7172	7332
T40	MOB/WPNS EFF TECH	15513	17448	17809	18024	18174	18578	18996
T41	MIL FACILITIES ENG TEC	5019	4178	4431	4297	4018	3979	3826
T42	COLD REGIONS ENGR TECH	4502	4530	4768	4830	4871	4979	5071
T45	ENERGY TEC APL MIL FAC	3329	3252	3208	3166	3132	3047	3041
T48	Center for Geosciences & Atmospheric Research		1988					
T52	Stationary Power and Energy Applied Research (CA)	3776						
T53	Military Engineering Applied Research (CA)	823	6043					

A. Mission Description and Budget Item Justification: The objective of this applied research program element (PE) is to provide military engineering technologies in support of the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. 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 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, and the Army Research Laboratory located at Aberdeen, Maryland, execute the work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	51278	51120	52118
Current BES/President's Budget (FY 2009)	50817	58693	52066
Total Adjustments	-461	7573	-52
Congressional Program Reductions		-507	
Congressional Rescissions			
Congressional Increases		8080	
Reprogrammings	-104		
SBIR/STTR Transfer	-357		
Adjustments to Budget Years			-52

Five FY08 congressional adds totaling $8080 were added to this PE.

($2000) Geosciences/Atmospheric Research
($1200) C-RAM Armor Development
($1280) Airborne Threats
($1600) Nano-Crystalline Cement for High Strength, Rapid Curing Concrete with Improved Blast Resistance
($2000) Biologically Inspired Security Infrastructure for Tactical Environments

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**855**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
855	TOPOGRAPHICAL, IMAGE INTEL & SPACE	11154	14622	15122	15809	16562	17494	18433

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide advanced technologies for storing, transforming, updating, 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 program elements (PE) 0601102A Project 52C and PE 0602784A Project H71. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Data Generation: In FY07, developed and refined technologies to detect and geo-locate toxic battlefield compounds and agents. Began incorporating this capability into sensor technology that can be deployed in the battlespace environment. In FY08, experiment with prototype sensors, and develop methodologies to integrate the data collected into an expanded geo-database to include elements beyond those incorporated in previous years. In FY09, will design and develop new capabilities that exploit sensor data from various sources (including Soldiers, imagery, and lidar) to rapidly generate the minimum geospatial data required to support operations in various terrain (e.g., urban and complex terrain.)	1783	2406	2510
Data Management: In FY07, developed and tested a geospatial data model that incorporated traditional terrain data types and also included detailed tactical HUMINT data. In FY08, develop and refine 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. In FY09, will implement new geospatial terrain and cultural data technologies, taxonomies and models to ensure interoperability and sharing of information.	4455	5716	5970
Data Analysis: In FY07, matured urban terrain reasoning tools that incorporate the effects of natural, man-made features, and human activities into urban Course of Action planning tools. Developed a prototype geospatial game board for wargame and gaming applications. In FY08, develop a state of the art model for evidential reasoning that incorporates terrain and cultural conditions. In FY09, will complete experimentation and prototyping to include connection to Future Combat Systems Brigade Combat Team. Will evolve standalone evidential reasoning model(s) from standalone to reachback services.	4916	6352	6642
Small Business Innovative Research/Small Business Technology Transfer Programs		148	
Total	11154	14622	15122

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**H71**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H71 ATMOSPHERIC INVESTIG	6701	6632	6728	6961	7016	7172	7332

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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research Laboratory.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Develop a new high resolution, short-range forecasting capability: In FY07, designed and evaluated a Local Analysis and Prediction System (LAPS) capable of ingesting data from conventional and non-traditional data sources for nowcasting applications. In FY08, integrate a complete Weather Running Estimate-Nowcast (WRE-N) capability for DCGS-A that supports the fidelity and timeliness of the forecasts. Evaluate the use of Weather Research and Forecasting (WRF) model as part of the LAPS package within the WRE-N system for improved ability to ingest data from both conventional and non-traditional sources. In FY09, will formulate new methods to use microscale model output for critical micro- Unmanned Aircraft System (UAS) flight parameters that can improve the launch, operation, and recovery of UAS assets. Will research, design, and apply high resolution meteorological model improvements that account for fine scale structure in the urban boundary layer meteorology for an improved capability for predicting atmospheric effects.	2529	2556	2567
Determine critical value thresholds for weather impacts on friendly and threat systems for the rule-based Integrated Weather Effects Decision Aids: In FY07, integrated UAS route planning decision aids based on effects of wind, terrain, and weather hazards on platform and sensor performance. Designed UAS mission route flight optimization capability including enroute adjustments to account for atmospheric conditions. Adapted neural network acoustic propagation model into Sensor Performance Evaluator for Battlefield Environments (SPEBE) to achieve a faster solution. In FY08, employ automated Weather Intelligence-Routing (WIN-R) UAS flight optimization capability enabling automated route adjustments based on detected atmospheric effects. In FY09, will construct an acoustic model predicting the effects of single urban structures on detection and avoidance capabilities. Will explore machine-to-machine	2071	2089	2100

capability options for autonomous UAS flight control using WIN-R technology that will eliminate the need for the man-in-the-loop. Will integrate wideband enhancements to Tri-Service MODTRAN. Will integrate night-time illumination model improvements into Tri-Service Target Acquisition Weapons Software (TAWS).			
Develop models to improve condition prediction in urban/complex terrains that integrate high resolution boundary layer meteorological (met) measurements. In FY07, investigated the use of super-continuum LIDAR for remote spectral identification of airborne compounds. Explored the potential of using parameterized slope flow effects in a microscale wind model for greater fidelity and accuracy. Evaluated urban wind field models through field experiments for optimum met sensor placement. In FY08, prepare a microscale wind model for urban domains initialized with WRE-N and WRF model output with computationally efficient data assimilation methods. Investigate the capture efficiency of single particle aerosol extraction technologies and explore urban field measurement data against urban wind flow predictive models. In FY09, will employ stable boundary layer (a cool layer of air adjacent to a cold surface of the earth, where temperature within that layer is statically stably stratified) to improve existing high resolution boundary layer meteorological models. Will simulate and evaluate use of a microscale wind model as an integrated part of the DCGS-A weather system. Will develop and integrate a Doppler LIDAR Analysis Toolkit (DLAT) for semi-autonomous data assimilation and processing. Will investigate an integrated aerosol separation and bioassay instrument for detecting aerosols.	2101	1980	2061
Small Business Innovative Research/Small Business Technology Transfer Programs		7	
Total	6701	6632	6728

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T40**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T40 MOB/WPNS EFF TECH	15513	17448	17809	18024	18174	18578	18996

A. Mission Description and Budget Item Justification: The objective of this applied research project is to develop technologies for rapid upgrading, construction, and repair of in-theater airfields; 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Adaptive Protection - In FY07, developed algorithms for survivability design and assessment tools; produced low-cost, threat specific modular protective systems for large areas at about 1/5th the cost per square foot of advanced composite and ceramic armors; and initiated effort to develop technologies to provide protective materials and configurations against large caliber rockets and mortars, light artillery, and 50-caliber arms; and initiated effort to gain improved understanding of geophysical phenomenology to support detecting buried targets. In FY08, create novel layered protective materials to defeat 50-caliber arms and develop procedures for numerical evaluation of protective materials through multi-scale modeling. Develop Target Recognition (TR) for tunnel and tunneling activity detection for use by Joint Task Force North in their interdiction mission. In FY09, will design and assess protective systems and retrofits to defeat large caliber rockets, light artillery, and 50-caliber arms. Will develop sensor/geophysical algorithms for disturbed material signatures to be utilized by sensors that detect buried objects. Will commence development of tunnel sensor fusion algorithms and of real time analysis techniques for tunnel sensor performance assessment. Using the Computational Protection Testbed, will assess expedient protection against artillery and missiles.	6797	6427	7002
Austere Entry and Maneuver /Joint Rapid Airfield Construction In FY07, supported Joint Enable Theater Access-Sea Ports of Debarkation (JETA-SPOD) Joint Concept Technology Demonstration (JCTD) in conducting full-scale Lightweight Modular Causeway System (LMCS) component testing and demonstration. In FY08, provide technical support to develop designs that enable final fabrication and/or modifications as necessary for the system to be tested in a controlled field environment, including two full-scale LMCS sections and the JETA-SPOD Analysis Tool. Provide scientific expertise to monitor fabrication of the systems and provide Quality Assurance/Quality Control for the full-scale LMCS and provide design details and drawings for an Emplacement and Recovery System to be used on multiple launch platforms for the LMCS test series. In FY09, will provide technical expertise to support 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. Will also develop and assess design modifications for the LMCS that arise from this series of tests and provide these design modifications to the Transition Manager. Will develop the capability to rapidly identify and repair austere landing zones for vertical lift intra-theater	3755	6908	7880

access.			
Maneuver Support/Gap Defeat - In FY07, finalized and evaluated algorithms to predict performance of ARDEC_s Multi-Threat Objective Projectile (M-TOP) against urban targets. In FY08, participate in M-TOP redesign using the ERDC-developed, DOD-accredited penetration model, PENCRV3D. Participate in the M-TOP integrated demonstration by providing the instrumented structural target and weapons effects analysis. Future Force Breaching in MOUT: In FY09, will 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. Will, in cooperation with 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.	2664	2454	1713
Geospatial Research and Engineering Support - In FY07, produced and refined products/procedures for interoperability; expanded scaling as required based on set of Battlespace Terrain Reasoning and Awareness (BTRA) information products; incorporated additional behaviors and related components as necessary to support training and course of action development and analysis. In FY08, create an Urban Tactical Decision Aid for planning the best mix of infantry and small unmanned ground vehicles for clearing a building. In FY09, will develop bridging analysis Tactical Decision Aid for determining necessary bridging assets to conduct gap crossing and defeat solutions and will support Geospatial Battle Management Language (GEOBML) syntax in support of the Battlespace Terrain Reasoning and Awareness Battle Command (BTRA-BC) efforts.	2297	1659	1214
Total	15513	17448	17809

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T41**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T41 MIL FACILITIES ENG TEC	5019	4178	4431	4297	4018	3979	3826

A. Mission Description and Budget Item Justification: The objective of this applied research project is to deliver sustainable, cost efficient and effective facilities; and provide installation operations required to support the Future Force. The project focuses on advanced 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 U.S. 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Facility Engineering: In FY07, completed protocols for determining boundary conditions (building exterior and interior) and boundary condition models for use by facility designers and operators to protect DoD facilities from air borne contaminants. In FY08, develop and evaluate prototype Carbon Nanotube (CNT)-based filaments, membranes, and coatings that have 2-fold to 10-fold improvement in performance (strength, weight) over existing materials (e.g. steels, polymers) for installation infrastructure materials. In FY09, will 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. Will develop molecular polarity maps for contaminant compounds using computational chemistry models.	1867	1537	2056
Facility Modeling and Simulation/Fort Future: In FY07, modeled buildings and cultural aspects of urban terrain in a computationally efficient form. In FY08, develop 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. Develop molecular models for sorption kinetics using dynamic, atom-by-atom buildup of contaminant on aged pipe-wall. Develop reaction kinetics in chlorinated/chloraminated water using computational chemistry models applied to the contaminant alone. In FY09, will develop analysis and predictive capabilities to enable units to gain cultural competence relevant to their mission. Will develop rate constants of uptake of contaminates on pipe wall based on results of the dynamic models using static representation of the contaminant alone.	3152	2641	2375
Total	5019	4178	4431

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T42**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T42 COLD REGIONS ENGR TECH	4502	4530	4768	4830	4871	4979	5071

A. Mission Description and Budget Item Justification: The objective of this applied research project is to 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Terrain State: In FY07, formulated new model of energy and mass exchange for exterior urban surfaces to support target surveillance and reconnaissance; validated models of radiant temperatures of urban exterior surfaces. In FY08, establish and validate approaches such as real-time analysis techniques for sensor performance to greatly improve computational efficiency for carrying out terrain-state calculations. In FY09, will 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.	3296	2851	2757
Signature Physics: In FY07, formulated new approaches to multi-sensor fusion (e.g., acoustic and seismic) and optimization based on characteristics of a complex battlespace environment. In FY08, design and evaluate tactical decision aids supporting multi-mode sensor missions with templates of geo-environmental effects. Develop algorithms to identify disturbed soil signatures based on sensor modality and geo-environment. In FY09, will 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 into Battlespace Terrain Reasoning and Awareness - Battle Command (BTRA-BC) efforts.	1206	1667	2011
Small Business Innovative Research/Small Business Technology Transfer Programs		12	
Total	4502	4530	4768

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T45**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T45 ENERGY TEC APL MIL FAC	3329	3252	3208	3166	3132	3047	3041

A. Mission Description and Budget Item Justification: The objective of this applied research project is to provide technologies necessary for secure, energy efficient, sustainable military installations, emphasizing energy and utility systems protection from, and in response to, evolving needs such as contaminant detection. Advanced 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Systems Response to Threats: In FY07, compared tool analyses to an instrumented Army facility using simulated chemical and biological agents. In FY08, develop predictive models and algorithms making use of activation energies for deformation and degradation mechanisms based on chemistry (moisture absorption, hygro-thermal effects and crack growth) for prediction of mechanical properties and durability of fiber reinforced polymer (FRP) composites for facilities and equipment. In FY09, will evaluate and test simulation algorithms based on failure modes and mechanistic models under interactive conditions. Will develop nanotechnology based detection and identification of targeted multiple contaminants in near-real-time for _detect-to-warn_ sensing in mission critical facilities.	1668	1787	3208
Installation Modeling and Simulation/Fort Future: In FY07, developed and assessed extended methodology to work with incomplete data sets. Network Enabled C2: In FY07, developed algorithms capable of inferring utility network layout from partial information. Developed algorithms to update the utility network layout as additional information is acquired. In FY08, develop analysis tools capable of identifying and summarizing a utility network's impact on military operations in urban terrain (MOUT).	1661	1443	
Small Business Innovative Research/Small Business Technology Transfer Programs		22	
Total	3329	3252	3208

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602785A - Manpower/Personnel/Training Technology**	**790**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
790	Personnel Performance & Training Technology	15705	16102	16412	16539	16694	17055	17428

A. Mission Description and Budget Item Justification: The objective of this program element (PE) is to conduct the behavioral and social science applied research that will provide the 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 to comprise a ready and relevant Landpower. This research, where feasible, exploits opportunities to enhance Current Force capabilities. 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 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 US 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 0601102-74F and PE 0603007-792. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Personnel: In FY07, designed more precise interactive model of retention and, using model and multivariate analyses, identified strategies emphasizing non-financial behavioral interventions that could potentially improve retention; collected data from operational Soldiers in selected MOS using knowledge, skills and abilities (KSA) assessment measures and evaluated potential to predict preliminary performance data from supervisors; investigated KSA clusters to determine if clustering improves prediction of performance. FY08, conduct experiments to assess effectiveness of potential intervention strategies by field testing with Soldiers in operational settings; based on findings from the field tests and extent the strategies actually relate to retention decisions, revise model and establish empirical strength of strategies to impact Soldier and Officer behavior; develop improved job performance measures as criteria for the KSA measures and clusters using subject matter experts and Soldiers in operational units within selected MOS. FY09, will further validate strategies and develop guidelines to implement strategies and track effects on retention; and collect job performance data and supervisor's performance assessments to empirically test KSA measures/clusters for strength in predicting actual job performance and longer-term Soldier success.	4882	6060	6747
Training: In FY07, developed exemplar training methods, and procedures for commanders and staffs performing battle command in networked-enabled environments; in laboratory experiments, assessed the impact of automated feedback alerts on the After Action Review (AAR) process; and identified the collaboration/communication requirements needed between dismounted Soldiers and robotic	3987	3152	

operators for effective employment of robotic platforms. FY08, develop tools and techniques to support rapid training development for network-enabled battle command; develop and validate procedures designed to enhance battle command and dismounted Soldier digital skills; develop preliminary skill retention curves for establishing refresher training schedules to retain critical digital skills and improve skill retention; and develop methods and procedures to assess the value of a network-enabled alternative to the traditional AAR process.			
Training: In FY07, conducted lab experiments of training effectiveness of massively multiplayer persistent simulations (MMPS); and identified blended learning approaches and technologies (e.g., mixes of on-site learning, distance learning, web-based instruction, classroom instruction, etc.) that have potential application to Army training. FY08, conduct assessment of MMPS training effectiveness in multi-national coalition warfare experiment; develop alternative blended training approaches and techniques for selected Soldier skills for experimental comparison; and develop preliminary models for alternative collective training systems incorporating various mixes of training aids, devices, simulators, and simulations (TADSS). FY09, will assess methods, techniques, and tools for training battle command skills at multiple echelons; leverage basic and applied research on intelligent agents and integrate into MMPS environment to use for command post and tactical scenarios; begin experiments to assess the effectiveness of alternative blended training approaches for teaching selected basic Soldier skills and improving retention of those skills; will determine differences in AAR requirements across simulation domains; and will evaluate alternative models for effectively training collective aviation tasks in laboratory or simulated exercises.	4626	2952	5431
Leader Development: In FY07, developed protocols and metrics for assessing effectiveness of leader development vignettes in operational tests; designed instruments for assessing leader skills and attributes needed for effective performance in high-stress, multi-team, networked systems; and developed prototype training modules for rapid team building. FY08, collect and analyze data to assess the impact of leader skills and knowledge on performance in joint, interagency, and multinational (JIM) environments; design training tools to enhance leader effectiveness in multi-team systems; design prototype training methods to enhance capability of leaders to take a multicultural perspective for mission success; and identify potential influence techniques leaders can use to be more effective in fighting Global War on Terrorism (GWOT). FY09, will further investigate methods and tools designed to improve leader performance in multi-team systems in complex and networked environments; design and test new influence techniques that will be most effective in GWOT scenarios, and improve leader capability for rapid team building.	2210	3669	4234
Small Business Innovation Research/Small Business Technology Transfer Programs		269	
Total	15705	16102	16412

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602785A - Manpower/Personnel/Training Technology**	**790**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	16021	16208	16458
Current BES/President's Budget (FY 2009)	15705	16102	16412
Total Adjustments	-316	-106	-46
Congressional Program Reductions		-106	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	-45		
SBIR/STTR Transfer	-271		
Adjustments to Budget Years			-46

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602786A - Warfighter Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	43200	36237	21948	22276	22519	23066	23631
283	AIRDROP ADV TECH	2307	2314	2370	2400	2418	2471	2527
C60	AC60	3582						
E01	Warfighter Technology Initiatives (CA)	18496	13311					
H98	CLOTHING & EQUIPM TECH	13878	15419	14262	14496	14680	15054	15437
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	4937	5193	5316	5380	5421	5541	5667

A. Mission Description and Budget Item Justification: This applied research program element (PE) investigates/evaluates technologies to improve Soldier survivability, sustainability, mobility, combat effectiveness, and field quality of life. Efforts focus on technologies for use in the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Work includes the design, development, and improvements of components used for air delivery of personnel and cargo; combat clothing; personal equipment (including protective equipments such as personal armor and eye wear); combat rations and combat feeding equipment. Main focus is on providing the Soldier with the most effective personal clothing, equipment and rations at the least weight and sustainment burden. The Airdrop Advanced Technology project (283) supports all Services' requirements for designing and developing technologies that support air dropping increasingly heavier combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft, and reducing life cycle costs. In addition, this project investigates technologies for safer, more efficient personnel parachutes, addressing a critical capability for rapid deployment and force projection into hostile environments. Project AC60 supports programs that are classified. Project E01 comprises Congressional special interest items. The Clothing and Equipment Technology project (H98) funds cutting edge research and investigation/evaluation of components and materials that have potential to enhance Soldier survivability from combat threats and the field environment (e.g., cold, heat, wet). Efforts focus on incorporating novel materials into component designs that protect Soldiers against flame, blast and ballistic threats, as well as, certain directed energy threats. This effort has the potential to enhance the areas of personnel armor, helmets and protective inserts for shelters. In addition, clothing components and other personal equipment is designed and evaluated to enhance signature management; provide wearable, conducting materials to augment data and power transmission; provide cooling to the Soldier to reduce risk of heat stress; lighten the Soldier's load; and reduce physical stress-induced injuries while conducting operational activities. Human science, anthropometric, and psychophysical methods are used to assess human responses to sensory, cognitive and affective stimuli to enable better prediction of the performance/effectiveness of items. Data is collected and incorporated 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. The Joint Services Combat Feeding Technology project (H99) supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with results of research investigations and evaluation conducted on high payoff technologies for preparing, preserving, stabilizing combat rations and ensuring that the rations provide the best combination of nutrients and energy enhancements to sustain the Soldier during missions. In addition, this project investigates novel ration packaging and combat feeding equipment/systems. Investigative focus is on enhancing nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimizing physical, chemical and nutritional degradation of combat rations during storage; meeting the needs of individual Soldiers in highly mobile battlefield situations; and providing equipment and energy technologies to reduce the logistics footprint of field feeding while improving the quality of food service. The efforts in this PE adhere to Tri-Service Reliance agreements on clothing, textiles, and operational rations and field food service equipment with oversight and coordination by the Department of Defense (DoD) Combat Feeding Research and Engineering Board.

Efforts are related to and fully coordinated with those in PE 0603001A (Warfighter Advanced Technology) and are complementary/non-duplicative with armor materials efforts conducted in PE 0602618A and PE 0602105A. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602786A - Warfighter Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	44044	23083	21988
Current BES/President's Budget (FY 2009)	43200	36237	21948
Total Adjustments	-844	13154	-40
Congressional Program Reductions		-246	
Congressional Rescissions			
Congressional Increases		13400	
Reprogrammings	105		
SBIR/STTR Transfer	-949		
Adjustments to Budget Years			-40

Nine FY08 congressional adds totaling $13400 were added to this PE.

($400) Injection Molded Ceramic Body Armor
($800) Protective Textile Fabric
($1000) Active and Smart Packaging for Combat Feeding
($1000) Advanced Fabric Treatment for Flame Resistant Uniforms
($1000) Nano-Enabled Ultra High Storage Non-Volatile Memory for Next Generation Commander's Digital Assistant
($1600) Carbon Nanotube Armor Protection System
($1600) Chemical and Biological-Protective Hangars (CAB-PH)
($2000) Biosecurity Research for Food Safety
($4000) Modular Ballistic System for Force Protection

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - Warfighter Technology**	**283**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
283 AIRDROP ADV TECH	2307	2314	2370	2400	2418	2471	2527

A. Mission Description and Budget Item Justification: This project researches, investigates and evaluates component technologies to enhance cargo and personnel airdrop capabilities. These enabling technologies support the goals of Army Transformation for global precision delivery, rapid deployment, and insertion capabilities for force projection, particularly into hostile regions. Areas of emphasis include parachute technologies, parachutist injury reduction, precision offset aerial delivery, soft landing technologies, and airdrop simulation. Efforts result in increased personnel safety; more survivable and more accurate cargo delivery; and reduced aircraft, crew, and cargo vulnerability. The goal for personnel parachute technology is to reduce injuries and to improve performance and combat effectiveness of the Advanced Tactical Parachute System (ATPS). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed and managed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Precision Airdrop Enhancements: In FY07, developed new means of measuring air flow around parachutes, cargo payloads, and paratroopers; and investigated and evaluated state-of-the-art autonomous Guidance, Navigation and Control (GN&C) of precision airdrop systems to improve aerodynamic performance and landings. In FY08, experiment with favorable GN&C technologies to mature sensing, guidance, navigation, and control algorithms for precision airdrop. In FY09, will downselect and implement the most mature and favorable GN&C technologies into prototypical precision airdrop systems and transition technology to be matured and demonstrated in PE 0603001A.	1255	1230	1280
Modeling and Simulation for Tactical Parachute System Performance Enhancement: In FY07, refined and evaluated computer tools developed to model parachute inflation and to calculate opening shock. Used High Performance Computing modeling and simulation to investigate fully open parachutist control and rate of descent aspects of ATPS. In FY08, utilize experimental methodologies to develop detailed knowledge of baseline parachute physics; complete investigation of fully open parachutist control and rate of descent issues; and investigate parachute opening phenomena. In FY09, will complete investigation of ATPS parachuting opening and validate full fidelity model against baseline physics from experiments; will provide detailed ATPS performance enhancement assessment to PM-Clothing and Individual Equipment (CIE); and will transition results to PM-CIE ATPS product improvement program.	1052	1076	1090
Small Business Innovative Research/Small Business Technology Transfer Programs		8	
Total	2307	2314	2370

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - Warfighter Technology**	**H98**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H98	CLOTHING & EQUIPM TECH	13878	15419	14262	14496	14680	15054	15437

A. Mission Description and Budget Item Justification: This project researches, investigates and evaluates component technologies to improve Soldier survivability, sustainability, mobility, combat effectiveness, and field quality of life. The project funds cutting edge research and investigation/evaluation of components and materials that have potential to enhance Soldier survivability from combat threats and the field environment (e.g., cold, heat, wet). Included are personnel armor, helmets, and protective inserts for shelters - efforts that focus on incorporating novel materials into designs that protect Soldiers against flame, blast and ballistic threats, as well as, certain directed energy threats. In addition clothing and other personal equipment is designed and evaluated to enhance signature management; provide wearable, conducting materials to augment data and power transmission; provide cooling to the Soldier to reduce risk of heat stress; lighten the Soldier's load; and reduce physical stress-induced injuries while conducting operational activities. Work includes exploration of nanomaterials and novel fibers for potential use in personnel armor plate laminates. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by PE 0601104A (University and Industry Research Centers) and PE 602105A (Materials Technology). The goal of the Ballistic and Blast Protection for the Individual Warrior effort is to research and apply advances in materials and materials-processing technology to improve the protection and performance of next generation personal armor and helmet systems against conventional and emerging ballistic threats while continually striving to reduce the weight and bulkiness of protective wear. In addition, this effort characterizes blast profiles, determines the hazard, and demonstrates improved personal protection concepts that provide protection against effects of blast and ballistic threats combined at minimum weight. The Soldier Integrated Tunable (Frequency Agile) Laser/Ballistic Eye Protection effort addresses the emerging threat of frequency agile lasers on the battlefield and provides increased ballistic fragmentation protection for the eyes, face and neck, and scratch resistance for the lenses. Lightweight transparent materials and advanced coatings (using novel coating methods) are fabricated and evaluated against laser, ballistic, and environmental threats (especially abrasives like sand) for use in Soldier protective glasses and goggles. The effort is performed in collaboration with the Army Research Laboratory in PE 0602120A (Sensors and Electronic Devices). The goal of Infantry Warrior Simulation (IWARS) is to continue to improve and mature accuracy and capability of essential analytic tools needed to assess the combat effectiveness of next generation Soldier systems, with a focus on network centric warfare technologies. The IWARS toolset is used extensively throughout the Army and with our national and international partners. Maintaining and increasing the capabilities of the models to correctly simulate advanced Soldier materiel and equipment in more relevant operational environments is essential to achieving cost-effective solutions to existing and emerging individual Soldier and small unit capability gaps. The Biomechanical Tools for Individual Soldier Extremity Protection and Performance Enhancement effort identifies promising candidate component configurations of extremity armor to provide individual Soldiers with extremity ballistic protection affording flexibility, agility and mobility, while minimizing the energy expended during dismounted operations. This effort also explores the effects of combined physical stresses (including physical load and load distribution, environment (heat/cold) and mission type) on a Soldier's ability to perform tasks without sustaining physical injury, perform with less fatigue, and process, act on and make decisions. This work is collaborative with and fully coordinated with the US Army Research Institute of Environmental Medicine (USARIEM). The data and results feed the component design efforts for Soldier as a System personal clothing and protective equipment. Electrotextiles - Self Powered, Conductive, and Smart Materials focuses on designing and evaluating conducting, flexible, wearable materials for lightweight power generating and storage devices that can be used to augment power sources for Soldier-worn computers and equipment. This effort makes extensive use of nanomaterials and photovoltaic technologies to achieve lightweight, multifunctional textiles and fabrics with novel electrical properties. The purpose of the Soldier Borne Microclimate Cooling effort is to design a capability to mitigate the effects of heat stress encountered by dismounted infantry exposed to hot environments and encumbered in protective clothing. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Ballistic and Blast Protection for the Individual Warrior: In FY07, validated, through laboratory testing, composite technology to enable a 20 to 30 percent reduction over current weight (FY03 fielded helmet weight of 2.0lb/ft2) with equivalent fragmentation protection; transitioned composite technologies for small arms protection to reduce weight and/or increase multiple-hit capability to PE 0603001A Warfighter Advanced Technology; developed and validated performance of an add-on concept for body blast protection. In FY08, continue development of advanced fiber technology (e.g., carbon nanotube-based) for lightweight armor applications, investigate conformable material configurations to reduce weight, minimize performance vulnerability associated with complex shapes in personnel armor applications, and explore performance thresholds for increased protection levels for personal armor technology; define and develop material system concepts for integrated ballistic/blast protection for use in improved body armor. In FY09, will validate performance of selected materials configurations for enhanced helmet performance; will downselect materials and begin integration of technological elements and components into a breadboard system for next generation armor systems and evaluate in various environments; will refine and validate material system concepts for integrated ballistic/blast protection for use in improved body armor.	3130	4035	5200
Soldier Integrated Tunable (Frequency Agile) Laser/Ballistic Eye Protection: In FY07, matured lighter weight ballistic materials while maintaining the improved level of performance; identified and evaluated abrasion resistant coatings and coating application procedures; and researched optical limiting concepts that meet system design response time requirements. In FY08, validate potential of new ballistic materials achieved through leveraged efforts; prepare and analyze hybrid lighter weight ballistic materials while maintaining the improved level of performance; integrate multi-layered laminates to provide multifunctional transparent armor materials with scratch resistance, and validate optical limiting concepts that do not require a lens system and that meet response time requirements over the visual spectrum. In FY09, will combine laser eye protection concepts, compatible ballistic materials, and abrasion resistance coatings into a new composite material; will assemble components on breadboard and perform system evaluation in a simulated environment.	3130	3408	1500
Infantry Warrior Simulation (IWARS): In FY07, developed initial small unit battle command module to support small unit information transfer impacts, and released the High Level Architecture compliant third version of IWARS. In FY08, include Advanced Soldier representations within IWARS, to include effects of sensor systems and the User Defined Operating Picture on the ability to provide actionable information to small units. In FY09, will enhance IWARS to include effects of Netted Communications and Collaborative Situational Awareness; will release the fourth version of IWARS.	2162	2293	2339
Biomechanical Tools for Individual Soldier Extremity Protection and Performance Enhancement: In FY07, completed a biomechanical model that predicts Soldier performance when encumbered with body armor; defined performance thresholds for the biomechanical variables; and developed empirically based fatigue model for integration with the biomechanical model. In FY08, integrate fatigue prediction into biomechanical model; verify and validate integrated model; exercise the model to design a prototype set of extremity body armor; define cognitive performance metrics; conduct human experiments to evaluate decrements in performance related to physical demands of warfighting, and establish a model for predicting these decrements. In FY09, will define additional complex Soldier output measures for incorporation into biomechanical model, scale biomechanical tools to range of human anthropometry; conduct human experiments to refine fatigue prediction into short term and long term components; refine awareness model with additional human experimental data and conduct research on strategies for mitigating decrements in awareness documented by preceding experiments.	1962	2125	1687
Electrotextiles - Self Powered, Conductive, and Smart Materials: - In FY07, matured novel weave and interconnect technologies for photovoltaic fibers and explored power generation and electrical conductivity in unique fiber-based compositions; investigated several lightweight, wearable, low profile, connectors, and demonstrated interconnections for current Soldier electronic systems; investigated new power generating, and electrically conductive textile-based compositions. In FY08, mature technologies for first active photovoltaic fabric	1957	2118	2651

and for unmanned photovoltaic ground sensors and camo-patterned photovoltaic devices; mature flexible conductive networks and connector technologies for shelters and wearable electronics; investigate current polymer-based optical conductors for secure, non-emissive, high-speed data transmission for optical networks; and mature new optical materials with high flexibility. In FY09, will integrate a variety of electronic, optical and sensing devices into photovoltaic fabrics to demonstrate a new class of self-powered, smart electrotextile applications; develop wearable connectors and interconnection methods for optical fibers; explore various textile integration methods to provide additional strength and protection to electronic and optical fibers.			
Soldier Borne Microclimate Cooling: In FY07, downselected material and design approaches, and began the integration of technological elements and components into a breadboard system. In FY08, complete the integration of the technological elements and components, and test the breadboard systems. Using the test results, downselect cooling technologies for Soldier applications and establish a baseline. In FY09, will transition downselected technologies to 6.3 for advanced technology development. Will size, design, and select components for the next generation microclimate cooling device.	1537	1158	885
Small Business Innovative Research/Small Business Technology Transfer Programs		282	
Total	13878	15419	14262

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - Warfighter Technology**	**H99**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	4937	5193	5316	5380	5421	5541	5667

A. Mission Description and Budget Item Justification: The Joint Services Combat Feeding Technology project researches, evaluates and applies combat ration and field food service equipment technologies with potential to revolutionize the manner in which we sustain and support the Armed Forces, ensuring optimal nutritional intake for individual Warfighter. 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. This project supports the Army Transformation in the areas of sustainability and reduced logistics footprint, with goals to demonstrate technology to reduce field feeding logistics by over 75 percent (i.e., weight, cube, fuel, and water) and labor requirements by 50 percent, while improving the quality of food service in comparison with current systems. The goal of the Combat Feeding Equipment Technologies effort is to research and evaluate component technologies with potential to reduce the logistics footprint of field feeding while enhancing operational efficiency of field feeding. The Ration Stabilization and Novel Nutrient Delivery Technologies effort focuses on technologies which enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimizing physical, chemical and nutritional degradation of combat rations during storage; and tailoring rations to the combat situation and provide an "eat on the move" capability, thereby improving mobility. In addition, research is conducted with the goal of reducing replenishment demand by extending shelf-life, permitting more extensive pre-positioning of stocks, while maintaining initial food quality. The Packaging and Food Safety Technologies effort explores methods and evaluates novel packaging materials and concepts to reduce ration weight/volume and food packaging waste to reduce logistics burdens associated with combat feeding. Long term data collected in this effort will assist in generating protocols for ration developers and US Army Veterinary Command to more effectively conduct surveillance inspections of rations. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the U.S. Army Natick Soldier Research, Development and Engineering Center, Natick, MA, and this project has collaborative efforts with the US Army Research Institute for Environmental Medicine.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Combat Feeding Equipment Technologies: In FY07, down selected four competing Waste to Energy (WEC) systems to two (a gasifier and supercritical water depolymerization process), verified that both WEC systems produced an economically viable quantity of gas from waste, integrated components, and containerized the processors; completed experimental development, test, and evaluation of individual water chiller; completed experimental development of two Solar Powered Refrigerated Containers. In FY08, complete experimental development of an inline water heater as an initial application of flameless combustion; complete experimental development of an air-activated, self-contained, exothermic, chemical heater for the Meals Ready to Eat (MRE) including all safety/health/environmental regulatory compliance; and investigate novel co-generators for potential to operate on a range of fuels from the WEC producer gas to JP8. In FY09, will complete evaluations of inline water heater (initial application of flameless combustion); will complete experimental development of an ethylene control system for fresh fruits and vegetables. Technologies developed within this effort transition to PE 0603001A, Warfighter Advanced Technology, for maturation.	2110	2325	2392
Ration Stabilization and Novel Nutrient Delivery Technologies: In FY07 validated performance of novel delivery systems and optimized	1313	1505	1559

nutrient delivery/absorption to enhance First Strike and other individual rations; incorporated encapsulated protein into these rations to assess stability and optimize bioavailability; and verified/evaluated retention of performance enhancers in rations over time by focusing on enhancers requiring protection to maintain efficacy; designed multiple tray food sterilizer using radio frequencies or microwaves in combination with high pressure. In FY08, continue incorporation and testing of probiotics (beneficial bacteria) for improved gastrointestinal health; incorporate selected performance enhancers for delivery via the mouth allowing for the immediate movement of the molecules into the blood; and transition protein encapsulation effort to PE 0603001A; validate Hybrid Optimal Processing (HOP) effectiveness to reduce processing time and increase food quality and nutrient retention, and scale-up design with selected model ration components; plan scale-up HOP design and engineering to produce high quality components; and develop additional shelf-stable combat ration breakfast items and transition to PE 0603001A. In FY09, will 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.			
Packaging and Food Safety Technologies: In FY07, continued modification and evaluation of food sampling procedures used for biosensor systems to improve their accuracy and sensitivity to pathogenic organisms; conducted study to assess rates of ration quality degradation using reaction rates (quality kinetics) correlated with sensory analysis. In FY08, continue optimization of array technologies for pathogen detection; develop food degradation profiles for quality kinetics ration storage study to correlate accelerated storage conditions to predict combat ration shelf life. In FY09, will investigate multiplexing of electrospun nanofibers for improved capture of pathogens and initiate incorporation into array systems to enable multiple pathogen detection from one sample; will investigate molecular beacon signal enhancement as an alternative to identifying pathogens using array-based (matrix) systems; will calculate quality data reaction rates and determine kinetic correlations based on storage studies conducted in FY08; will continue long-term storage study to include extensive analytical, microbiological, and sensory testing; will complete food degradation profiles for quality kinetics.	1514	1319	1365
Small Business Innovative Research/Small Business Technology Transfer Programs		44	
Total	4937	5193	5316

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	228291	184214	75395	73639	74556	76105	77825
845	BONE DISEASE RESEARCH PROGRAM	968	795					
863	BTLFLD SURGICAL REPLAC							
865	CENTER FOR MILITARY BIOMATERIALS RESEARCH							
866	CLINICAL TRIAL PLEZOELECTRIC DRY POWDER INHALATION							
867	DIAGNOSTICS IN TRAUMATIC BRAIN INJURY BLOOD BASED							
869	T-MED/ADVANCED TECHNOLOGY	2912	3031	3141	3017	3045	3113	3184
870	DOD MED DEF AG INF DIS	15511	14883	15516	15802	16166	16480	16930
873	HIV EXPLORATORY RSCH	10976	11245	11389	10711	10780	11021	11268
874	CBT CASUALTY CARE TECH	18729	14595	11975	12084	12153	12355	12566
878	HLTH HAZ MIL MATERIEL	11926	13924	14312	13666	13815	14124	14438
879	MED FACT ENH SOLD EFF	10112	9955	10316	9902	9978	10200	10429
953	DISASTER RELIEF & EMERGENCY MEDICAL SVC (DREAMS)							
968	SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	7747	4967					
96C	DIGITAL IMAGING AND CATHERIZATION EQUIPMENT							
96I	REMOTE ACOUSTIC HEMOSTASIS							
977	EMERGING INFECTIOUS DISEASES	3486						
FH2	FORCE HEALTH PROTECTION - APPLIED RESEARCH	8053	8407	8746	8457	8619	8812	9010
MA2	DIABETES PROJECT	2034						
MA3	MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	4164						
OA3	CENTER FOR ADV SURGICAL &	2324	993					

	INTERVENTIONAL TECH (CA)							
OA5	COMPUTATION PROTEOMICS (CA)							
OA7	ELGEN GENE DELIVERY TECHNOLOGY (CA)	1066						
OA8	ENHANCED RES IN TRAUMA PREVENTION/TREATMENT/REHAB							
OA9	GENETIC ACUTE ENHANCED BIOWARFARE THERAPY PROG (CA							
PA4	WOUND HEALING PROJECT (CA)	968	1192					
PA5	NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	1453	993					
PA9	PROSTHETIC DEVICE CLIN EVAL AT WRAIR AMPUTEE CTR	5810						
RA2	TARGETED NANOTHERAPEUTICS FOR CANCER (CA)							
RA4	TRANSPORTABLE PATHOGEN REDUCT AND BLOOD SAFETY SYS	1066						
RA6	VERSA HSDI (CA)							
TA1	AUTO MEDICAL EMERGENCY INTRAVASCULAR ACCESS (CA)							
TA7	COMBAT CASUALTY CARE FOR BATTLEFIELD WOUNDS (CA)	3776						
UA2	HIGH-SPEED MEMS ELECTROMAGNETIC CELL SORTER (CA)							
UA5	NEUTRON THERAPY (CA)							
UA6	PREDICTIVE TOOLS FOR PTSD (CA)							
UA7	PREVENTIVE MEDICINE RESEARCH INSTITUTE (CA)	1743						
UA8	PROTEIN HYDROGEL (CA)	968	1987					

VB3	MEDICAL TECHNOLOGY INITIATIVES (CA)	109788	97247					
X06	HIBERNATION GENOMICS	2711						

A. Mission Description and Budget Item Justification: This program element (PE) supports applied research required to sustain a force of healthy, medically protected warfighters. The primary goal of military medical applied research is to develop medical knowledge and technology (drugs, vaccines, and devices) to effectively protect and improve the survivability of US Forces. This PE funds applied research in the following areas: Militarily Relevant Infectious Diseases including HIV (Human Immunodeficiency Virus); Combat Casualty Care; and Military Operational Medicine (efforts aimed at protecting the Soldier against physiological and environmental degradation). Applied research program development and execution is externally peer reviewed and, to prevent unnecessary duplication, fully coordinated with other Services and Agencies through the Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management Committee.

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 experimental (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, including an increasing number of people in each subsequent phase. Research conducted in this PE primarily focuses on completing preclinical technology maturation activities, although some activities may require use of human subjects to determine preliminary effectiveness when there are no validated animal models.

The Military Relevant Infectious Diseases effort focuses on designing and developing medical protection and treatment against naturally occurring diseases of military importance as identified by worldwide medical surveillance and military threat analysis. Methods identified and matured for prevention and treatment of infectious diseases include candidate vaccines, prophylactic (i.e. preventive measures) intervention, therapeutic drugs, and control of disease-carrying vectors (e.g., mosquitoes, ticks, and mites). HIV Exploratory Research focuses on developing diagnostics, surveillance, epidemiology, and identification of candidate vaccines for prevention and treatment of HIV subtypes found outside the US, which are problematic in military deployments and joint operations with coalition forces.

The Combat Casualty Care effort conducts research to develop knowledge and technologies that can improve medical treatment outcomes for battlefield injuries. Work involves identification and evaluation of drugs, biologics (products derived from living organisms), and diagnostics for resuscitation and life support, as well as trauma care systems for use by forward medics and surgeons. This effort also includes research into treatments for face and neck injuries.

The Military Operational Medicine (MOM) effort focuses on biomedical solutions that protect Soldiers and enhance their performance in the face of multiple stressors in operational and training environments. Research matures knowledge and technologies, such as biomedically-valid design criteria for body armor and physiological monitors, to protect Soldiers from injuries from exposure to hazardous environments and materials. This research also examines physiological indicators and associated algorithms/sensors that potentially indicate performance degradation produced by operational stressors such as high altitude, extreme temperatures, hydration, fatigue, isolation, and sleep deprivation.

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

028 0602787A MEDICAL TECHNOLOGY 235

028 0602787A MEDICAL TECHNOLOGY

235

Work in this PE is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; US Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, 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; and the Naval Medical Research Center, Silver Spring, MD.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	229893	76544	72584
Current BES/President's Budget (FY 2009)	228291	184214	75395
Total Adjustments	-1602	107670	2811
Congressional Program Reductions		-1220	
Congressional Rescissions			
Congressional Increases		108890	
Reprogrammings	3914		
SBIR/STTR Transfer	-5516		
Adjustments to Budget Years			-189

Fifty-five FY08 congressional adds totaling $108890 were added to this PE.

($350) Mass Decontamination and Biosecurity Initiative
($500) Oxygen Diffusion Dressings for the Accelerated Healing of Battlefield Wounds and Burns
($800) Bone Health and Military Medical Readiness Program
($800) Center for Vaccine Scale-Up Process Research (Phase I)
($800) Neuroscience Research Consortium to Study Spinal Cord Injury
($940) West Nile Virus Vaccine
($1000) Nanofabricated Bioartiflcal Kidney and Bioterrorism
($1000) Center for Advanced Surgical and Interventional Technology (CASIT)
($1000) Carbon Nanotube Production
($1000) Center for Research on Integrative Medicine for the - Military (CRIMM)
($1000) Medical Image Database Holographic Archiving Library System (MIDHALS)
($1000) Regional Nuclear Magnetic Resonance (NMR) Facility
($1000) Remote Robotic Teleproctoring to Promote Rapid Surgical Skills Acquisition
($1000) Storage Area Network
($1200) Rapid Wound Healing Technology Development Project
($1200) Improving Musculoskeletal Health & Function
($1200) Medical Resources Conservation Technology Pilot Energy Cost Control Evaluation (PECCE)
($1200) Wound Infection Treatment Program
($1600) Advanced Bio-engineering for Enhancement of Soldier Survivability
($1600) Armed Services Gynecological Cancer Health Program
($1600) Cancer Prevention Through Remote Biological Sensing

($1600) Copper Air Quality Program
($1600) Defense Against Viral Infection (DAVI)
($1600) Electronic Technology-Infrastructure in Support of Military Missions
($1600) Epigenetic Disease Research
($1600) Integrated Medicine, Communications, Compassion, Chronic Care Program
($1600) Molecular Switch Vaccines for Biodefense and Cancer
($1600) Neutron/Hadron Particle Therapy
($1600) Orthopedic Implant Design and Manufacturing for Taumatic Injuries
($1600) Prevention of Radiation Injury by use of Statins
($1600) Respiratory Biodefense Initiative
($1600) Technological Regional Center of Excellence for PTSD
($2000) BioFoam Protein Hydrogel for Battlefield Trauma
($2000) Center for Ophthalmic Innovation
($2000) Disposable Unit Dose Drug Pumps for Anethesia and Antibiotics
($2000) Fibrin Adhesive Stat (FAST) Dressing
($2000) Impact of Intensive Lifestyle Modification on Chronic Medical Conditions
($2000) Plant-based Vaccine Research
($2000) Rapid Vaccine Discovery Technology
($2000) Staph Vaccine
($2400) Cedars-Sinai Core Imaging Center
($2400) Proton Therapy
($2400) Synthetic Malaria Vaccine
($2500) MRI-DTI Technology to Improve Diagnostics and Treatment of TBI
($2800) Injury Research Center-Ryder Trauma Center
($3000) Center for Resuscitation Research
($3200) Center for Injury Biomechanics
($3200) Cold Spring Harbor Laboratory Women's Cancer Genomics Center
($3200) Cone Beam CT Scanners
($4000) Military Interoperable Digital Hospital Testbed
($4000) New Vaccines to Fight Respiratory Infection
($4800) Orthopaedic Extremity Trauma Research
($5000) Complimentary & Alternative Med Research (MIL-CAM)
($5000) Synchrotron-Based Scanning Research
($5600) Pain and Neuroscience Center Research Center

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**869**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
869 T-MED/ADVANCED TECHNOLOGY	2912	3031	3141	3017	3045	3113	3184

A. Mission Description and Budget Item Justification: This project funds applied research in the design and development of physiological status monitoring technology that enables remote monitoring of the Soldier to provide commanders and medics information on health and performance, including performance status (tracking changes in warfighter physical characteristics and physiological capacities), casualty avoidance (preventing environmentally related non-battle injuries), and wound detection (a signal identifying the occurrence of a wound). The focus is on developing the reliable interpretation of signals from a wearable, integrated system that can monitor Soldier physiological status and provide actionable information. It enables personnel to quickly and accurately determine that a Soldier is fully functional, impaired but still capable of functioning, or in need of medical attention. This information would also be useful in planning the evacuation and treatment of casualties. Work includes identification and initial development of parallel and supporting technologies including medical informatics (science of organizing and interpreting medical information), medical artificial intelligence, and data mining tools that develop predictors of detrimental physiologic changes. Work is performed in coordination with US Army Natick Soldier Research, Development, and Engineering Center. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the US Army Research Institute of Environmental Medicine, Natick, Massachusetts; the US Army Institute of Surgical Research, Fort Sam Houston, Texas; and the Walter Reed Army Institute of Research, Silver Spring, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Physiological/Life Sign Monitoring: In FY07, demonstrated real-time remote monitoring of thermal-work strain in encapsulated Soldiers during a simulated chemical-biological mission. In FY08, develop and evaluate Spartan network (SPARNET) and next-generation Heat Strain Decision Aid (HSDA) prototypes with Ranger Training Brigade; track Ranger student hydration and geo-location; demonstrate HSDA value in reducing likelihood of heat injury. Apply predictive modeling and simulation to support improvements in training doctrine and individual equipment. Evaluate new method of monitoring fluid consumption. Demonstrate remote real-time prediction and management of thermal strain in physically active Soldiers. In FY09, will 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.	2912	2968	3141
Small Business Innovative Research/Small Business Technology Transfer Programs		63	
Total	2912	3031	3141

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**870**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
870 DOD MED DEF AG INF DIS	15511	14883	15516	15802	16166	16480	16930

A. Mission Description and Budget Item Justification: This project supports applied research on medical countermeasures to naturally occurring infectious diseases that pose a significant threat to the operational effectiveness of forces deployed outside the United States. Preventive countermeasures would protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations. Of major importance to the military are malaria, bacterial diseases responsible for diarrhea (i.e., caused by Shigella, enterotoxigenic Escherichia coli, and Campylobacter), and viral diseases (e.g., dengue fever and hantavirus). This project explores improved materiel to control disease transmission by insects, ticks, and other organisms (vectors) that transmit diseases to humans thus reducing incidence of these diseases. It also addresses a variety of other infectious disease threats to mobilizing forces, including leishmaniasis, meningitis, viral encephalitis, scrub typhus, and hemorrhagic fevers. Improved diagnostic capabilities will enable rapid battlefield identification important for a commander's medical situational awareness and physician's intervention. Major goals include the discovery and application of new technologies including the integration of genomic (DNA-based) and proteomic (protein-based) technologies into vaccine and drug discovery, developing broad-spectrum vaccines that can protect against multiple disease strains and developing improved drugs to prevent or treat malaria. For the development of drugs and biological products, preclinical studies in the laboratory and in animal models assess safety, toxicity, and effectiveness and are necessary to provide evidence to the U.S. Food and Drug Administration (FDA) to justify approval for a product to enter into future human clinical trials. Additional nonclinical 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 bear 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. In drug discovery, about 1 of every 10,000 new chemical entities will end up as a licensed drug with most being disqualified in early cell and animal safety and effectiveness testing. Similarly vaccine candidate have a high failure rate, but as animal testing is not a predictor of human response, disqualification of this technology occurs after going into human trials. The high risk of such technology development forces efforts to be repetitive to provide the continuing pipeline of candidates needed to sustain the developmental efforts. Work is managed by the US Army Medical Research and Materiel Command. As the lead service for infectious diseases research within the Department of Defense, the Army is responsible for programming and funding all research on joint and service-specific requirements thereby precluding duplication of effort within the Military Departments. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, Maryland, and its overseas laboratories; the US Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland; and the Naval Medical Research Center, Silver Spring, Maryland, and its overseas laboratories.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Drugs to Prevent/Treat Parasitic Diseases: Assess and improve current candidate drugs for prevention and treatment of malaria and/or leishmaniasis, selecting the most effective and safe candidates for continued development. The malaria parasite becomes resistant to currently licensed drugs, making it necessary to continually search for new drugs to maintain the developmental pipeline. In FY07, assessed about 100 potential vaccine components against malaria and leishmaniasis from the greater than 1000 chemical compounds screened in basic science program. Qualified 40 compounds of potential interest and as possible replacement lead candidates. Introduced novel approaches identified in basic research to aide in accessing these compounds. Continued to optimize (improve safety and	4232	4706	5815

effectiveness profiles) current lead candidates in the developmental pipeline. In FY08, continue studies to design, assess, and qualify candidate chemical compounds in search of more promising candidate drug classes to maintain pipeline of potential compounds of which the best will enter lead optimization. In FY09, will continue the process of identifying and improving chemical compounds that have highest potential to be effective drugs against malaria and/or leishmaniasis. Will examine drugs currently licensed for another medical indication for potential to be effective against malaria or leishmania. Will complete optimization of one lead drug to move into clinical testing (transition to PE 810).			
Vaccines for Prevention of Malaria: Conduct studies to investigate new candidate vaccines as well as assess and improve current candidate vaccines for prevention of malaria to find and select the most effective and safe items for continued development. A malaria vaccine could reduce the need for antimalarial drugs, the continuing problems with parasite drug resistance and compliance issues with taking antimalarial drugs. In FY07, assessed, designed, or disqualified candidate vaccines against malaria, introducing novel approaches identified in basic research to improve assessment and selection of candidate vaccines. Refined candidates previously assessed as promising, including improved versions of these, through using alternative vaccine delivery methods. In FY08, assess potential malaria vaccine subcomponents in animal testing. Take into concept exploration new proteins and gene-based vaccines identified from animal malaria models or malaria in humans, using molecular biological approaches to produce sufficient material to formulate into a vaccine candidate and to test in animal studies. In FY09, will continue to test and develop vaccine candidates in the pipeline until they fail or are moved to Advanced Technology Development and will continue to assess new vaccine candidates against malaria emerging from the basic science program to maintain a pipeline of new technologies to mitigate risk if lead technologies fail.	2249	3117	3082
Bacterial Threats Vaccine Programs: Conduct studies to design and assess antibacterial vaccine candidates to prevent diarrhea and dysentery (a threat to deployed troops), meningitis (a threat to trainee and deployed troops), and scrub typhus (a debilitating disease that is developing resistance to the only treatments available). In FY07, continued to design and validate potential vaccine candidates against diarrhea, meningitis, and scrub typhus, including assessment of new vaccine strategies and of candidate vaccines against diarrhea; completed improved version of meningitis vaccine for assessment in animals; and assessed new and revised scrub typhus DNA and protein vaccines in mouse model based on lessons learned in FY06. In FY08, refine antidiarrheal vaccine candidates and assess a potential vaccine made of bacterial proteins associated with the bacteria adhering to the gut, establish 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 complete preclinical evaluation of new candidate diarrheal and meningitis vaccines. In FY09, will continue systematic examination of potential bacterial gut adhesion proteins as new vaccine candidates and assess other nonvaccine countermeasures against diarrhea. Continue to genetically modify the meningitis bacteria to expand the diversity of expressed proteins, thereby increasing the range of protection across multiple subtypes of the bacteria, and manufacture and test as a vaccine in animal models. Will test new scrub typhus proteins as potential candidates in a broadly protective vaccine against multiple scrub typhus subtypes, over 100 subtypes recognized.	3880	2731	2591
Insect Vector Control and Infectious Disease Diagnostics Programs: Develop interventions that protect warfighters from insect bites that transmit diseases and design new medical diagnostic and surveillance tools for the field. Sand flies can transmit Leishmania, and different species of mosquitoes can transmit dengue fever and malaria. In FY07, conducted studies to find better ways to protect from insect-borne diseases and to improve medical diagnostic capabilities in the field. Refined field pathogen detection kits and continued to assess sand fly preventive medicine materials and an improved standard bed net that is an effective barrier to tiny sand flies. Continued to develop improved laboratory diagnostics for malaria, dengue virus and diarrheal diseases. In FY08, refocus effort to reduce disease threat from insects other than sand flies, including testing of insect-based pathogen detection assays, down selecting a new insect repellent for final formulation, and continuing to improve medical diagnostic capability in the field. Assess individual and combined components of	2332	1973	2152

diagnostic tests for selected naturally occurring infectious disease agents and begin design of next-generation diagnostic assays. In FY09, will investigate new intervention methods that reduce/prevent biting by insect vectors and will design and evaluate new medical diagnostic and surveillance tools for the field to improve the medical response to threats for which solutions have not been found.			
Viral Threats Vaccine Programs: In FY07, continued developing and testing new vaccine candidates against dengue and hantaviruses and assessed new technologies to protect against other lethal viral diseases. In FY08, evaluate new antiviral vaccines against emerging viral threats, and assess 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, will continue to assess and evaluate new antiviral vaccine against Lassa virus in animals and continue to support the hantaviral vaccine development effort. Will examine new vaccine delivery approaches to improve vaccine responses in animal models with goal of finding a way to enhance vaccines for protecting against or treating viral disease threats.	2818	2313	1876
Small Business Innovative Research/Small Business Technology Transfer Programs		43	
Total	15511	14883	15516

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**873**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
873 HIV EXPLORATORY RSCH	10976	11245	11389	10711	10780	11021	11268

A. Mission Description and Budget Item Justification: This project supports the medical technology area of the Future Force by conducting applied research and development of improved diagnostics, assessing genetic diversity of the virus, conducting regional overseas studies of disease to identify and develop vaccine trial sites, and developing of candidate vaccines for prevention and treatment of human immunodeficiency virus (HIV) infection. HIV is the virus that causes Acquired Immunodeficiency Syndrome. This program is jointly managed through an Interagency Agreement between the U.S. Army Medical Research and Materiel Command and the National Institute of Allergy and Infectious Diseases. Main efforts include development and preclinical studies (studies required before testing in humans) of candidate vaccines, such as small animal and nonhuman primate studies, as well as laboratory methods to assess vaccine protection, improved diagnosis of HIV infection, improved prognostic assessment, and disease management of HIV-infected individuals. 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 0603105, project H29. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Walter Reed Army Institute of Research and the Naval Medical Research Center, Silver Spring, Maryland, and their overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation, Rockville, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
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 FY07, continued assessment of new HIV vaccine candidates, vaccine test site development in Africa and Asia, and epidemiological and genetic assessment of the HIV threat and potential impact to operations. Continued vaccine testing using a "prime-boost" vaccine strategy (using a combination of two different vaccines to induce strong and long-term protective immune response), evaluated animal and human physiological responses that correlate with disease protection for assessing effectiveness of vaccines in humans and novel vaccine strategies. In FY08, continue ongoing long-term candidate vaccine refinement based on studies of globally prevalent HIV viral subtypes, continue to improve methodologies for medical monitoring of Department of Defense (DoD) personnel's viral exposure and infection, and continue to improve and integrate new methods to assess the effectiveness of candidate vaccines in support of clinical research (tests in humans). In FY09, will continue long-term efforts to find solutions to the HIV threat to DoD personnel with ongoing studies directed at assessing HIV vaccine candidates, vaccine test sites in Africa and Asia, and continuing changes in global risk and genetic makeup of HIV threat to U.S. forces to help direct future research and intervention programs.	10976	10947	11389
Small Business Innovative Research/Small Business Technology Transfer Programs		298	
Total	10976	11245	11389

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**874**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
874 CBT CASUALTY CARE TECH	18729	14595	11975	12084	12153	12355	12566

A. Mission Description and Budget Item Justification: This project supports applied research to develop and assess the feasibility of concepts, techniques, and materiel that improve survivability and ensure better medical treatment outcomes for warfighters wounded in combat and military operations other than war. The focus is on improving the effectiveness of medical treatment in the pre-hospital setting and during evacuation. Major areas of emphasis include hemorrhage control (novel bandages and techniques), resuscitation (fluid replacement and oxygen delivery), prognostics and diagnostics (predictive indicators, decision aids, and devices for triage), life support (computerized monitors and autonomous patient care devices), and repair (novel treatments to minimize tissue damage and accelerate restoration of function). This project also funds research to enable better medical training for Soldiers, medics, and other battlefield medical personnel to reduce evacuations due to dental disease and reduce the medical logistics footprint (weight, cube, and number of personnel) on the battlefield. For the development of drugs, biological products, medical devices, preclinical studies in the laboratory and in animal models assess safety, toxicity, and effectiveness and are necessary to provide evidence to the U.S. Food and Drug Administration to justify approval for a product to enter into future human clinical trials. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work on this project is performed by the U.S. Army Institute of Surgical Research, Fort Sam Houston, Texas; the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts; and the Walter Reed Army Institute of Research, Silver Spring, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Hemorrhage 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: In FY07, completed stability studies of freeze-dried plasma; selected best method to inactivate disease-causing agents in blood to prevent disease from blood transfusions; developed preclinical models of abnormal blood clotting in combined injury, bleeding, and massive resuscitation model; defined resuscitation strategies to correct abnormal clotting; engineered a nonperishable fluid to mimic fresh whole blood; completed comparative experiments to determine the best new fluid for resuscitation; and selected the most promising blood additive to reduce tissue and organ injury, inflammation, and shock in severely injured patients. In FY08, begin preparation for initial safety study of freeze-dried plasma, identify new strategies to treat the abnormal blood-clotting response that occurs in severely injured patients, establish the effects of resuscitation treatments for combined blast-trauma-hemorrhage injuries on the brain and lungs; and determine if red blood cells lose efficacy near the end of their shelf life. Also, test products and methods of using a foam blood clotting agent to stop internal bleeding. In FY09, will identify specific diagnostic and therapeutic interventions for abnormal blood clotting from the candidates identified in FY08, optimize resuscitation strategies for blast-trauma-hemorrhage on brain and lung in small animal models and investigate methods to freeze-dry red blood cells.	6050	7519	5138
Combat Trauma Therapies: Includes identification and development of candidate drugs and medical procedures to minimize the effects of combat injuries: In FY07, began planning a long-term collaborative effort with the Armed Forces Institute of Regenerative Medicine (AFIRM) to study restoration of limb function by both reducing infections and by regenerating skin, muscle, and bone tissue in battle-injured extremities; evaluated a method of cooling the brain as a neuroprotection therapy; and studied a drug to enhance brain function as a potential post injury rehabilitation treatment for brain trauma. In addition, the Biomarker Assessment for Neurotrauma Diagnosis and	8800	3895	4552

Improved Triage System (BANDITS) implemented a clinical research platform for biomarker analysis. In FY08, award contracts to AFIRM and begin to assess emerging therapeutics (stem cell therapy and growth factors for tissue and bone regeneration) in animal models and assess new methods to repair areas with major injuries caused by projectiles; develop selective brain cooling and neuroregeneration for early intervention and treatment of traumatic brain injury; establish 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; complete studies of FDA-licensed drugs that are candidate anti-seizure therapies for silent brain seizure; and continue BANDITS biomarker clinical trials and design a prototype device for brain injury diagnostics. In FY09, will focus AFIRM tissue regeneration activities on the most promising clinical treatments for blood vessel grafts, muscle regeneration, regeneration of bones in the head and face, and preclinical assessment of long-bone regeneration; will continue to refine selective brain cooling and neuroregeneration for early intervention and treatment of brain injury; will conduct drug combination studies for the treatment of acute brain trauma.			
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. In FY07, completed preclinical evaluation of a software algorithm for automated ventilation and oxygen administration based on lung mechanics and blood gas measurements. Continued toxicity and formulation studies on an antimicrobial, antiplaque compound. In FY08, complete preclinical evaluation of algorithms for simultaneous operation of closed-loop control of ventilation, oxygen administration, and fluid administration, and identify a hardware platform for this system and complete toxicity and formulation studies on an antimicrobial, antiplaque compound. In FY09, will complete preclinical evaluation of oxygen, ventilation, and 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 antiplaque compound to a commercial partner.	2200	1168	1220
Combat Casualty Bioinformatics and Simulation: Focuses on a data management system to capture and analyze time series 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. In FY07, refined components of a deployable medical simulation training system for reinforcement training of far-forward care providers and designed new technologies to add to simulators that depict realistic battlefield injuries to train combat medics in treatment of severe trauma. This effort builds upon previous medical simulator technology efforts through the introduction of simulated skin, flesh, and blood to increase realism of models and reduce the need for live tissue (animal) training for trauma treatment. In FY08, complete prototype patient trauma simulations with advances in material sciences that depict realistic skin, flesh, blood, bone, organs, and loss of fluids; and improve sensors that detect and provide feedback on interventions by medics. In FY09, will support testing and evaluate trauma simulation components developed in a joint Research, Development & Engineering Command/U.S. Army Medical Research and Materiel Command effort to assess training effectiveness at the Army Medical Department Center and School and other military training venues.	1679	1759	1065
Small Business Innovative Research/Small Business Technology Transfer Programs		254	
Total	18729	14595	11975

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**878**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
878 HLTH HAZ MIL MATERIEL	11926	13924	14312	13666	13815	14124	14438

A. Mission Description and Budget Item Justification: This project supports the Medical and Survivability technology areas of the Future Force 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. Major 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. Specific hazards addressed include blast overpressure generated by weapons systems, toxic chemical hazards associated with deployment into environments contaminated with industrial and agricultural chemicals (which complement 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, Maryland; the US Army Research Institute of Environmental Medicine, Natick, Massachusetts; the US Army Center for Environmental Health Research, Fort Detrick, Maryland; and the US Army Aeromedical Research Laboratory, Fort Rucker, Alabama.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Laser Protection Research: In FY07, examined candidate drug therapy interventions for laser-induced eye injuries and monitored recovery rates of nerve fibers responsible for eye-to-brain data transmissions. In FY08, complete 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, will utilize animal testing to assess laser eye injury hazards from advanced military systems. Will evaluate a combination of drugs for treatment of laser-induced eye injury.	1694	2020	2479
Injury Protection (face/eye): In FY07, used laboratory tests and injury trend data to assess computational and physical models of the face and eye, and proposed injury-based protection criteria. The data obtained from these models will produce a biomedically valid advanced physical headform device that can be utilized to assess facial and ocular injury. In FY08, validate and transition physical model and face/eye injury dose-response models to Army materiel developers. In FY09, will design an impact test methodology for assessing face shield performance.	3064	3490	2950
Pulmonary Hazards and Risk Assessment Models: In FY07, developed assessment software that predicts lung damage progression caused by blunt impacts and severe injuries. Conducted large-animal tests to determine the effects of inhaled toxic fire gases on physical performance. In FY08, develop an integrated model that will predict lung injury and performance outcomes from exposures to combined insults of blast over-pressure and blunt trauma. Collect experimental 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, will use new and existing animal injury and performance data to validate the integrated blast overpressure/blunt trauma lung injury	3884	4324	4460

and performance model. Will 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.			
Biomonitor System and Dehydration Research: In FY 07, completed laboratory testing of an environmental sentinel biomonitor platform that integrates toxicity sensor information to provide rapid analysis of drinking water quality; designed and validated models to predict water needs for a broad spectrum of modern missions in environmental extremes. In FY08, conduct 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, conduct 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, will assess technologies for rapidly identifying chemical contamination by toxic industrial chemicals and that are appropriate for use with field water production equipment. Will conduct field test to evaluate on-the-move enhanced fluid and nutrient delivery systems to enhance fluid and electrolyte delivery to Soldiers. Will demonstrate efficacy of inducing acquired thermal tolerance (cellular protection) coincident with heat acclimatization in Soldiers.	3284	3806	3211
Systems Biology and Network Science: In FY09, will 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. Will 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.			1212
Small Business Innovative Research/Small Business Technology Transfer Programs		284	
Total	11926	13924	14312

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**879**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
879 MED FACT ENH SOLD EFF	10112	9955	10316	9902	9978	10200	10429

A. Mission Description and Budget Item Justification: This project supports 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, and 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. 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, Silver Spring, Maryland; the US Army Research Institute of Environmental Medicine, Natick, Massachusetts; and the US Army Aeromedical Research Laboratory, Fort Rucker, Alabama.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
High Altitude Research: In FY07, refined predictive models of altitude acclimatization and completed studies to determine how to optimally accelerate high-altitude acclimatization through intermittent exposure to reduced levels of oxygen. In FY08, integrate 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, will examine use of FDA approved drug (erythropoietin) to prevent neuropsychological deficits and acute mountain sickness. Will provide critical information to the Army Medical Department Combat Developer for the development of new Army doctrine related to high altitude deployments.	2686	2815	2657
Fatigue/Sleep Research: In FY07, conducted studies to improve Soldier effectiveness predictions and assessed the efficacy of drug countermeasures for individual Soldiers. In FY08, conduct laboratory studies to assess predictions of performance effectiveness and efficacy of drug interventions for individual Soldiers. In FY09, will 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.	1823	1702	1682
Mental Health Research: In FY07, determined the impact of deployment length and frequency of deployments in identifying unit/individual characteristics that enhanced resilience. In FY08, assess individual intervention strategies such as DoD post-deployment health assessment and post-deployment health reassessments; assess 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, will develop unit-level intervention tools for military-wide implementation to improve warfighter resiliency, health, and performance.	3153	2809	3589
Vision and Auditory Research: In FY07,used human and animal data to initiate evaluation of a hearing damage model, the Auditory	2450	2520	2388

Hazard Assessment Algorithm for the Human Ear, to assess its utility in performing auditory health risk assessments and guiding development of hearing protective devices; conducted laboratory evaluations of a noise immune electronic stethoscope. The ability to use a stethoscope in noisy environments (i.e., medical evacuation vehicles) will provide significant improvements to Soldier survivability following trauma from hostile action or accidental injury; completed analysis of optometric data investigating the visual effect of wearing a monocular helmet mounted display; designed test methodology for production compliance/quality assurance testing of the protective eyewear program. In FY08, conduct evaluations of animal database for the effects of impulse noise/blast waves on hearing; conduct clinical and animal evaluations of a noise immune electronic stethoscope directed toward future Food and Drug Administration approval; develop the concept of solar protection compatible with rapid transition into darkened environments. In FY09, will conduct comparative analysis of six 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 prototype eye protection systems.			
Small Business Innovative Research/Small Business Technology Transfer Programs		109	
Total	10112	9955	10316

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602787A - MEDICAL TECHNOLOGY**	**FH2**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
FH2	FORCE HEALTH PROTECTION - APPLIED RESEARCH	8053	8407	8746	8457	8619	8812	9010

A. Mission Description and Budget Item Justification: This project supports applied research directed toward the sustainment of a healthy force of warfighters from accession through retirement. This research focuses on enhanced protection of Soldiers against health threats in military operations and training. Stressors that adversely affect individual Soldier health readiness are identified and studied to 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 a decade of research on Gulf War Illnesses and other chronic multisymptom illnesses that have suspected nerve and behavioral alterations due to environmental contaminants and deployment stressors. Additionally, environmental monitoring efforts are directed at demonstration and validation of an Environmental Sentinel Biomonitor (ESB) that can identify the presence of toxic industrial chemicals in water and monitor potable water sources. Force Health Protection applied research is conducted in close coordination with the Department of Veterans Affairs. The program has the following three major thrust areas: (1) global health monitoring; (2) health behavior interventions and health risk communication (e.g., weight management and benefits of exercise); and (3) health risk assessment methods and medical materiel safety (e.g., interactions of operational stressors such as heat strain, psychological trauma, and pesticides) with neurotoxic chemical exposures including petroleum products and insecticides). The goals of the Health Behavior/Weight Control effort are to evaluate the effectiveness of specific health behavior interventions, modification to establish their benefit to readiness, especially non-drug, neuroprotection that comes from an informed and positive lifestyle. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services working on Army projects. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the US Army Center for Environmental Health Research, Fort Detrick, Maryland; and the US Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Nerve-based Disease Research: In FY07, further characterized cognitive and behavioral changes associated with deployment and assessed the time it takes for recovery. Refined the Automated Neuropsychological Assessment Metric test battery to a minimum number of robust, reproducible, and well-validated set of tests, which provided measures of change in psychological and neural functioning due to military operational impacts. Conducted range finding for selected military relevant chemicals in model organisms. In FY08, complete a study of relationships between military occupation and nerve degeneration diseases. Complete comprehensive data collection on the health effects of exposure to jet fuel in a military setting. Complete examination of individual permethrin (insect repellent) exposure and dose levels in different environmental settings designed to simulate operationally relevant scenarios; conduct assessments of military relevant chemicals and materials to identify biological markers, biomarkers, of exposure and effect using genomic and proteomic analyses. Identify potential multianalyte testing platforms for ready determination of identified biomarkers. In FY09, will complete analyses of the association between jet fuel exposure over a work week and nervous system health outcomes. Will 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). Will integrate ESB components and will conduct bench testing of the composite system.	5937	6082	4664
Health Behavior/Weight Control: In FY07, developed a diet and exercise program for redeployed Soldiers to reduce body fat without loss	2116	2090	4082

of lean body tissue (including bone and muscle). In FY08, assess novel military weight management programs that include food intake monitoring, meal replacement, and portion size retraining. Complete analysis of two community-based intervention programs for military weight management in active duty and reserve forces. In FY09, will 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 a 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.			
Small Business Innovative Research/Small Business Technology Transfer Programs		235	
Total	8053	8407	8746

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	63981	86103	46793	42611	44099	45457	46498
242	AIRDROP EQUIPMENT	3941	4127	3800	3841	3870	3957	4045
543	AMMUNITION LOGISTICS	1262	1320	1275	1362	1371	1401	1433
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	1973	1779	2265	2296	2312	2364	2418
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	31918	36205	39453	35112	36546	37735	38602
J52	WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)	24887	42672					

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates technologies to enhance dismounted Soldier capabilities while reducing the logistics burden on the battlefield, decreasing operation and sustainment costs, and improving ammunition logistics system performance. Efforts in this project are focused on improving Soldier survivability, sustainability, mobility, combat effectiveness, and field quality of life through maturation of technologies associated with air delivery of personnel and cargo, combat clothing, personal equipment (including protective equipment such as personal armor, helmets and eye wear), combat rations and combat feeding equipment. The overall goal is to provide the Soldier with the most effective personal clothing, equipment and rations at the least weight and sustainment burden. Efforts address technologies for use in the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. The Airdrop Equipment project (242) provides enhancements to rapid deployment and force projection capabilities by maturing and demonstrating technology required for dropping increasingly heavier cargo to precise locations from high altitudes and greater offset distances, and increasing the precision of delivery to remote locations in challenging terrain. The objective is to increase both the survivability of aircraft and crews, and the probability that payloads delivered will land in a usable condition. This project provides technology development for the family of Joint Precision Airdrop Systems (JPADS) which will demonstrate a precision delivery capability with 100 meter or less Circular Error Probable (CEP) accuracy. The major effort within this project is to demonstrate a 30,000 pound precision airdrop capability. The Ammunition Logistics project (543) demonstrates technology that optimizes weapon system rearm, ammunition packaging/palletization, explosives safety, material handling equipment, and ammunition throughput/management for improved munitions availability and survivability. Project 543 is performed by the Armament Research, Development, and Engineering Center, Picatinny, NJ. The Joint Service Combat Feeding Technology project (C07) demonstrates technologies for military combat feeding systems and combat rations to include processing, preservation, packaging, and equipment and energy technologies to reduce the logistics footprint while enhancing warrior mental and physical agility. The DoD Combat Feeding Research and Engineering Board and Nutrition Committee provides oversight for this project. The Future Warrior Technology Integration project (J50) matures, demonstrates and integrates high-payoff technologies from a variety of sources for transition to current and future Soldier equipping programs. Efforts in this project are focused on improving Soldier survivability, sustainability, mobility, combat effectiveness, and field quality of life through 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/subsystems for the individual Soldier. Through FY07 the major effort was Future Force Warrior (FFW) Advanced Technology Demonstration (ATD). Using active duty Soldiers in a relevant field environment, the FFW ATD demonstrated system-of-systems functionality through a government-owned open architecture design. This Soldier system-of-systems consists of a lightweight protective ensemble that enabled advanced multi-functional

sensors, weapons and weapon targeting systems, and medical monitoring devices which were modularly incorporated through hardware and software interfaces. Project J50 continues to work on reducing the size, weight and integration burden of several of the component technologies developed under FFW and also to mature and demonstrate technologies that support upgrades to fielded Soldier equipment and subsystems and components to enable additional capabilities at the Small Unit and individual Soldier level. Specific emphasis is on achieving capability improvements enabled by advanced integrated lightweight Soldier protective headgear and clothing; wearable load-bearing equipment that will assist in strength and mobility; lighter weight more energy efficient Soldier-borne computing and communication equipment; lighter, more durable Soldier displays and subsystems that provide greater situational awareness with less cognitive stress; and lightweight high-energy-density Soldier power. These efforts support the goals of the Soldier as a System concept, as well as, the Ground Soldier System requirements. Project J52, Warfighter Advanced Technology Initiatives, funds Congressional special interest items. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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 efforts in PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE0602624A (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). Work is performed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA; the Armament Research, Development, and Engineering Center, Picatinny, NJ; and the Research, Development, and Engineering Command, Edgewood MD.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	65632	47065	47055
Current BES/President's Budget (FY 2009)	63981	86103	46793
Total Adjustments	-1651	39038	-262
Congressional Program Reductions		-3906	
Congressional Rescissions			
Congressional Increases		42944	
Reprogrammings	78		
SBIR/STTR Transfer	-1729		
Adjustments to Budget Years			-262

Twelve FY08 congressional adds totaling $42944 were added to this PE.

($800) Extended Shelf Life Produce for Remotely Deployed Forces
($1440) High Pressure Alrbeam Shelter Cost Reduction Technology Improvements
($1600) ChemBio Integrated Material for Tent Structures
($1600) Deployment of Affordable Guided Airdrop System
($1600) Flame & Thermal Protection for Individual Soldier
($1600) High-Pressure/Microwave MRE Processing
($3000) BioSensor Communicator and Controller System
($3000) Multifunctional Protective Packaging Technology
($3200) Joint Precision Airdrop System (JPADS) Program for Payloads up to 30K lbs
($4504) Remote Environmental Monitoring and Diagnostics in the Perishables Supply Chain
($4600) Ration Packaging Materials and Systems for Meals Ready-to-Eat
($16000) Alternative Energy Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**	**242**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
242 AIRDROP EQUIPMENT	3941	4127	3800	3841	3870	3957	4045

A. Mission Description and Budget Item Justification: This project matures and demonstrates equipment and innovative techniques for aerial delivery of cargo and personnel. This is a key capability for rapid force projection and global precision delivery envisioned for the Future Force. Precision airdrop can provide a long-range, autonomous airdrop capability, with the option to deliver separate and distinctive payloads to multiple locations. Capitalizing on advances in decelerators, guidance, and sensing (e.g., Global Positioning System), and wind sensing technologies, precision airdrop systems have the ability to be deployed from high altitudes (up to 25,000 feet) with large offset distances (between 8 and 20 kms) and to deliver payloads with improved accuracy, which enhances cargo, crew, and aircraft survivability. This project provides technology development for the family of Joint Precision Airdrop Systems (JPADS) which demonstrates a precision delivery capability with 100 meter or less Circular Error Probable (CEP) accuracy. The Medium Precision Airdrop effort advances the payload capability to 30,000 pounds. Advanced Precision Airdrop Enhancements leverages the latest Guidance, Navigation and Control (GN&C) airdrop technologies, advanced under the applied research program (PE 0602786A), to develop a precision airdrop capability that is highly precise for resupply in complex, mountainous terrain with small, challenging drop zones. The efforts in this project support the Army Transformation goals in the area of rapid deployment. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed and managed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Medium Precision Airdrop: In FY07, completed all component-level evaluations, system design, and system modeling; integrated components into airdrop system; and began system evaluation and system control logic validation. In FY08, demonstrate full-scale concept for guided, autonomous, precision medium (30,000 pound) airdrop payload for JPADS.	3941	4028	
Advanced Precision Airdrop Enhancements: In FY09, will mature and demonstrate latest GN&C airdrop technologies in a precision airdrop concept that is designed for accurate resupply in complex, mountainous terrain with small, challenging drop zones; will optimize and demonstrate GN&C technology enhancement for precision airdrop; will spiral the second generation GN&C technology into JPADS family.			3800
Small Business Innovative Research/Small Business Technology Transfer Programs		99	
Total	3941	4127	3800

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**	**543**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
543 AMMUNITION LOGISTICS	1262	1320	1275	1362	1371	1401	1433

A. Mission Description and Budget Item Justification: This project develops technology that provides rapid munitions deployability, resupply, and return from deployment for the Army's Future Force. It enhances force readiness and reduces the logistics footprint through improvements in explosive safety, Materials Handling Equipment (MHE), ammunition and missile packaging/palletization, and asset throughput/management. It also improves weapon system rearm for artillery, armor, air defense, aviation, and infantry. A major effort is a lightweight, high strength cargo platform system, the Joint Modular Intermodal Platform (JMIP), a component of the Joint Modular Intermodal Distribution System (JMIDS) Joint Capability Technology Demonstration (JCTD) and leverages work funded in Defense-wide PE 0603750D. The effort facilitates logistics through its compatibility with the C-17 and C-130 aircraft; current and future trucks; and aerial delivery systems. The JMIP's modularity and compatibility will reduce aircraft load/unload time by up to 75 percent, and allow more efficient loading of aircraft (reducing number of aircraft missions required). The Tactical Ammunition Accountability (TAA) 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). Technology developed within this project transitions to development programs for weapons, munitions, MHE, force sustainment, and tactical vehicles. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This project is managed by the US Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Component of the JMIDS JCTD: In FY07, modified, designed and tested demonstration quantities of Joint Modular Intermodal Platforms (JMIPs) with integrated automated identification technology that tracks, delivers, and manages supplies to the soldier. Conducted Military Utility Assessments (MUA) as part of the JCTD. In FY08, conduct residual evaluation of JMIDS with field users as part of the JCTD.	1262	500	
Tactical Ammunition Accountability (TAA) - In FY08, develop low cost environmental sensors, both automated and visual indicators, for munition health monitoring at the point of consumption: conduct industry search of available hand held devices suitable for remote inventory activities. In FY09, will develop software interface for tactical ammunition management systems and will integrate with health monitoring sensors.		790	1275
Small Business Innovative Research/Small Business Technology Transfer Programs		30	
Total	1262	1320	1275

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**	**C07**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
C07	JOINT SERVICE COMBAT FEEDING TECH DEMO	1973	1779	2265	2296	2312	2364	2418

A. Mission Description and Budget Item Justification: This project matures and demonstrates technologies for military combat feeding systems and combat rations to include processing, preservation, packaging, and equipment and energy technologies to reduce the logistics footprint while enhancing warrior mental and physical agility. The project supports the Army Transformation with a goal to demonstrate combat feeding technology with potential to reduce logistics (in component parts, weight, cube, fuel, and water) and labor requirements, while improving the quality of food service. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. 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. The Combat Feeding Equipment Technologies effort focuses on improving energy utilization and using advanced heating technologies to provide logistically streamlined combat feeding systems with enhanced fuel efficiencies to decrease the combat feeding logistics tail. Ration Stabilization, Packaging, and Novel Nutrient Delivery Technologies focuses on demonstrating advances in combat ration technology, nutritionally advanced rations, packaging materials, and biosensor technologies for food pathogen contamination/wholesomeness assessment. It also demonstrates predictive modeling and simulation to assist in ration design, mission, planning, and Class I (subsistence) distribution and tracking. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The work in this project is performed and managed by the US Army Natick Soldier Research, Development and Engineering Center, Natick, MA. This project has collaborative efforts with the US Army Research Institute for Environmental Medicine.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Combat Feeding Equipment Technologies: In FY07 demonstrated and transitioned thermoelectric self-powered tray ration heater for Army, US Marine Corps, and Air Force kitchens reducing reliance on JP8 by about 50 percent; drafted initial procurement document for quasicrystal nonstick durable coating for cookware. In FY08, integrate and demonstrate a prototype beverage chiller with a standard commercial or military backpack hydration system and transition to PM-Clothing and Individual Equipment (CIE) and PM-Individual Combat Equipment (ICE); develop new Joint Service Battlefield Kitchen; demonstrate Multi-serving Self-Heating Hot Water System enhancement to Unitized Group Ration Express (UGR-E); and complete prototype development and demonstration of Solar-powered Refrigerated Container and transition to PM Force Sustainment Systems (FSS). In FY09, will complete demonstrations of Joint Service Battlefield Kitchen based on state of the art power generation systems and transition to PM-FSS; will complete final technology demonstration of Waste to Energy Converter and transition to PM FSS.	243	639	582
Ration Stabilization, Packaging, and Novel Nutrient Delivery Technologies: In FY07 validated novel diagnostic technologies for rapid detection of food pathogens and demonstrated feasibility/utility of incorporation into array (matrix) systems; conducted producibility and performance testing of Meals Ready to Eat (MRE) meal bags fabricated from a low density polyethylene nanocomposite to significantly reduce weight and cube of individual ration packaging. In FY08, downselect novel diagnostic technologies for incorporation into advanced array systems which expand diagnostic capability, while reducing weight and cube of deployable array system; conduct biodegradable coating trials for prototype compostable fiberboard containers; characterize for biodegradation, water resistance and insect	1730	1140	1683

repellency. In FY09, will demonstrate effectiveness of providing performance enhancers via buccal delivery (directly into bloodstream through tissue in mouth); will conduct final technology demonstration of novel diagnostic technologies incorporated into array systems for food pathogen detection and will transition to Veterinary Services Activity and Office of the Surgeon General for procurement; will incorporate performance enhancers into ration components to achieve a 20 percent demonstrated human performance optimization in one or more highly relevant validated military performance tasks (e.g., victim rescue, 30m combat rushes).			
Total	1973	1779	2265

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603001A - Warfighter Advanced Technology**	**J50**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
J50	FUTURE WARRIOR TECHNOLOGY INTEGRATION	31918	36205	39453	35112	36546	37735	38602

A. Mission Description and Budget Item Justification: This project matures, demonstrates and integrates high-payoff technologies from a variety of sources (including PE0602786A) for transition to current and future Soldier equipping programs. The overall goal is to provide the Soldier with the most effective personal clothing and mission equipment at the least weight, sustainment and cognitive burden. Efforts in this project are focused on improving Soldier survivability, sustainability, mobility, combat effectiveness, and field quality of life through 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. Through FY07 the major effort was Future Force Warrior (FFW) Advanced Technology Demonstration (ATD). Using active duty Soldiers in a relevant field environment, the FFW ATD demonstrated system-of-systems functionality through a government-owned open architecture design. This Soldier system-of-systems consists of a lightweight protective ensemble that enabled advanced multi-functional sensors, weapons and weapon targeting systems, and medical monitoring devices which were modularly incorporated through hardware and software interfaces. FFW provided capability to Small Combat Units (SCU) and individual Soldiers that allowed them to connect to other dismounted combat personnel, the Future Combat Systems and robotic air/ground platforms, giving them unparalleled situational awareness and effectiveness. The open architecture and individual components (including hardware and software) matured and demonstrated in FFW were transitioned to Program Executive Officer (PEO) Soldier and are being incorporated into on-going programs that will benefit the Current, as well as the Future Force. Project J50 continues to work on reducing the size, weight and integration burden of several of the component technologies developed under FFW and also to mature and demonstrate technologies that support upgrades to fielded Soldier equipment and enable additional capabilities at the Small Unit and individual Soldier level. Specific emphasis is on achieving capability improvements to Soldier protective headgear and clothing; wearable load-bearing equipment that will assist in strength and mobility; lighter weight more energy efficient Soldier-borne computing and communication equipment; and lightweight high-energy-density Soldier power. These efforts support the goals of the Soldier as a System concept, as well as, the emerging Ground Soldier System requirements. The Soldier Ballistic and Blast Protection effort designs/refines survivability test protocols and analysis tools to assess blast and ballistic protective systems in support of Project Manager-Soldier Equipment. This effort collaborates with the Medical Research and Materiel Command (MRMC) and begins to fill a significant gap by addressing the complex injury mechanisms presented by explosive devices. The Integrated Soldier Protection effort focuses on maturing and demonstrating innovative, integrated personal protection and casualty management solutions for ground and mounted Soldiers and aviators in the areas of improved tactical concealment; protection against ballistics, blast, flame, lasers, and toxic industrial chemicals and materials (TIC/TIM); multi-spectral signature reduction; and integrated protection concepts incorporating passive and active ventilation and micro-climate conditioning with combat headgear-integrated respiratory and ocular protection. Concepts and material technologies are leveraged for integrated protection from PEs 0602786A, 0602105A, and the DoD Chemical / Biological Protection Program that include: selectively permeable membranes; flame resistant fibers, fabrics and treatments, nano-technology based materials; and cooling, ventilation, and filtration technologies optimized for weight and power reduction. The goal of the Soldier Mobility and Enhanced Load Carriage effort is to mature, demonstrate, and integrate innovative Soldier mobility and load carriage solutions. The effort focuses on exploiting and further maturing and demonstrating technology concepts including those initially developed under PE 0602786A, the Defense Advanced Research Projects Agency's (DARPA) Exoskeleton program, Army biomechanical tools for maximizing Soldier load carriage capability, and the Institute of Soldier Nanotechnology's (ISN) lightweight nanomaterials for lightening the Soldier's load. The goal of the Small Combat Unit Command, Control, Communications and Computers (C4) Integration and Interfaces effort is to reduce size and weight, as well as ruggedize C4 components and subsystems that are designed and developed by others and integrate them with current and future Soldier systems. The objectives are to provide platoon, squad and individual Soldiers situational awareness and

information now only available at the company and/or higher command headquarters level. This effort leverages and is non-duplicative with work accomplished by the Army Communications and Electronics Research, Development and Engineering Center (CERDEC) and the Flexible Display Center (PE 0602705A). The Soldier Power and Energy effort further matures, reduces size and weight, ruggedizes, integrates and demonstrates components developed by others (such as CERDEC, the Army Research Laboratory (ARL) and DARPA) that have potential to significantly reduce the weight and volume of power generating and storage devices required to support advanced Soldier-borne computers, communications and situational awareness equipment. Efforts focus on batteries, fuel cells and devices with increased efficiency and reduced weight. The Small Unit Lethality Integration thrust area builds upon the foundation that the FFW program established. Using government owned open system architecture, this systems engineering approach allows subsystem components to be matured and integrated into current and future system of system architectures. This thrust area is focused on Soldier-centric design within an SCU down to the individual warfighter bounded by Soldier-centric design. Weapon mounted sensors allow ground combatants to identify targets and allow other shooters to service these targets. This effort is complementary to and relies on component technologies designed and evaluated in PE 0603603A, Joint Small Arms Program. The goals of Small Unit Systems Integration and Demonstration effort are to bring technology to the Soldier through subsystem-level testing and evaluation to enhance Soldier combat performance. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The US Army Natick Soldier Research, Development and Engineering Center, Natick, MA, manages this project.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
FFW Body Borne System: In FY07, completed final system development and integration, and integration of Personal Area Network enhancements; retrofitted existing 12 systems and fabricated and tested 30 additional integrated body borne systems to support up to platoon level size field demonstrations.	3316		
FFW Headgear: In FY07, completed integration of headgear ballistic material, single aperture vision enhancement, sensor fusion, Tactical Engagement System (TES) functionality, XM50 chem/bio mask interface, and Air Force Special Operations Command (AFSOC) Battlefield Air Operations (BAO) Kit; modified existing 12 systems and fabricated, integrated and tested 25 additional headgear systems to support field demonstrations; performed systems engineering tasks to support integration, interoperability, and supportability. This task leveraged and integrated technologies developed in PE 0602786A and PE 0602105A.	5581		
FFW Soldier Computer/Software (SW): In FY07, down-selected and completed computer/software functionality development; used built in test to check/verify system performance when system is booted up, optimized and code for a power constrained computing environment; conducted field demonstrations with FFW computer hardware/software (HW/SW); closely monitored/participated in Army activities concerning Information Assurance (IA) and Multiple Level Security; performed system engineering to support integration/interoperability/supportability. Task leveraged/integrated PE 0602308A.	4903		
FFW Personal Area Network (PAN): In FY07, refined PAN; fabricated and tested PAN to support field demonstrations; performed systems engineering tasks to support integration, interoperability and supportability. This work included the investigation and development of a wireless interface to the weapon system.	695		
FFW Power Sources: In FY07, conducted analyses on energy usage from FY06 FFW demonstrations. Procured, tested, and integrated direct methanol fuel cells for FY07 FFW demonstrations. This task leveraged and integrated technologies developed in PE 0602705A.	803		
FFW Network/Communications/ Antennas: In FY07, refined network based on FY06 demonstrations and Modeling and Simulation (M&S). Fabricated 25 additional communication subsystems to support field demonstrations. Performed systems engineering tasks to support integration, interoperability, and supportability. This task leveraged and integrated technologies developed in PEs 0602782A and 0603008A.	2661		

FFW Small Combat Unit (SCU) Lethality and Fire Control: In FY07, down-selected optimal lethality/fire control solution and completed development and integration into FFW System of Systems (SoS); fabricated distributed lethality components to support field demonstrations; performed systems engineering tasks to support integration, interoperability, and supportability. This task leveraged and integrated technologies developed in PEs 0602623A and 0603607A. This task used three systems: a current system (Storm Multi Function Laser), a modified PM system (XM104), and an R&D product, Smart Sight.	1088		
FFW Precision Position System (PPS): In FY07, integrated precision position/navigation system into overall FFW architecture; completed development and maturation of PPS systems and conducted integration into FFW HW/SW architecture to support field demonstrations. Performed systems engineering tasks to include metrics, requirements allocation, interoperability, and supportability.	2355		
FFW Technical Evaluations, Analysis, Assessments and Demonstrations: In FY07 conducted Experimental Force training and executed FFW System level demonstrations through participation in FCS Exp 1.1, C4ISR On The Move Demonstration and Army Air Expeditionary Force Spiral D demonstrations employing an FFW equipped platoon to validate system performance at Technical Readiness Level 6; completed final analyses regarding SCU combat effectiveness; initiated trade studies to identify optimal technology solutions and integration opportunities for investment after completion of the FFW ATD.	6516		
Soldier Ballistic and Blast Protection: In FY08, design and refine test equipment and experimental protocols to generate an inexpensive/reliable means of evaluating current/future protective systems against primary blast lung injury (PBLI). Conduct comprehensive analysis of available blast and ballistic protective system and component assessment tools, devices and protocols to determine which have the most promising capabilities to evolve into a suite of standardized system level assessment protocols. Conduct blast testing with the devices to determine required changes to the devices (e.g., sensor responsiveness, sensor location/density, device networking), and begin to develop associated specific standardized personnel blast test protocol so that the correlation to the effects on the blast testing device and biological surrogates are understood and characterized. In FY09, will finalize test equipment and protocol for PBLI protection system assessment, benchmark the protection afforded by currently fielded items and transition equipment protocol to the acquisition program manager (PM) and industry; will lead effort to develop assessment protocols and/or test devices to address other characterized blast-related injury mechanisms (fragments, burns, inhalation of toxic gas, etc.); will begin to translate knowledge of injury data, criteria, and blast event characterization efforts into materiel solutions and evaluate effectiveness of protection systems. This task collaborates with MRMC and leverages / integrates technologies and knowledge products developed in PE 602786A and PE 602747A.		5322	4966
Integrated Soldier Protection: In FY08, design integrated chemical, biological, toxic industrial chemicals and materials (TIC/TIM), and microclimate technology protection solutions in collaboration with Joint Science and Technology Offices Joint Chemical Ensemble project. Mature concepts and material technologies leveraged from PE 602786A and PE 602105A for integrated protection that include: selectively permeable membranes; flame resistant fibers, fabrics and treatments, nano-technology based materials; cooling, ventilation and filtration technologies optimized for weight and power reduction; and physiological sensors and algorithms. In FY09, will select the most promising integrated protection technology solutions designed in FY08, (i.e., casualty management, eye protection, ballistic, Microclimate Cooling) and will continue to mature and demonstrate; will 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 met and to support rapid transition of integrated technology solutions.		5322	6016
Soldier Mobility and Enhanced Load Carriage: In FY08, leverage technology transition from PE 0602786A and the Defense Advanced Research Projects Agency's (DARPA) Exoskeleton program; further mature and refine select components and subsystems; continue to develop concept for using exoskeleton to aid Soldiers in loading/delivery operations. In FY09, will develop human use protocols to assess effects of wearing exoskeleton; continue to mature technology and integrate safety performance parameters into Soldier load carriage and		3472	3466

mobility systems; will conduct technical tests and field demonstrations with Combined Arms Support Command (CASCOM/Ft. Lee) for user feedback to ensure relevant system performance evaluations that enables rapid transition of technology solutions to PEO Soldier.			
Small Combat Unit C4 Interfaces: In FY08, select, assess and mature ground Soldier components and/or subsystems that require refinement and further maturation (see-through/ flexible displays, heads-up/heads-down 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; reliable jam-proof wireless technologies and advanced cabling and connectors to include e-textiles and micro/nano connectors to enhance personal area networking between head, body, and weapon systems); continue to mature the software translation tools and demonstrate additional modular capabilities. In FY09, will continue to exploit Soldier, squad, and platoon network technology maturation efforts; will conduct technical tests and field demonstrations, combined with user feedback, to ensure relevant system performance evaluations that enable rapid transition of integrated technology solutions. These systems and subsystems will be focused on Soldier centric design as well as cognitive loading.		6272	8416
Soldier Power and Energy: In FY07, evaluated hybrid power systems for reliability, suitability, and utility on Soldiers, leveraging test results and knowledge developed in PE0602705A and from feedback gained from lab and field demonstrations; collected data during field demonstrations that captured duty cycles and load profiles by duty position and mission for use in refining Soldier system architectures and power source system optimization; matured conformal rechargeable battery concept and demonstrated completed battery packs on a bench-top; monitored and tracked developments in solid oxide fuel cells as well as thin-film rechargeable battery technology with technical support from ARL; evaluated various candidate technologies in collaboration with CERDEC and ARL for use as platoon-level generators including engines and fuel cells. In FY08, integrate innovative Soldier power and energy solutions and mature system solutions for ground and mounted Soldiers and aviators to include: a methanol-based Soldier hybrid fuel cell power source designed under PE 0602705A, 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. In FY09, will continue to mature methanol-based Soldier hybrid fuel cell power source; higher energy density conformal rechargeable battery; and half-sized BA 5590 Li/CFx batteries; will initiate rechargeable battery development based on packaging thin film rechargeable battery technology; will integrate nano-technology based electro-textiles with photovoltaic energy properties to augment primary system power sources; will demonstrate platoon-level generator recharging batteries; will conduct technical tests and demonstrations, combined with user feedback to ensure relevant system performance evaluations that enable rapid transition of integrated technology solutions to Army PMs.	4000	4847	4978
Small Unit Lethality Integration: In FY08, conduct lethality analyses of Small Combat Unit (SCU) operational concepts and enabling technologies and evaluate promising technologies individually and as integrated systems of systems in a relative field environment. Analyze effectiveness (using models and simulations where applicable to assess the combat effectiveness of the SCU) of networked lethality; small-unit weapon systems; weapon-based sensors, optics and fire control; fighting in urban and complex environments; innovative message processing that reduces time, increases accuracy and safety, and coordinates identification, gunfire detection, targeting, synchronization, and massing of internal and external Platoon fires (e.g. Field Artillery and Army/Joint Aviation). Assess design parameters impacting the SCU to include: system size, weight, power, and cost; cognitive load precision of direct and indirect fires; weapon system range; ability to reduce operational cycle from detection to service the target in order to identify cost/performance trade space. Integrate enhancements to small unit cooperative engagement for more accurate firing solutions to include integration with XM-320 grenade launcher and improved firing solution software (updated ballistics tables) for both the fielded Storm Multi function Laser, XM-104 and Picatinny Smart Sight. In FY09, will continue to mature government owned open system architectures that are focused on current and future networks; will assess and evaluate latency across the networks to enable quicker call for effects and battlefield sensor awareness; will conduct laboratory tests and field demonstrations, combined with user feedback, to ensure desired system performance.		4722	5072

Small Unit Systems Integration and Demonstration: In FY08, expand the Soldier Systems Integration Lab (SIL) capabilities to include an open architecture lab environment, coupled with a robust data collection infrastructure to support early and iterative analysis of emerging Government, Industry, Soldier and Small Combat Unit (SCU) technology integration, interface, and operational issues; continue to identify means to improve Soldier and SCU physical, network, software, interoperability, and human integration testing within a system of systems platform without impacting concurrent technology innovation; integrate performance evaluation and assessment of survivability, lethality, and power and energy technologies seamlessly within current and emerging small unit operational and technical architectures; evaluate rapidly configured and reconfigured modular operational concepts, network architectures, and C2 information systems through modeling and simulation. In FY09, will develop and implement transportable test and demonstration Soldier subsystem modules featuring pre-tested architectures, data collection infrastructure/plans/analysis with efforts conducted through simulation, design, demonstration, and test in both the Soldier Systems Integration Laboratory and operational venues, such as Future Combat System Experiments, Joint Forces Experiments (JFEX), and Air Assault Expeditionary Force (AAEF) field experiments at Ft. Benning, GA; will analyze test and experiment data to assess subsystem usefulness to Soldiers and recommend transition of products to Army and Joint PMs.		5288	6539
Small Business Innovative Research/Small Business Technology Transfer Programs		960	
Total	31918	36205	39453

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	291716	299676	59043	57249	57518	58748	59887
800	TELEMEDICINE TESTBED	3700	5390	4092	3966	4051	4142	4234
801	DEF WOMEN'S HEALTH RES	1743						
804	PROSTATE CANCER RSCH		2385					
810	IND BASE ID VACC&DRUG	19757	21233	22093	20597	20528	21031	21426
814	NEUROFIBROMATOSIS	9684	7949					
819	FLD MED PROT/HUM PERF	1124	1194	1257	1226	1258	1286	1315
840	COMBAT INJURY MGMT	21074	23127	29530	29465	29646	30208	30785
893	TISSUE REPLACEMENT							
923	PROSTATE DIAGNOSTIC IMAGE	1161						
929	ARTIFICIAL LUNG TECHNOLOGY	968						
932	Minimally Invasive Surgery (CA)							
938	Tissue Engineering		1192					
941	Diabetes Research	2227						
945	BREAST CANCER STAMP PROCEEDS	1288						
954	DIGITAL X-RAY		3180					
955	ASSISTIVE TECHNOLOGY	2130	2385					
969	ALCOHOLISM RESEARCH	5326						
97A	BIOSENSOR RESEARCH	1840	1589					
97B	BLOOD SAFETY	968	1988					
97D	CENTER FOR AGING EYE	1936	1589					
97O	LUNG CANCER RESEARCH							
97T	NEUROTOXIN EXPOSURE TREATMENT	25662	19873					
97W	SEATREAT CANCER TECHNOLOGY	1549						
97X	SYNCHROTRON-BASED SCANNING RESEARCH	5617	7949					
FH4	FORCE HEALTH PROTECTION - ADV	1898	1987	2071	1995	2035	2081	2127

	TECH DEV							
MB1	ADV DIAGNOSTICS & THERAPEUTIC DIG TECH	1549	1589					
MB2	BRAIN, BIOLOGY, AND MACHINE	2422	1988					
MB3	CENTER FOR INTEGRATION OF MEDICINE & INNOV TECH	9296	7949					
MB4	CENTER FOR UNTETHERED HEALTHCARE	968						
MB9	JOINT US NORWEGIAN TELEMEDICINE	1259						
MC4	SECURE TELEMEDICINE TECH PROGRAM	1259						
MC7	NATIONAL TISSUE ENGINEERING CENTER							
MD1	EMERGENCY TELEMED RESPONSE & ADV TECH	3147	1988					
ME9	BEHAVIORAL/COMPARATIVE GENOMICS							
MF2	ADVANCED PROTEOMICS (CA)	1307	1192					
MF9	GENOMIC MEDICINE AND GENE THERAPY (CA)	1743						
MG1	GYNECOLOGIC DISEASE PROGRAM (CA)	3486						
MG3	MEDICAL TRAINING TECH ENHANCEMENT INITIATIVE (CA)	1259						
MG5	NATIONAL FUNCTIONAL GENOMICS CENTER (CA)	8715	8347					
MG7	ON-LINE MEDICAL TRAINING (CA)							
MH1	PICTURE ARCHIVING AND COMMUNICATIONS SYSTEM (CA)							
MH2	PROJECT COLLABORATION MATERIAL (CA)							
MH3	PROTEOMICS CENTER (CA)	1356						

030 0603002A MEDICAL ADVANCED TECHNOLOGY
266

MH4	RAPID BIO-PATHOGEN DETECTION TECHNOLOGY (CA)	968	3975					
MH6	RUGGED TEXTILE ELECTRONIC GARMENTS (CA)							
MH7	STUDY OF HUMAN OPERATOR PERFORMANCE (CA)							
MH9	ADVANCE OF NON-INVASIVE GLUCOSE MONITORING (CA)	1405	795					
MI3	ADVANCES IN BREAST CANCER CARE THERAPY (CA)							
MI4	ALLIANCE FOR NANOHEALTH (CA)	1066	3975					
MI5	BEHAVIORAL GENOMICS SLEEP APNEA RESEARCH (CA)							
MI8	FULL-FEATURED PATIENT MONITOR WITH DEFIBRILLATOR							
MJ1	EXTRA CORPOREAL MEMBRANE OXYGENATION AT TRIPLER	1549						
MJ2	FIBRINOGEN BANDAGES FOR BATTLEFIELD WOUNDS (CA)	1743						
MJ3	FORT DETRICK TECHNOLOGY TRANSFER INITIATIVE (CA)	1453						
MJ4	HANDS FREE ELECTRONIC HEALTH RECORD (CA)							
MJ7	LIGHT-BASED SELF TREATMENT FOR PFB (CA)							
MK1	MEDICAL M&S THROUGH SYNTHETIC DIGITAL GENES (CA)	1066	1589					
MK2	METROPLEX COMPREHENSIVE MEDICAL IMAGING RESEARCH							
MK6	ORPHAN DISEASE DRUG DISCOVERY							

	PROGRAM (CA)							
MK7	PEDIATRIC BRAIN TUMOR & NEUROLOGICAL DISEASE PRGM	1161	1589					
MK8	PLASMA STERILIZER (CA)	958						
ML2	SEAmed ORAL HEALTH PROJECT (CA)							
ML3	SOLDIER-MOUNTED EYE-TRACKING & CONTROL SYSTEM (CA)	1598						
ML5	SURGICAL WOUND DISINFECTION & BIO AGENT DECON PROJ	968	1589					
ML6	Tripler Army Medical Ctr eICU Remote Critical Care							
ML7	UNIVERSAL MEDICAL AND SURGICAL PRODUCT CATALOG(CA)	2227						
MM1	WEIGHT MEASUREMENTS & STANDARDS FOR MIL PERSONNEL	968						
MM2	MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)	127168	160101					

A. Mission Description and Budget Item Justification: This program element (PE) supports development of advanced medical technologies to sustain a force of healthy, medically protected warfighters. The primary goal is to mature medical technology (drugs, vaccines, and devices) to effectively protect and improve the survivability of U.S. Forces across the entire spectrum of military operations. Efforts are focused in three principal medical areas: Militarily Relevant Infectious Diseases, Combat Casualty Care, and Military Operational Medicine. Activities funded in this PE are externally peer reviewed and, to prevent unnecessary duplication, fully coordinated with 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 U.S. Food and Drug Administration (FDA) as part of their process for approving new medical products for use in humans. The FDA requires medical products undergo extensive testing in animals and/or other models (pre-clinical) before they can be tested in human subjects (clinical). Clinical trials are conducted in three phases (Phase 1, 2, and 3) to prove the safety and effectiveness of a drug, vaccine, or device for the targeted disease or medical condition. Each successive test includes larger numbers of human subjects and requires FDA approval prior to proceeding with the next test. Work conducted in this PE primarily focuses on advanced technology maturation activities required to obtain FDA approval to initiate Phase 2 clinical trials, although some high risk technologies may require additional maturation and FDA approval to initiate Phase 3 clinical trials prior to transition into a formal acquisition program. Activities in the PE may include completion of pre-clinical animal studies, as well as studies involving human volunteers.

030 0603002A MEDICAL ADVANCED TECHNOLOGY
266

Military Relevant Infectious Disease efforts mature and demonstrate medical countermeasures against naturally occurring diseases of military importance as identified by worldwide medical surveillance and military threat analysis. Example countermeasures include: vaccines, prophylactic interventions, diagnostics, therapeutic drugs, and methods for controlling disease-carrying insects. Countermeasures are developed against parasitic diseases (e.g., malaria and leishmania), and bacterial (e.g., diarrheal diseases and scrub typhus) and viral threats (e.g. hantaviruses and dengue).

Combat Casualty Care efforts mature and demonstrate methods and technologies that improve medical treatment outcomes for battlefield injuries. These technologies include: drugs, fluids, devices, and diagnostics for resuscitation, treatment of injuries, and life support. Example medical devices and products include blood clotting drugs, freeze-dried plasma, neuroprotective drugs (protection against brain impairment), and operator assisted and automated critical care systems to provide life support functions (resuscitation, and oxygen and fluid administration). Additionally, research efforts into treatments for face and neck injuries developed in PE 62787 are tested and validated.

Military Operational Medicine (MOM) efforts mature and demonstrate biomedical solutions that protect Soldiers and enhance their performance in the face of multiple stressors in operational and training environments. Example products include biomedically-validated design criteria for body armor and helmets, injury models, and physiological algorithms, and factors for monitoring the effects of high altitude, extreme temperatures, hydration, fatigue, isolation, and sleep deprivation on Soldier health and performance. MOM efforts also addresses lessons-learned from research and treatment of deployment-related illnesses to gain a better understanding of the health threats in military deployments.

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 armor design, and improved rations for soldiers. Work funded in this project is fully coordinated with efforts undertaken in PE 0602787A. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by Walter Reed Army Institute of Research, Silver Spring, MD; US Army Medical Institute of Chemical Defense, Aberdeen Proving Ground, MD; US Army Medical 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 and US Army Medical Detachment Brooks, San Antonio, TX.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	299017	53274	54863
Current BES/President's Budget (FY 2009)	291716	299676	59043
Total Adjustments	-7301	246402	4180
Congressional Program Reductions		-1908	
Congressional Rescissions			
Congressional Increases		248310	
Reprogrammings	1011		
SBIR/STTR Transfer	-8312		
Adjustments to Budget Years			-320

Software limitations preclude listing the One hundred two FY08 congressional adds totaling $248310 that were added to this PE. To see the list of congressional adds for this PE, please refer to the Conference Report on Defense Appropriations for Fiscal Year 2008, House Report 110-434, pages 260 to 263.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**800**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
800 TELEMEDICINE TESTBED	3700	5390	4092	3966	4051	4142	4234

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. The goal is to improve warfighter health, survivability, and performance while reducing the requirement for deployed medical professionals. Major efforts include collaborative tools for mission planning and rehearsal that enable deployment of optimally tailored medical support for a deployed force; medical modeling and simulation; 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/materials), and enabling technologies for reducing these risks. 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the U.S. Army Center for Environmental Health Research (USACEHR), Fort Detrick, Maryland, and the Walter Reed Army Institute of Research (WRAIR), Silver Spring, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Sleep Research/Environmental Monitoring: In FY07, integrated mature components (the electric cell-substrate impedance sensor and the Abraxis enzyme test kit) into the Environmental Sentinel Biomonitor and conducted field tests. Conducted studies to validate the Fatigue Intervention Recovery Model to predict military performance (i.e., tactical vigilance, situational awareness, and marksmanship). In FY08, conduct clinical studies in the laboratory 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, will conduct expanded (FDA) safety/initial efficacy study in humans through field studies to validate the efficacy of cognitive enhancers as a fatigue countermeasure in an operational environment. Demonstrate validity of near real-time SPARNET-enabled (Spartan Sensor Network) network to improve situational awareness of soldiers during training) model predictions of hydration requirements and heat strain using physiological and weather data. Will demonstrate value of network-enabled predictive biomedical modeling in training mission planning and real-time mission support.	3700	5239	4092
Small Business Innovative Research/Small Business Technology Transfer Programs		151	
Total	3700	5390	4092

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**810**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
810 IND BASE ID VACC&DRUG	19757	21233	22093	20597	20528	21031	21426

A. Mission Description and Budget Item Justification: This project matures and demonstrates medical countermeasures to naturally occurring infectious diseases that can adversely affect the Future Force. Infectious diseases are a major threat to U.S. military forces. Program focus is on prevention, diagnosis, and treatment of diseases that can seriously hamper military mobilization, deployment, and effectiveness. Infectious diseases that have had a significant impact on Soldier health include malaria and leishmaniasis (classified as parasitic diseases), bacterial diseases that cause diarrhea (e.g., Shigella, enterotoxigenic Escherichia coli, and Campylobacter), and viral diseases such as dengue fever. Additional disease threats to deployed and mobilizing forces include meningitis, viral encephalitis, and viruses that cause internal bleeding and kidney failure. Promising medical countermeasures, identified through applied research conducted under program element 0602787A, project 870, are further matured under this project. Example countermeasures include vaccines and drugs to protect against malaria, diarrhea, dengue fever, meningitis, and hemorrhagic fever; insect control measures; and diagnostic devices. Advanced techniques and prototype devices for rapid battlefield identification and diagnosis of infectious diseases are tested and refined. Work is conducted in compliance with U.S. Food and Drug Administration (FDA) regulations for medical products that are intended for human use. FDA requirements include producing drug and vaccine pilot production lots (between 1,000 and 10,000 doses) using Good Manufacturing Practice together with nonclinical studies of these products to support New Drug Applications and demonstrate their safety and effectiveness in humans under FDA Investigational New Drug rules. Work is managed by the U.S. Army Medical Research and Materiel Command. The Army is the Executive Agent for infectious disease research within the Department of Defense and is responsible for programming and funding all research on joint and service-specific requirements thereby precluding duplication of effort within the Military Departments. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Walter Reed Army Institute of Research, Silver Spring, Maryland, and its overseas laboratories; the U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland; and the Naval Medical Research Center, Silver Spring, Maryland, and its overseas laboratories.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Drugs to Prevent/Treat Parasitic Diseases: Conduct FDA-required, nonclinical (laboratory-based) testing, select promising malaria and leishmaniasis drug candidates for testing in human subjects, and prepare data package required for FDA approval to proceed with testing in humans. Studies have shown that the malaria parasite can become resistant to treatment with existing drugs, which makes it necessary to continually research new and more effective treatments. In FY07, completed human testing of artesunate (a new and more effective malaria treatment drug), prepared data package for an FDA New Drug Application, and received approval for compassionate use (available through Centers for Disease Control and Prevention); and completed assessment of existing leishmaniasis drugs for possible development. In FY08, conduct human subject safety trials (30 volunteers, 8-month trial) of one antimalarial drug and assess two existing drugs for effectiveness in treating leishmaniasis. In FY09, will continue nonclinical and clinical testing between two candidates to down select current drug as potential new leishmaniasis treatment.	3287	3704	3828
Vaccines for Prevention of Malaria: Conduct FDA-required, nonclinical (laboratory-based) testing of candidate vaccines, prepare data package required for FDA approval to proceed with further testing, and test promising malaria vaccine candidates in human subjects. A malaria vaccine against the severe falciparum form of malaria and the relapsing vivax form could reduce the need for antimalarial drugs and address the continuing problems with parasite drug resistance and compliance issues with taking antimalarial drugs. In FY07,	5194	4925	4428

continued ongoing safety and effectiveness clinical trials, conducted large-scale testing of one of the malaria vaccine candidates (400 African volunteers over 18 months), and continued to work with industry on a multicomponent vaccine for advanced human subject trials and FDA licensing of a malaria vaccine. In FY08, finalize a multicomponent candidate malaria vaccine for larger scale testing in human subjects if candidate components prove safe and effective in clinical trials. Initiate preclinical testing of a new vivax malaria vaccine. In FY09, will continue refinement of the final formulation of the falciparum malaria vaccine and continue ongoing clinical trials to demonstrate effectiveness of candidate vaccines. Vaccines found effective and safe will transition into advanced development.			
Bacterial Threats Vaccine Program: Conduct FDA-required, nonclinical (laboratory-based) testing of candidate vaccines, select promising candidate vaccines against each of the three bacterial causes of diarrhea (significant threat during initial deployments) and meningococcal vaccine candidates (a threat during deployment, training, and for military families) for testing in human subjects, and prepare data package required for FDA approval to proceed with further testing. In FY07, continued testing of candidate diarrheal vaccines and manufactured pilot lot of an improved third diarrheal vaccine for a safety trial using human subjects. Completed initial clinical testing of meningitis vaccine started in FY06. In FY08, continue with ongoing human subject testing of candidate vaccines by conducting extended clinical trials (100 volunteers, 12-month trial), including a second-generation oral dysentery vaccine if the current candidate fails in testing. Initiate clinical trials (20-40 volunteers, 6-12 month trial) of two additional diarrheal vaccines. In FY09, will continue larger scale human subject testing for effectiveness of diarrheal vaccine candidates (200 subjects, 12-month trial) and will initiate further human subject testing (20-40 volunteers, 6-12 month trial) of a genetically modified meningitis vaccine.	5070	6506	7327
Viral Threats Vaccine Program: Select most promising vaccine candidates for testing in human subjects against dengue hemorrhagic fever (an increasing threat worldwide) and hantavirus (severe viral infection that causes internal bleeding). Conduct FDA-required, nonclinical testing (laboratory-based) and disease models of candidate vaccines and conduct clinical testing of vaccines. In FY07, continued testing of the dengue DNA vaccine, manufactured pilot lots of second-generation dengue vaccines, and initiate human safety trial (40 volunteers), completed animal testing and studies with second hantavirus vaccine against a second major Hemorrhagic Fever with Renal Syndrome (HFRS) subtype (Puumala virus), manufactured clinical lot of broad-spectrum HFRS vaccine (a combined Puumala/Hantaan virus vaccine) for testing in human subjects. In FY08, continue ongoing human subject testing of multiple hemorrhagic virus vaccines including testing of broad-spectrum hantavirus (200 subjects, 18_month trial) and dengue vaccines (70 subjects, 6-month trial). In FY09, will continue with long-term human subject testing of hemorrhagic virus vaccines if study results support their continuation and will down select to most effective and safe dengue vaccine candidates based on larger scale studies (120 volunteers).	3962	3901	4035
Insect Vector Control and Infectious Disease Diagnostics Programs: Conduct field and human subject testing of field medical diagnostic devices and insect control measures. In FY07, conducted additional field and clinical testing of medical diagnostic devices and insect control measures, including comprehensive field testing of sand fly control measures, conducted FDA-required testing of medical diagnostic systems reaching maturity with focus on commercializing systems, and completed initial human subject testing of Leishmania diagnostic systems for transfer to commercial partner. In FY08, continue 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, and conduct 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 ulcer caused by the parasite) and an FDA-approved diagnostic test for latent infection (without signs of clinical disease) with Leishmania parasites. In FY09, will transition selected components of sand fly control tools, such as screening assays and bednets; will continue to conduct field testing and clinical testing of medical infectious disease diagnostic devices; will transition a clinical diagnostic test for Leishmania infection; and will continue to refine and test dengue diagnostic device and insect vector control items in collaboration with commercial partners.	2244	1692	2475
Small Business Innovative Research/Small Business Technology Transfer Programs		505	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**819**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
819 FLD MED PROT/HUM PERF	1124	1194	1257	1226	1258	1286	1315

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 identifying stressors and validating methods for assessing risk to the Soldier due to both physical and operational stressors. Effort mature and demonstrate methodologies and tools associated with biomechanical-based health risks, injury assessment/prediction, Soldier survivability, and performance during continuous operations. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Physical Performance Enhancement: In FY07, validated the effectiveness of measuring bone and muscle metabolism as a noninvasive injury prediction tool for monitoring the course of musculoskeletal adaptation to strenuous training. In FY08, validate a method to evaluate pre- and post-deployment physical status (i.e., body composition, performance, and muscle strength). In FY09, will validate an integrated longitudinal model for predicting individual Soldier and unit musculoskeletal injury and adverse physical performance outcomes.	1124	1160	1257
Small Business Innovative Research/Small Business Technology Transfer Programs		34	
Total	1124	1194	1257

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**840**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
840 COMBAT INJURY MGMT	21074	23127	29530	29465	29646	30208	30785

A. Mission Description and Budget Item Justification: This project matures, demonstrates, and validates new medical technologies and methods to improve survivability and ensure better medical treatment outcomes for warfighters wounded in combat and military operations other than war. Major efforts include hemorrhage control (novel bandages and techniques), resuscitation (fluid replacement and oxygen delivery), prognostics and diagnostics (predictive indicators, decision aids, and devices for triage), and life support (computerized monitors and autonomous patient care devices). Additionally, efforts include combat trauma therapies (novel treatments to minimize tissue damage and accelerate restoration of function) and development of realistic trauma simulators for training of medical personnel. Included are new candidate intravenous clotting drugs, advanced technologies for regrowth of tissue and repair of extremity injuries, freeze-dried plasma to treat hemorrhage, neuroprotective drugs to minimize consequences of head injury, preventive dental care technologies to fight dental disease, and other capabilities to guide and assist the combat medic in the care of the wounded on the battlefield and during evacuation. Work is conducted in compliance with U.S. Food and Drug Administration (FDA) requirements. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the U.S. Army Institute of Surgical Research, Fort Sam Houston, Texas; the U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts; and the Walter Reed Army Institute of Research, Silver Spring, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Hemorrhage Control, Blood, and Resuscitative Fluids: Includes work required to validate safety and effectiveness of drugs and medical procedures to prevent or minimize secondary organ failure (including brain and spinal cord injury) after major trauma. In FY07, conducted animal testing, which determined limitations of activated Factor VII (injectable clotting factor) and freeze-dried plasma to control internal bleeding; conducted human clinical studies to verify safety and effectiveness of freeze-dried plasma and platelet-derived hemostatic agent (PDHA) (a blood-clotting product derived from blood cells); demonstrated that complement inhibitors (CI) reduce swelling and organ failure in a large animal model; conducted multiple animal studies using various blood components to compare the effectiveness of whole blood as a resuscitation fluid; and validated new regimens for treatment of shock. In FY08, continue 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; continue PDHA clinical studies to determine potential to increase survival; determine best transfusion and storage practices for blood products; and begin safety and effectiveness clinical trial of CI in trauma patients with severe hemorrhage. In FY09, will continue to evaluate combinations of products and treatment strategies to best control all forms of bleeding and will publish guidelines for implementation of these strategies; analyze PDHA human clinical trial data; and continue safety and effectiveness human clinical trials of CI therapy in trauma patients.	12945	13198	9600
Combat Trauma Therapies: Includes work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from battlefield injuries. In FY07, began an expanded human safety and efficacy study for an experimental neuroprotectant drug (NNZ2566) as a treatment for acute silent seizures resulting from a brain injury and continued evaluation of biomarkers in the brain that may indicate brain trauma. In FY08, conduct expanded (FDA) safety/efficacy/dosing studies of neuroprotectant drugs in humans, complete clinical validation of brain trauma biomarkers, and identify potential, mature tissue	3200	3666	11236

regeneration methods through the Armed Forces Institute of Regenerative Medicine (AFIRM). In FY09, will conduct initial (FDA) safety studies in humans of second-generation neuroprotectants and a prototype diagnostic device for brain trauma, which integrates validated brain trauma biomarkers and standard physiological parameters (i.e., blood oxygen, chemistry, and pH). (Brain trauma research is coordinated with related efforts under the Military Operational Medicine Research Program in PE 0602787A, Project 878.) Will also begin extensive, multicenter, clinical validation of the most promising tissue regeneration treatment regimens through the AFIRM.			
Far-Forward Medical Systems: Includes diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation, stabilization, life support, and dental care. In FY07, refined usage parameters for a special breathing valve that military medical personnel use at all locations on the battlefield as a noninvasive treatment of shock, completed clinical evaluation of the computer-assisted resuscitation algorithm in operating room situations; and completed activities required to transition the first-generation warfighter physiological status monitor to Program Executive Office Soldier. In FY08, complete clinical testing of the automated ventilation algorithm for operating room and intensive care settings and begin initial, FDA-approved safety study in humans for an antimicrobial, antiplaque chewing gum. In FY09, will begin an (FDA) safety study in humans of oxygen, ventilation, and fluid resuscitation algorithms integrated into either the Army's integrated litter or the Navy's lightweight trauma module for casualty transport; will complete clinical trials and data analyses required to transition antimicrobial, antiplaque chewing gum to advanced development; and will complete prototype development and data analysis of a diagnostic device that will provide the field medic enhanced decision support capability for casualty treatment far forward on the battlefield.	3839	5076	7849
Combat Casualty Bioinformatics and Simulation: Includes testing and validation of a data management system to capture and analyze time series data, such as heart and respiration rates, and testing and validation of durable and realistic casualty simulators for initial and reinforcement training of medical care providers. In FY07, finalized prototype by incorporating results from tests run by the Research, Development, and Engineering Command in medic training classes at the U.S. Army Medical Department Center and School. In FY08, complete revisions of algorithms intended to enhance recovery of usable physiological data and validate use of high-frequency features of electrophysiological signals (electrical measurements of body function) to predict the need for a lifesaving intervention (LSI). In FY09, will complete development and test validity of an algorithm that incorporates low- and high-frequency signals to provide an automated decision assist tool that identifies the requirement for a specific LSI.	1090	542	845
Small Business Innovative Research/Small Business Technology Transfer Programs		645	
Total	21074	23127	29530

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603002A - MEDICAL ADVANCED TECHNOLOGY**	**FH4**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
FH4	FORCE HEALTH PROTECTION - ADV TECH DEV	1898	1987	2071	1995	2035	2081	2127

A. Mission Description and Budget Item Justification: This project funds efforts that mature, validate, and support enhanced force health protection of Soldiers against threats in military deployments. Health-monitoring tools are matured to rapidly identify deployment stressors that also affect 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. This effort builds on knowledge from a decade of research on Gulf War Illnesses (GWI) and other chronic multi-symptom illnesses that have suspected neurotoxin (toxin that destroys/damages the nerve cells) and neuropsychological origins. 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 working on Army projects. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts, and the Naval Health Research Center, San Diego, California.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Health Research: In FY07, conducted major data collection for the Millennium Cohort Study (a longitudinal effort designed to monitor and protect Soldiers from chronic multi-symptom illnesses) by initiating enrollment of the third cohort, which consisted of more than 30,000 Service members to further validate and track important health effects of deployment and other military exposures over time. In FY08, complete enrollment for Millennium Cohort Study and conduct analyses on data validity, reliability, as well as mental and functional health outcomes. In FY09, will 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.	1898	1931	2071
Small Business Innovative Research/Small Business Technology Transfer Programs		56	
Total	1898	1987	2071

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	93880	98899	57277	69597	66132	77532	82521
313	ADV ROTARYWING VEH TECH	30274	42205	45949	56040	51530	56914	59132
435	AIRCRAFT WEAPONS	1853	2889	2688	3723	2659		
436	ROTARYWING MEP INTEG	2637				1743	10190	12727
447	ACFT DEMO ENGINES	8051	8453	8640	9834	10200	10428	10662
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	44618	41376					
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	3147	3976					
BA9	PIAC VECTORED THRUST HELICOPTER	3300						

A. Mission Description and Budget Item Justification: The Aviation Advanced Technology Development program element (PE) matures and demonstrates manned and unmanned rotary wing vehicle (RWV) technologies and systems in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Within this PE, aviation technologies are matured and integrated into realistic and robust demonstrations. Work includes maturing manned and unmanned teaming in combat and combat support operations for attack, reconnaissance, air assault, and command and control missions. Integrated unmanned operations are advanced through autonomous collaboration and maturation of advanced unmanned technologies such as components and subsystems that enable increased system survivability and crew protection, platform lift, maneuverability, agility and endurance, autonomous flight, common mission equipment architecture, team-based intelligent mission operations, manned / unmanned battle space integration, and/or improved operational availability and reduced maintenance are matured and demonstrated. Major efforts within this PE include component maturation and flight demonstrations; manned-unmanned system teaming demonstrations; operation and support cost reduction applications; joint concept exploration including multi-role rotorcraft and integrated full-spectrum aircraft survivability. This PE also supports the maturation and demonstration of major aviation subsystems in propulsion, drive-trains, aeromechanics and flight controls for future force manned and unmanned aviation systems in accordance with the Army Aviation Transformation Plan. This PE also matures manned and unmanned rotorcraft sensor and weaponization technologies for air-to-air and air-to-ground application. Projects BA7 and BA8 fund congressional interest items. Department of Defense (DoD) systems such as the US Army AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook, Armed Reconnaissance Helicopter, Light Utility Helicopter; the US Navy SH-60 Seahawk; and the US Marine Corps V-22 Osprey, AH-1 Cobra, and CH-53 Super Stallion benefit and are supported directly or indirectly by this PE. Related applied research is conducted under PE 0602211A (Aviation Technology). Aircraft survivability efforts in this PE are coordinated with 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). This PE does not duplicate any efforts within the Military Departments. The Army is the executive agent for the maturation of rotorcraft science and technology on behalf of all Service needs. 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 with facilities located at Redstone Arsenal, AL; Fort Eustis, VA; and Moffett Field, CA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	96575	53890	57615
Current BES/President's Budget (FY 2009)	93880	98899	57277
Total Adjustments	-2695	45009	-338
Congressional Program Reductions		-631	
Congressional Rescissions			
Congressional Increases		45640	
Reprogrammings	-103		
SBIR/STTR Transfer	-2592		
Adjustments to Budget Years			-338

Eighteen FY08 congressional adds totaling $45640 were added to this PE.

($800) Power Dense Rotorcraft Transmission
($1200) Night Vision Goggle Compatible Electrostatically Conductive Windscreen Laminates for use on Acrylic/polycarbonate Windscreens on Helicopters
($1600) Enhanced Rapid Tactical Integration and Fielding of Systems
($1600) Helmet Mounted Display/Visor Projection for Army Helicopters
($1600) Quick-MEDS Automated Release Pod
($2000) UAV Resupply (BURRO)
($2240) Alternate Payload Bomb Live Unit Munition
($2400) Autonomous Cargo Acquisition for Rotorcraft Unmanned Aerial Vehicles
($2400) Drive System Composite Structural Component Risk - Reduction Program
($2400) Excalibur
($2400) Fuel Cells for Mobile Robotic Systems Project
($2400) Improved VAROC/UAV Compression System Development
($3000) Universal Control Full Authority Digital Engine Control
($3600) Parts-on-Demand for CONUS Operations
($4000) Inter Turbine Burner for Turbo Shaft Engines
($4000) Joint Technical Data Integration-Wide Intelligent Content Enhancements
($4000) Technologies for Military Equipment Replenishment
($4000) Vectored Thrust Ducted Propeller Compound Helo

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**313**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
313 ADV ROTARYWING VEH TECH	30274	42205	45949	56040	51530	56914	59132

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and demonstrates rotary wing manned and unmanned platform technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The Army Aviation Transformation Plan requires rotorcraft systems that have significantly increased / improved lift, range, survivability, and mission capability with an overall reduction in logistics and cost of operation. The critical technologies to support these capabilities are matured through the demonstration of key subsystems such as rotors, active controls, structures, drive-train, integrated threat protection technologies, as well as prototype Unmanned Aerial Systems (UAS). The integration of technology into UAS and manned teaming operations involves the merging of a common operating architecture and incorporates team survivability. The Enhanced Rotorcraft Drive System program provides a 40 percent increase in power-to-weight ratio, 30 percent reduction in both production and Operating and Support (O&S) costs and a 15 decibel (dB) reduction in noise for the drive-systems of both manned and unmanned rotorcraft. These technologies are a significant contributor to Future Force capability and enable a 40 percent increase in payload for the AH-64 Apache, a 20 percent increase in range for the UH-60 Black Hawk, and over a 25 percent increase in range for the CH-47 Chinook over their respective baselines. The Rotorcraft Survivability program reduces Infra-Red (IR) signatures by up to 50 percent, incorporates innovative directional IR jamming, hostile fire warning sensors to detect small arms and Rocket Propelled Grenades (RPG), threat location cueing and eye-safe visual dazzler components to improve aircraft survivability by at least 50 percent against small arms, RPG and Man-Portable Air Defense Systems (MANPADS) threats. The Intelligent Decision-aiding for Aircraft Survivability (IDAS) program integrates an eye-safe visual laser jammer and laser obstacle avoidance capability into a low cost, lightweight laser missile jammer to reduce system cost by 50 percent and system weight by 50 percent. IDAS also integrates an in-cockpit Survivability Planner function which provides enhanced situational awareness/understanding of the tactical threat situation to the manned-unmanned team and develops and displays recommended courses of action. This project also supported the Concept Exploration of a Joint Heavy Lift rotorcraft platform. This effort assesses the technologies and system design trades to enable vertical mounted maneuver and Naval sea-basing. The Capability-Based Operations and Support Technologies (COST) program improves operational availability and reduces maintenance time by providing 50 percent reduction in inspections per flight hour, 12 percent reduction in maintenance labor, and 15% increase in component time on wing by 2013 for critical mechanical/electrical components and providing prognostic capability for long lead-time airframe and propulsion components, resulting in timely delivery of flight-critical parts. 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 located at Fort Eustis, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
UAS Technology Demonstration: In FY07, flew the A-160 Hummingbird-based UAS testbed with turboshaft engine installed. Evaluated the aircraft in a ground testing environment by performing ground runs for 250 hours to increase operational hours and experience in order to mitigate risk during flight operations. Conducted approximately 35 hours of flight tests to step towards program performance goals of range, endurance (18-20 hours), hover-out-of-ground-effect altitude (15,000 feet) and speed (140 knots). Have demonstrated 12 hours endurance (with 500 lbs. of payload) and program goals of 140 knots and 1000 lbs. payload for 1000 kilometers. Flew at gross weights up to nearly 5000 lbs.	14407		
Robotics Collaboration: In FY07, completed system integration and trial runs for the Unmanned Autonomous Collaborative Operations	2760		

final demonstrations that included three RMAX UAS and two UGVs. Concluded program with final demonstration of Air-Ground Cooperative Engagement using Soldiers commanding this unmanned team from a High Mobility Multipurpose Wheeled Vehicle (HMMWV) mounted Control Unit or alternately a hand-held display device at the McKenna MOUT Range at Ft. Benning, GA. Work on this effort is also being accomplished under PE 0602716A, project H70; PE 0602211A, project 47A; PE 0603005A, project 497; and PE 0603005A, project 515.			
Rotorcraft Survivability: In FY07, continued the maturation of aircraft IR signature technologies, inclusive of engine exhaust suppression, and tailored IR coating systems. Conducted multiple risk reduction flight tests to refine hostile fire indication (HFI) algorithm false alarm rejection characteristics. Refined subsystem integration activities and executed initial simulation lab checkout of the integrated subsystem and system level communication and control. Integrated the eye-safe visual disruption laser into the visual targeting disruption system. Initiated fabrication of aircraft installation hardware required for the UH-60 Black Hawk installation. In FY08, integrate a suite of candidate survivability technologies on a Black Hawk helicopter and perform flight tests to quantify the increase in threat detection range as well as the reduction in the threats' lock-on range and targeting accuracy. Develop a fully-integrated team-based aircraft self-protection suite for defeating current MANPADS threats, small arms and rocket propelled grenades, anti-tank guided missiles, and radar threats, utilizing multi-function threat detection and threat countermeasures for reduced system weight and cost. In FY09, will begin integration of cognitive decision aiding technologies (developed earlier under the Survivability Planner Associate Rerouter/Manned-Unmanned Rotorcraft Enhanced Survivability effort) into a demonstrator aircraft. Work on this effort is also being accomplished under PE 0602270A, project 442 and PE 0603270A, project K16.	7684	8777	7234
Enhanced Rotorcraft Drive System (ERDS): In FY07, completed design and analysis for the composite gearbox housing; completed analytical tools for helical face-gear manufacturing and profile/mesh development; started surface durability testing of advanced gear materials in helical face-gear configuration; fabricated support system components for the demonstrator transmission; generated failure mode analysis and diagnostic algorithms for face-gear applications; and conducted detailed design and fabrication of tooling for integral composite coupling/shaft. In FY08, begin fabrication of the helical face gears, gears for the enhanced power density tail rotor gearbox, and composite shafts. Conduct demonstration testing of the composite gearbox housing. In FY09, will complete fabrication of components; will conduct endurance testing of the helical face gear design; will perform demonstration tests of the composite shaft/coupling, composite main rotor drive shaft, and tail rotor enhanced power density gears. Will validate diagnostic algorithms as part of the demonstration tests.	2358	4119	5000
Joint Heavy Lift (JHL): In FY07, completed the final Concept Refinement Design Review; completed Concept Design and Analysis including an Independent Government performance and risk assessment; completed a preliminary Joint Concept Analysis of Alternatives; and developed a draft Capabilities Development Document.	3065		
High Altitude Long Endurance (HALE) Platforms: In FY08, conduct first flight and begin expansion of envelope to demonstrate endurance, durability, maintainability, and structural life. Evaluate manning schemes to determine optimum ground personnel support requirements. In FY09, will refine flight characteristics and demonstrate air vehicle endurance, foot-print and turn time (time to prepare vehicle for next mission). Will demonstrate payload performance and data assimilation and storage. Will validate military utility of air vehicle in concert with ground control station and military operators. Work on this effort is done in coordination with PE's 1160401BB; 1160428BB; 0604857F; 0603160BR; and 0207434F during execution of the Global Observer Joint Capability Technology Demonstration.		5000	7500
Rotor Design and Capabilities: In FY08, mature and demonstrate passive and active control methods for improving rotorcraft performance in a heavy vibration environment. Determine benefit, design implications and limitations of the Optimum Speed Rotor technology when applied to rotorcraft of different classes and mission types. Evaluate high lift technologies that provide rotor systems		16595	18108

with improved aero performance, while enhancing damage tolerance. Characterize advanced main rotor hub concepts compatible with on-blade rotor control systems leading to increased rotorcraft performance. Evaluate applicability of candidate technologies to current airframes. In FY09, will characterize rotor system performance across the flight envelope, under a wide variety of flight conditions and mission types through rigorous flight testing. Will optimize the design of lightweight active rotor technology intended to improved aerodynamic efficiencies and maximize air vehicle performance. Will demonstrate enhanced rotor durability and performance technologies to assess contribution to aircraft maintenance and performance. Will mature leading concepts in passive and active technology arena to provide enhanced aerodynamic performance with optimized active and passive technology implementation.			
Capability-Based Operations and Sustainment Technologies (COST): In FY08, expand 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 remaining life of components and scheduling of maintenance; and enable the modification of the engine control laws to optimize engine performance. Refine state-awareness algorithms for aircraft parameters such as Center of Gravity (CG) to enable accurate usage monitoring, thus preventing early retirement of components (as current component life is determined by an assumed worse-case application of CG and operating weight). Integrate rotor/swash-plate bearing, pitch rods, flight controls, and hanger bearing algorithms into a health monitoring system. Develop and validate diagnostic/prognostic algorithms for electrical subsystems to detect health and degradation rates of generators, power converters and batteries resulting in proactive maintenance and reduced mission aborts. In FY09, will validate and refine engine software algorithms by testing a engine in a controlled, instrumented test cell. Will perform full-scale rig testing of rotor head, flight controls, and bearings to verify/validate the newly developed algorithms. Will initiate regression testing of software (which is when, during a bench test, the algorithms' functionality and interoperability with other software and sensor inputs is evaluated using simulated flight test data) in preparation for system integration and flight testing. Will perform full-scale testing of electrical system algorithms using aircraft components. Will begin testing of corrosion monitoring sensors and algorithms, reducing time intensive inspections. Will demonstrate prognostication of remaining service life in damage tolerant airframe components.		6600	8107
Small Business Innovative Research/Small Business Technology Transfer Programs		1114	
Total	30274	42205	45949

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**435**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
435 AIRCRAFT WEAPONS	1853	2889	2688	3723	2659		

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures and integrates manned and unmanned rotorcraft sensor and weaponization technologies for Future Force air-to-air and air-to-ground application and, where feasible, exploits opportunities to enhance Current Force capabilities. This project provides mature technologies to focus combat power on multiple targets. The technologies provide precision engagement capabilities to meet the demands of Military Operations in Urban Terrain (MOUT), force protection, and other asymmetrical threats. This project includes integration of advanced missiles, rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities onto existing and developing airframes. These capabilities are evaluated to ensure compatibility and demonstrate timely, precision engagement capabilities and the full spectrum effectiveness of the manned and unmanned team. Technology integration issues concerning on-board systems, vehicle flight characteristics and weapon systems will be matured and demonstrated. 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 located at Fort Eustis, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Aviation Multi-Platform Munition: In FY07, Aerial Delivery of Effects from Lightweight Aircraft (ADELA) demonstrated the integration of low cost sensors and weapons (0.338 cal rifle) on a Class III Unmanned Aerial System (UAS) to provide a precision engagement capability. ADELA concluded with a demonstration of tactical fire control, human-in-the-loop protocols and collaborative, team-based weapons and precision targeting to show how small UAS can provide an airborne sniper capability in support of ground troops in a Military Operations in Urban Terrain (MOUT) environment. In FY08, conduct a Concepts Based Analysis 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. Mature the requirements definition for a new, lightweight weapon system for both manned and unmanned aviation platforms. In FY09, will finalize requirements documentation for a lightweight weapons system. Will mature design of weapon system components to support platform integration efforts for both manned and unmanned aviation platforms. Will evaluate application of this weapon system to other than aviation platforms such as Unmanned Ground Systems.	1853	2822	2688
Small Business Innovative Research/Small Business Technology Transfer Programs		67	
Total	1853	2889	2688

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**447**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
447 ACFT DEMO ENGINES	8051	8453	8640	9834	10200	10428	10662

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures and demonstrates power system technologies for use in the Future Force through competitively performed design, fabrication, and test of advanced material technologies, engines, and integrated components, and, wherever feasible, exploits opportunities to enhance Current Force turbine engines. This project supports the Future Force by demonstrating mature technologies for lighter turbine engines that provide more power, can go farther, and are easier for the warfighter to maintain and sustain. These attributes improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The Small Heavy Fuel Engine (SHFE) and Advanced Affordable Turbine Engine (AATE) efforts are fully aligned with the goals of the Department of Defense (DoD) Versatile Affordable Advanced Turbine Engine (VAATE) program. VAATE goals focus on reducing specific fuel consumption (SFC) and increasing the power-to-weight (P/W) ratio of turboshaft engines while decreasing production and maintenance costs. SHFE and AATE provide significantly increased range and payload capabilities for future manned and unmanned rotorcraft and sustainment upgrades for current engines. This includes significant Operation and Support cost savings and a significantly reduced logistics footprint. The SHFE effort focuses on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower (HP) class engine and AATE addresses needs in the 3000 HP class. The SHFE provides significant improvements in SFC and P/W ratio that enable a heavy fuel (JP-8) engine capability for applications such as the UAS Testbed, Armed Reconnaissance Helicopter (ARH), AH/MH-6 Mission Enhanced Little Bird, and other future ground and aerial vehicles. The AATE effort enables enhanced operational capability that is applicable to UH-60 Black hawk and AH-64 Apache. 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 located at Fort Eustis, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
UAS Technology Demonstrations - Small Heavy Fuel (Turbine) Engine (SHFE): In FY07, completed engine and rig testing of optimized components consisting of a combustor, controls, and associated mechanical systems; completed the fabrication and installation of the final components into the complete engine build; and conducted final engine ground stand testing to demonstrate program goal achievement.	8051		
Advanced Affordable Turbine Engine (AATE) Tech: In FY08, complete preliminary design, detailed design, and component fabrication of the initial build of an advanced 3000 horsepower-class turboshaft engine demonstrator, building on knowledge gained in the Small Heavy Fuel Engine effort and the DOD Versatile Affordable Advanced Turbine engine effort. Design activity includes 2-D and 3-D mechanical and aerothermal efforts to evaluate the inlet particle separator, compressor, combustor, gas generator turbine, power turbine, bearings, seals, shafts, controls, and accessories. Fabrication efforts include component hardware and rig support hardware for initial component rig tests. In FY09, will complete initial rig-tests for several engine components (e.g. compressor, turbine, combustor, mechanical systems) to validate design aerodynamic performance and mechanical integrity prior to integrating these technologies into a gas generator for a full engine test. Will use results from initial component rig-tests to complete / refine hardware fabrication efforts as appropriate for first engine build. Will analyze component rig-test results to support redesign efforts as required for future engine builds.		8240	8640
Small Business Innovative Research/Small Business Technology Transfer Programs		213	
Total	8051	8453	8640

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	95165	85981	73697	76273	79563	79284	81047
232	ADVANCED MUNITIONS DEM	46612	31216	38084	39748	40132	34592	35234
43A	ADV WEAPONRY TECH DEMO	25469	28955					
L94	ELECTRIC GUN SYS DEMO	13038	9511	11578	11826	12976	17646	18160
L96	HIGH ENERGY LASER TECHNOLOGY DEMO	9056	15280	23009	23671	25427	25995	26579
L97	SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	990	1019	1026	1028	1028	1051	1074
L98	HIGH EXPLOSIVE AIRBURST AMMUNITION AND WEAPONS SYS							

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates advanced weapons and munitions technologies to increase battlefield lethality and survivability for the Future Force and, where possible, the Current Force. The goal of this program is to provide the warfighter with weapons and munitions that provide equivalent or greater lethality (or other desired effects) at greater ranges, with greater precision, in lighter weight systems and at affordable costs when compared to current weapon systems. Project 232 matures and demonstrates munitions enhancements and emerging technologies in lightweight structures, smart materials, acoustic/seismic sensors and in-flight update architectures that enable equivalent or greater lethality (or other desired effects) at greater ranges, with greater precision, in lighter weight systems and at affordable costs when compared to current weapon systems. Project 232 provides enhanced capabilities beyond the baseline line-of-sight/beyond-line-of-sight (LOS/BLOS) armament and munition suite and matures the Mid Range Munition (MRM) to add an objective dual-mode hardened seeker for autonomous and designated engagement modes. The Common Smart Submunition effort matures and demonstrates component technologies for a next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems. The Fuze and Power for Advanced Munitions effort integrates enabling fuze technologies such as Micro-Electro-Mechanical Systems (MEMS), proximity sensors, Electronic Safe and Arm Devices (ESADs) and hybrid power systems in end item munitions for demonstration purposes. The Non-Lethal Payloads for Personnel Suppression effort matures and demonstrates the munitions to suppress activity or deny access to designated areas using non-lethal means. The Multi-mode High Powered Microwave (HPM) and Laser Induced Plasma Channel (LIPC) Technology efforts are focused on improvised explosive devices (IEDs) and electronically controlled materiel threats. The Scalable Technology for Adaptive Response (STAR) effort demonstrates muniton and weapon concepts that can be gun or missile launched to deliver a broad spectrum of effects, while reducing collateral damage. The Military Operation in Urban Terrain (MOUT)/Urban Lethality Technologies effort demonstrates the next generation of explosive wall breaching and shoulder launched warhead technologies. The Soldier and Small Unit Lethality Integration provides a modular, configurable open architecture, net centric fire control, target hand-off and integrated effects decision support capability for dismounted Soldier/Leader. The Ground Based Munitions Technologies effort creates an integration approach allowing ground based munition delivery to a precise location once deployed from the primary delivery mechanism such as the multiple launch rocket system, unmanned aerial systems, fixed or rotary wing platforms, etc. The Lightweight Cannon Integration effort applies novel recoil attenuation techniques to large caliber weapons for future spirals of FCS weapon systems. Project 43A funds congressional special interest items. Project L94 matures subsystem technologies for an Electromagnetic (EM) Gun armament system demonstrations in FY08. Based on successful completion of the subcomponent technology, Project L94 will

initiate the design, fabrication, and test of an integrated EM armament system demonstrator. Project L96 matures and demonstrates technologies that comprise a high energy power, solid-state laser weapon. Project L97 matures and demonstrates smoke and obscurant technologies with potential to enhance personnel and platform survivability. Work in projects 232 and L94 is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), and PE 0602618A (Ballistics Technology). Work in project L96 is related to, and fully coordinated with, efforts in PE 0603005A, project 441 (Pulse Power for FCS) PE 0602307, project 042 (High Energy Laser Technology) and PE 62120, project 140. Work in this PE associated with project L97 is related to and fully coordinated with, efforts in PE 0602622A, project 552 (Smoke/Novel Obscurant Munitions). Work in this PE is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ, the Edgewood Chemical and Biological Center, Edgewood, MD, and the Space and Missile Defense Command (SMDC). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	92054	59389	74072
Current BES/President's Budget (FY 2009)	95165	85981	73697
Total Adjustments	3111	26592	-375
Congressional Program Reductions		-2548	
Congressional Rescissions			
Congressional Increases		29140	
Reprogrammings	5541		
SBIR/STTR Transfer	-2430		
Adjustments to Budget Years			-375

Fourteen FY08 congressional adds totaling $29140 were added to this PE.

($800) Lightweight Cannon Recoil Reduction
($1000) Common Smart Submunition (CSS)
($1000) Knowledge Driven Manufacturing System (KDMS)
($1000) Reactive Nanocomposite Materials
($1440) Development of Truck-deployed Explosive Containment Vessel
($1600) Advanced Tungsten Penetrators end Ballistic Materials
($1600) Disruptive Technology Acceleration
($1600) Integrated Aircraft Test Bed
($1600) RAMAN Chemical Identification System
($2400) Rapid Insertion of Developmental Technologies
($2500) Micro Electrical Mechanical Systems (MEMS) Application for Armor and Munitions
($3600) Nanotechnology Fuze-on-a-Chip
($4000) Lightweight Munitions and Surveillance System (LMSS) for Unmanned Air & Ground Vehicles
($5000) Rapid Prototyping for Special Projects

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**232**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
232 ADVANCED MUNITIONS DEM	46612	31216	38084	39748	40132	34592	35234

A. Mission Description and Budget Item Justification: This project matures and demonstrates munitions enhancements and emerging technologies in lightweight structures, smart materials, acoustic/seismic sensors and in-flight update architectures that enable equivalent or greater lethality (or other desired effects) at greater ranges, with greater precision, in lighter weight systems and at affordable costs when compared to current weapon systems. A major effort completed in FY07 was the MCS and Abrams Ammunition System Technologies (MAAST). MAAST supports the maturation and demonstration of hardened dual mode seeker technology for the Mid-Range Munition (MRM) (a gun-launched precision munition for the Mounted Combat System (MCS) capable of defeating high-value heavy armor and other targets out to 12km). The MAAST effort also matured technologies such as Low Cost Precision (LCP) components and subsystems for command-guided projectiles, which enhance the capabilities of the MCS and the M1A2 through spiral insertion and upgrades. Ongoing major efforts include the Common Smart Submunition (CSS), which pursues critical subsystem evaluations leading to system demonstrations of a submunition that offers increased operational efficiency through multiple kills per munition, affords greater flexibility for carrier applications, and enables use of a variety of delivery systems; Robotic and Network Technologies, which addresses various aspects of making armaments and munitions part of the networked battlespace; and warhead and fuze safe and arm development supporting the Kinetic Energy Active Protection System (KEAPS), which is developing munitions and countermeasures for Active Protection Systems (APS) to enhance survivability for lightly armored, or very lightweight vehicles. Other efforts in this project include: Fuze and Power for Advanced Munitions, which matures technologies that reduce munition sizes while adding tailorable effects to advanced munitions, and also improves advanced on-board munition power systems with increased power densities, increased mission time, improved temperature performance, and reduced volume and weight; Countermine/Surface Laid and Buried Mine Neutralization which matures and assess Laser Induced Plasma Channel (LIPC) technology to defeat surface laid and buried mines; and Extended Area Protection and Survivability, which demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery, and mortar rounds. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This work is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, 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. The APS countermunition efforts are developed and collaborated with the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
MAAST-MRM: In FY07, completed fabrication and assembly of integrated dual-mode MRM target acquisition, guidance, and counter active protection systems; demonstrated gun-fired multi-mode MRM at a BLOS target. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624A/H28.	10000		
MAAST: In FY07, fabricated, assembled, and demonstrated multi-function warhead for LOS-MP/MRM and demonstrated advanced propellant and robust cartridge case technologies; fabricated, assembled, and demonstrated in-flight tracking and maneuver control performance of projectile with LCP technologies.	16044		
Pulsed Laser Technologies: In FY08, mature Laser Guided Energy (LGE) technology using Ultra Short Pulse lasers (USPL) to		6225	5172

demonstrate feasibility at militarily relevant ranges. In addition, mature and demonstrate advanced solid state High Power Microwave (HPM) device designed to reduce the size and weight over that of existing solid state power HPM devices; increase the length of the Laser Induced Plasma Channel(LIPC) using novel laser technology; and demonstrate HPM stackable, modular, and higher power density modules. In FY 09 will begin design to integrate compact solid state High Power Microwave sources and high voltage sources using LIPC for laser guided energy (LGE) in a directed energy weapon system demonstrator; will model LIPC interaction with various directed energy sources and down select mature LGE technology. Efforts described here are coordinated and complimentary to related efforts in PE/Projects: 0602624A/H18 and H19.			
Ground Based Munitions Technologies: In FY09, will 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. Will focus on an approach 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. Will assess numerous means for providing maneuverability to an object in a drop test. Will also develop a concept which will integrate technologies that allow precision emplacement of Intelligent Munitions Systems (IMS) from a standoff distance that is as effective as hand emplaced IMS (PE 654808/D016). Will demonstrate in a drop test the maneuverability device and will develop a concept plan for expulsion from round. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624A/H19.			3113
Scaleable Effect Weapons and Munitions System: In FY08, establish and evaluate baseline modeling of experimental hardware for evaluation of next generation explosives, reactive materials, and advanced warhead liners. In FY09, will define and evaluate system selectability requirements to allow for controlled lethality against less-than-lethal, controlled lethal area, and extremely lethal target requirements; will evaluate warhead tailoring methodologies to control munition energy output and will verify modeled scalability effects in reduced munition sizes for man-portable classed systems; will fabricate and test prototype hardware for evaluation of multipurpose capabilities. Efforts described here are coordinated and complimentary to related efforts in PE/project(s): 0602624A/H18 and H28.		3095	5165
Fuze and Power for Advanced Munitions: In FY07, continued explosive compatibility and safety tests of Microelectromechanical systems (MEMs) in surrogate test vehicle; demonstrated prototype battery designs in laboratory and conducted air gun high-g tests for new thermal and liquid reserve batteries and hybrid power systems; began alternative/hybrid energy systems evaluations. In FY08, integrate Electronic Safe and Arm devices (ESAD) subsystem. Conduct demonstration of gun launched multipoint warhead initiation. Conduct performance testing of MEMS S&A device and MEMS impact switch performance in 155 mm projectile. For sensors: demonstrate gun launch RADAR proximity fuze capability in direct fire application, validate stand-off improvements and size reduction. Achieve mortar configuration for LADAR sensor using advanced laser and detector. For power: demonstrate prototype organic chemistry based liquid reserve batteries and thermal management battery improvements with flight tests in a gun-launched munition. Efforts described here are coordinated and complimentary to related efforts in PE/project(s): 0602624A/H18. In FY09, will demonstrate pre-programmed maneuver and guide to hit capabilities in a mature prototype precision guided 105mm projectile.	4402	4750	3543
Common Smart Submunition (CSS): In FY07, matured sensor and algorithms for follow-on captive flight test (CFT) to achieve 0.95 probability of discriminating and firing at a target of interest; baselined Autonomous Target Recognition (ATR) performance and identified future iteration work building toward multi-target discrimination capability (Army, Air Force, Navy targets); provided test data for system analysis model and developed and validated a CSS system model for end-to-end simulation evaluation. In FY08, demonstrate (drop) full up functional CSS prototype submunitions at the suspended cable facility at Sandia; demonstrate sensor and algorithm Technical Readiness Level (TRL) during CFT (Phase 2); verify LADAR/IR sensor and ATR discrimination algorithms in a dynamic Captive Carry Test (CCT); verify all ATR performance sub-sets such as registration, target detection, key feature extraction, and target	7970	8703	

recognition during CCT; conduct evaluations to serve as entrance criteria for System Design Review (SDR #2) and follow on efforts; conduct demonstrations of Warhead TRL and integration of multiple systems; finalize interface design for warhead to support integration of warhead with submunition; conduct final demonstration of CSS with live warhead and self-destruct capabilities at end of FY08. Efforts described here are coordinated and complimentary to related efforts in PE/project(s): 0602624A/H18 and H19 and 0603004/232.			
Lightweight Cannon Integration: In FY09, will demonstrate novel recoil attenuation techniques to large caliber weapons for future spirals of FCS weapon systems; will validate design concepts for the next generation of highly mobile cannon-based firing platforms with significantly enhanced firepower, i.e., the set of weapons beyond the current NLOS-C or MCS 120mm systems; will mature and assess RArefaction waVE guN (RAVEN) technologies, momentum cancellation techniques, and rapid fire initiatives.			3100
Soldier and Small Unit Lethality Integration: In FY09, will demonstrate mission tasking, target geo-location (GPS fused, Selective Availability Anti-Spoofing Module [SAASM] compliant), de-confliction & automated target hand-off from an small unmanned ground vehicle (UGV)/Soldier platform to a small unit effects network; will demonstrate initial target hand-off /effects node processing within 10 seconds and target geo-location accuracy of 10 meters; will mature and validate modular software & algorithms for Ground Soldier Systems (GSS) incremental capability. Efforts described here are coordinated and complimentary to related efforts in PE/project 63001/J50.			3000
Dual Use Composites (DUC): In FY07, optimized DUC munition to increase accuracy and lethality through test demonstrations in an operational environment; developed most promising light weight solutions for remote weapon stations on robotic vehicle. Assessed current and developmental unmanned platforms which would benefit from DUC and tailor technical parameter of the DUC material to increase the physical properties of the material. In FY08, optimize DUC munition to increase accuracy and lethality through test demonstrations in an operational environment. Mature most promising lightweight solutions for remote weapon platforms. Select one or two unmanned platforms from the candidates identified during FY07 and produce complex, high fidelity DUC components. In FY09, will optimize and integrate complex high fidelity DUC components (classified) into the unmanned platforms selected during FY08; will demonstrate the quality, integrity and lethality through tests in an operational environment	1081	878	2970
Tunable Pyrotechnics: In FY08, evaluate the efficacy of tunable pyrotechnic formulations by integrating and combining pyrophoric reactive materials, nano technology and pyrotechnic chemistry. Evaluate the key processes, products, and physical parameters. In FY09, will use the successful candidate formulations and conduct energetic characterization, sensitivity studies, and initial prototype application for counter measures and battlefield effects simulators; will develop and test low visibility infrared decoy flare compositions to protect aircraft from IR guided missiles without revealing aircraft position during night operations; will conduct signature and performance measurements of new nano pyrophoric and pyrotechnic formulations.		1032	2886
Countermine/Surface Laid and Buried Mine Neutralization: In FY07, integrated directed energy power source technologies onto a ruggedized skid to demonstrate and assess the feasibility of further maturing and developing this technology for mine destruction. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624A/H19.	1920		
Extended Area Protection and Survivability (EAPS): In FY07, integrated advanced warhead and fuze configurations within the EAPS projectile and conducted live fire demonstrations to validate lethality against static RAM targets. In FY08, integrate projectile design based on results of "A" and "B" round developments and conduct demonstration firings. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624A/H28.	1392	2813	
Military Operations in Urban Terrain (MOUT)/Urban Lethal Technologies: In FY07, for shoulder launched munitions, matured multi-mode, high-blast/anti-armor warhead designs for single warhead configurations and also the forward precursor charge designs for tandem	3803	3100	3494

warhead configurations. For the lightweight breaching system, matured the system design and used data to demonstrate several full size prototypes that met the threshold penetration requirements; used designs for modeling and fabrication of prototype warheads for experimental validation. In FY08, conduct initial modeling and experimental validation of multi-mode warhead design concepts and fuze requirements which enable demonstration and refinement of the precursor charge for shoulder launched munitions; for the light weight wall breaching system, demonstrate maturing linear shaped charge liner and multipoint initiation. In FY09, will evaluate advanced fuzing options of multimodal warheads and mature the bash-through warhead on shoulder launched munitions; for the light weight wall breaching system, will refine liner and initiation concepts for system integration and demonstrate a one-shot, on-target tandem wall breaching system against appropriate targets; Will demonstrate multi-purpose capability (multiple targets) from a single shoulder launched munition; Will 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.			
Kinetic Energy Active Protection System: In FY09, will mature warhead technologies and use modeling and simulation (M&S) and verification testing to validate performance against all classes of threats; will demonstrate warheads and enhanced blast explosives through M&S and verification testing in near tactical environments; will refine fuze Safe & Arm (S&A) device for warheads and explosives and will demonstrate in near tactical environment. Efforts described here are coordinated and complimentary to related efforts in PE/Project 062624/H28 and are developed and collaborated with efforts in PE/Project 063005/221 and 063313/550.			4642
Reliability for the Future Force: In FY09, will develop probabilistic models for micro-electrical-mechanical system (MEMS) failure physics that will measure performance degradation and/or predict system failure; will develop reliability models for each failure mode building from sub-component and material levels up through component, subassembly to integrated Inertial Measurement Unit (IMU) and safe & arm levels; will develop optimization process for technology and design trades and process control sensitivities to improve the inherent reliability and process effectiveness; will mature life enhancement technology features and define inherent reliability improvements.			999
Small Business Innovative Research/Small Business Technology Transfer Programs		620	
Total	46612	31216	38084

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L94**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
L94 ELECTRIC GUN SYS DEMO	13038	9511	11578	11826	12976	17646	18160

A. Mission Description and Budget Item Justification: This project matures and demonstrates Electromagnetic (EM) armament subsystems and the enabling technologies for tactically relevant gun systems. EM Guns have the potential to revolutionize the future battlefield by their unique performance characteristics (hypervelocity and reduced-signature launch), elimination of vulnerable propellants, synergistic relationship with hybrid electric vehicles, and reduction in sustainment burden. In addition to designing, fabricating, and demonstrating subsystem components, the project confronts system level technology challenges including synchronization/compatibility of twin counter-rotating machines, technology scalability, thermal management, and full energy system performance. After successful demonstration of the critical components and subsystems at tactical scale, a follow-on effort is planned to integrate next generation subsystems into an armament prototype, comprising robust launcher, pulsed power supply, launch packages, prime power, cooling and auxiliaries, to demonstrate system performance. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This project is executed by the Armaments Research, Development, and Engineering Center (ARDEC) at Picatinny, NJ, in cooperation with the Army Research Laboratory (ARL), Adelphi, MD, and The University of Texas at Austin (a University Affiliated Research Center). This work complements and is fully coordinated with efforts in PE/project(s) 0602618A/H75 and PE 0601104A/H56.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
EM Gun System Demonstration: In FY07, completed fabrication of a one-half length (2 meter) railgun test bed and demonstrated strength of design and scaling effects by testing at full scale launch peak loading conditions. Verified fuze performance for safe & arm in an inert configuration and completed high explosive (HE) risk reduction ballistic tests in an EM environment. Completed acceptance/verification testing of Pulsed Power Supply (PPS) components and manufactured the major rotating machine sub-assemblies. In FY08, build a lightweight cantilevered high fidelity (4 meter) railgun with integrated breech and muzzle shunt and demonstrate threshold performance at hypervelocity and multi-round launchability; test fire an integrated HE, fuzed launch package from a laboratory EM gun; integrate the compact, twin counter-rotating pulsed alternator power supply, conduct subsystem functional tests and accomplish high fidelity breadboard PPS demonstrations that establish and validate requisite performance criteria. In FY09, will build upon the test beds to mature next generation EM gun subsystem hardware; will conduct upfront requirements analysis and prepare point-of-departure performance specifications to support evolutionary concepts for an integrated EM armament system prototype selected on best balance of technical achievability and military utility; will configure the high fidelity (4 meter) railgun, pulsed power supply, and launch package components/subsystems to enable full firing chain demonstration in FY10 to assess system level functionality.	13038	9295	11578
Small Business Innovative Research/Small Business Technology Transfer Programs		216	
Total	13038	9511	11578

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L96**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
L96	HIGH ENERGY LASER TECHNOLOGY DEMO	9056	15280	23009	23671	25427	25995	26579

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. HEL systems have the potential to address the following identified Army capability gaps: 1) Defeat In-Flight Projectiles such as rockets, artillery, mortars, anti-tank guided missiles, and man-portable surface-to-air missiles; 2) Ultra-Precision Strike with little to no collateral damage; 3) Disruption of Electro-Optical (EO) and Infra-Red (IR) sensors; 4) Neutralizing surface-laid mines and other ordnance from a stand-off distance; and 5) Ultra precise lethal / non-lethal effects against a wide variety of targets. HEL TD possesses the characteristics required to support future Joint / Army requirements for a lethal capability that is deployable, mobile, and self-sustaining, while capable of operating in a full spectrum, networked, information-based battlefield environment. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. The HEL TD program 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 (pulsed), and Battle Management Command, Control, and Computers (BMC3). At weapon system power levels of around 100 kW, Solid State Laser (SSL) technology has the potential to enhance survivability by addressing the capability gaps identified above. 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. The HEL TD effort plans to use and integrate the Pulse Power Supply developed in PE 0603005A scheduled for completion in FY08 and available for integration in FY09. The supporting effort under this project is the development of a Force Encampment Protection System (FEPS) radar designed to detect, track, discriminate, and predict impact / launch points of rockets, artillery, and mortars (RAM) launched from any direction. Its goal is to meet the demanding 360 degree, short-timeline search requirements imposed by rockets fired directly into defended encampments on depressed trajectories. A novel three-tier antenna configuration enables fast horizon searches as well as track of targets up to 80 degrees elevation, providing near hemispherical radar coverage at a fraction of the cost of a conventional phased array antennas. The FEPS radar design is capable of providing a highly-accurate and reliable sense and warn capability. In order to accomplish this mission, FEPS will detect, discriminate, and provide impact and launch point prediction on RAM threats. It also provides precision track data to directed energy and kinetic energy munitions used to intercept these targets. There are currently no sensors that provide this total capability. The Counter-Rocket, Artillery, and Mortar (C-RAM) program office has identified the FEPS radar technology as key in filling a gap in the search, track, discrimination, and impact point prediction of RAM targets. The FEPS effort transitions to PE 0603313A in FY08. Work in this project is related to, and fully coordinated with, efforts in PE 0602307A, PE 0602890D8Z, PE 0603005A, and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), PE 0603005A/441 (Combat Vehicle and Automotive Advanced Technology), and PE 0603313A (US Army Aviation and Missile Research, Development, and Engineering Center). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by Aberdeen Proving Ground, MD, and US Army Space and Missile Defense Command Technical Center, Huntsville, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
High Energy Laser Technology Demonstrator (HEL TD): In FY07, began the design of the HEL TD ruggedized beam control system	6456	14852	23009

(BCS), which incorporates technologies that improve pointing accuracy and minimize jitter to optimize the amount of laser energy placed on a target ensuring its destruction. This included defining detailed BCS specifications and conducting design-to-capabilities trades. In FY08, complete the BCS design, including structural / vibration support platform, beam steering / focusing mechanisms, with on board target acquisition (pointing / tracking camera), and functional software; Purchase some long lead item procurements; and begin 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 detailed interface requirements. Develop detailed system requirements for power, thermal management, and BMC3 (includes Fire Control) and analyze, assess, and select appropriate tactical vehicle platform. In FY09, will continue HEL TD system engineering efforts; will begin the fabrication, assembly, and testing of the BCS; and will begin the design of the miniaturized and ruggedized high energy solid state laser (SSL) component that will provide the lethal laser energy to destroy a target, while also being capable of withstanding the shock and vibration from a combat vehicle platform operating in a tactical environment. This program may use one of the SSLs developed in PE 0602307A as the basis of the design for the miniaturized and ruggedized SSL component.			
Force Encampment Protection System (FEPS) radar: In FY07, developed primary Ku-band antenna components, Rotman lens, slotted waveguide radiators, and interconnecting waveguide pieces manufactured from plated plastic. Developed slotted waveguide emitter antenna design and a prototype receiver capable of receiving signals from up to four channels. Developed two elements of the radar array and performed high power, heat dissipation and monopulse tracking tests. At the end of FY07 this program transitioned to the US Army Aviation Missile Research, Development, and Engineering Center (AMRDEC) as part of the C-RAM tracking and fire control effort in PE 0603313A.	2600		
Small Business Innovative Research/Small Business Technology Transfer Programs		428	
Total	9056	15280	23009

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603004A - Weapons and Munitions Advanced Technology**	**L97**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
L97	SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	990	1019	1026	1028	1028	1051	1074

A. Mission Description and Budget Item Justification: This project matures and demonstrates smoke and obscurant technologies with potential to enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces. A major effort will demonstrate the dissemination of newly developed advanced infra-red (IR) obscurants having four times the previous performance. Mature modeling and simulation tools developed in PE 0602622A to predict performance and analyze strategic use of obscurants on the battlefield. Other efforts mature dissemination, delivery, and vehicle obscurant enabling technology with potential to increase survivability through increased standoff and threat protection. After successful demonstration, these technologies transition to the Family of Tactical Obscuration Devices, and other System Development and Demonstration programs. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Obscurant Enabling technologies: In FY07, refined design of prototype packaging/dissemination concepts; developed prototype system for advanced IR obscurant for use in grenades, artillery rounds and other smoke generating systems. Conducted experiments of new dissemination techniques in a relevant operational environment. In FY08 mature, fabricate, and test the selected grenade concept as necessary to meet TRL-6 prototype requirements. In FY09, will evaluate dissemination methods and will conduct modeling and analysis of advanced IR obscurants for artillery and mortar applications.	990	991	1026
Small Business Innovative Research/Small Business Technology Transfer Programs		28	
Total	990	1019	1026

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	200974	245629	112492	92447	94339	98743	112004
221	COMBAT VEH SURVIVABLTY	17662	45126	37525	24166	28890	38406	50930
441	COMBAT VEHICLE MOBILTY	33194	43599	44659	50019	46789	41345	41738
497	COMBAT VEHICLE ELECTRO	9288	13027	7459	7598	7718	7890	8067
515	ROBOTIC GROUND SYSTEMS	16855	9424	10182	10316	10942	11102	11269
533	Ground Vehicle Demonstrations	45186	76097					
53D	NAC Demonstration Initiatives (CA)	53831	38952					
53G	FUTURE COMBAT SYSTEMS (FCS)	20951	14101	11992				
C66	DC66	4007	5303	675	348			

A. Mission Description and Budget Item Justification: The Army vision demands a force that is deployable, agile, versatile, lethal, survivable, and sustainable across the spectrum of operations. The goal of this program element (PE) is to mature and demonstrate leap-ahead combat vehicle automotive technologies to enable transformation to the Future Force and, where possible, to exploit opportunities to enhance Current Force vehicle-related capabilities. This PE supports maturation and demonstration of enabling component technologies in the areas of survivability (project 221), mobility (project 441), combat vehicle electronics (project 497), and robotic ground systems (project 515). These advanced technologies are demonstrated in coordination with Army Acquisition Project Managers and warfighter organizations. Project 221 matures and demonstrates survivability technologies including advanced armors, Active Protection Systems (APS), and safety devices. Project 441 matures and demonstrates power/energy component and hybrid electric vehicle (HEV) technologies, which provides power for propulsion, control systems, communications, life support systems, electric weapons, and protection systems, which are key enablers for enhancing Current Force and Future Force capabilities. Project 441 includes evaluating the maturity of HEVs for military applications and on demonstrating the associated performance benefits and burdens by evaluating against relevant tactical mission duty cycles and environments. The Pulse Power technology effort focuses on the development of those key high power electronic devices essential in the development of viable advanced electric weapons (lasers, high power microwaves, and electromagnetic guns) and advanced electric-based protection systems (Electromagnetic (EM) Armor). Project 497 focuses on maturing technologies that enable Soldiers and robotic systems to fight side-by-side. The Robotics Collaboration effort that concludes in FY08 pursues technologies for human-robot interaction in Soldier-robot teams such as: intelligent agents, adaptive automation, augmented reality for increased local situational awareness, and user-friendly displays to reduce the Soldier's burden in the control of manned and unmanned ground and air systems. Project 515 focuses on the development, integration, and engineering evaluation of control architecture, autonomous navigation technologies, as well as Unmanned Ground Vehicle (UGV) platform mobility trade studies. Army Science and Technology continues to play an important role for the Future Force vehicles by providing critical technology solutions and spiral opportunities. Project 53G matures UGV technologies. The Robotic Vehicle Technologies and Autonomous Platform Demonstrator efforts will focus on the design and development, and fabrication of UGV control architecture, hardware and software, and UGV platform mobility technologies. Projects 533 and 53D fund congressional special interest items. Project C66 supports classified activities. Properly accessed individuals can obtain further information from the ASA(ALT) Special Programs Office. Work in this program element is related to, and fully coordinated with, PE 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology, Robotics Technology), 0602105A (Materials), and 0602705A (Battery/Ind Power Technology). Work in this PE is coordinated with the US Marine Corps, the Naval Surface Warfare Center, the Naval Research Laboratory, Air Force Armaments Command, and other ground vehicle developers

within the Departments of Energy, Commerce, and Transportation as well as DARPA. 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.

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	204383	131436	108554
Current BES/President's Budget (FY 2009)	200974	245629	112492
Total Adjustments	-3409	114193	3938
Congressional Program Reductions		-1587	
Congressional Rescissions			
Congressional Increases		115780	
Reprogrammings	1959		
SBIR/STTR Transfer	-5368		
Adjustments to Budget Years			3938

Forty-eight FY08 congressional adds totaling $115780 were added to this PE.

($800) Enhanced Directed Armor RPG Vehicle Protection System
($800) Ground Vehicle Fastening and Joining Research
($800) Vehicle Information Manager Display for Drivers (VMID)
($900) Liquid Desiccant-Based Atmospheric Water Generation without Reverse Osmosis
($1000) Battlefield Requirements Management Support System
($1000) No Idle System (NIS)
($1000) Hydraulic Hybrid Vehicles (HHV) for the Tactical Wheeled Fleet
($1000) Improved HMMWV Tactical Shelter Project
($1000) Vehicle Armor Structure Development and Testing for Future Combat Systems and Joint Light Tactical Vehicle
($1600) Advance Lithium Iron Phosphate Battery System for Army Combat Hybrid HMMW V and Other Army Vehicle Platforms
($1600) Advanced Lightweight Composite Armor
($1600) Center for Tribology and Coatings
($1600) Full Spectrum Close-in Layered Shield (FCLAS) for thin skinned vehicles (Transfer from line 55)
($1600) Ground Forces Readiness Enabler for Advanced Tactical Vehicles (GREAT-V)
($1600) High Performance Aluminum Structures and Components
($1600) Networked Reliability and Safety Early Evaluation System (NRSEES)
($1600) On-Board Vehicle Power Management
($1600) Secure On-the-Move Information Analysis and Control for Advanced Combat Vehicles
($1600) Tactical Rocket Propelled Grenade Airbag Protection System (TRAPS) Enhancement
($1600) Advanced Thermal and Oil Management System
($1600) Fuel Cell Cost Reduction Research

($1600) Next Gen Non-Tactical Vehicle Propulsion
($1600) Special Operations Vehicle - Lightweight, Armored, Hybrid, Power Generating,Tactical Vehicle
($2000) Diesel Hybrid-Electric Utility Vehicles
($2000) Diminishing Manufacturing Sources and Material Shortages (DMSMS) Case Resolution Program
($2000) LEAN Digital Product Development
($2000) Light Weight Structural Composite Armor for Blast and Ballistic Protection
($2000) Rotary Multi-Fuel Auxiliary Power Unit (APU) for the Abrams M1A1 Tank
($2400) Field Deployable Fleet Hydrogen Fueling
($2400) Military and Interstate Commercial Truck Component Weight Reduction Program
($2400) Novel Onboard Hydrogen Storage System Development
($2400) Tactical Wheeled Vehicle Composite Component Weight Reduction Program
($2560) Vehicle Maintenance and Prognostics System
($2600) High Strength, Powder Metal Gears for Vehicle Transmissions
($3000) Armor Ready Composite Cab Transition
($3000) Crosshairs Hostile Fire Indicating System
($3040) Active Protection Systems Initiative for the Joint Light Tactical Vehicle
($3200) Advanced Composites Development for Light Weight, Low Cost Transportation Systems Using 3+ Extruder
($3200) Advanced Thermal Management System
($3200) Next Generation Manufacturing Technologies for Defense Supply Chain
($3200) 3-D Advanced Battery Technology
($3200) Defect-Free Commercially Viable SVC Semiconductor Using Superlattice Technology
($3200) High Speed Diesel Combustion
($4000) Tactical Wheeled Vehicle Structures for Improved Survivability and Performance
($4000) Antiballistic Windshield Armor (AWA)
($4080) Center for Military Vehicle Technologies
($8000) Hybrid Engine Development Program for Tactical Wheeled Vehicle Fleet
($12000) Unmanned Ground Vehicle Initiative

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**221**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
221 COMBAT VEH SURVIVABLTY	17662	45126	37525	24166	28890	38406	50930

A. Mission Description and Budget Item Justification: This project matures and demonstrates combat vehicle survivability technologies essential for the Future Force and provides technical solutions for enhancing the survivability capabilities of the Current Force. Focus is on advanced armors, Active Protection Systems (APS), safety devices, and integration of these onto the Future Force combat and tactical wheeled vehicles and where practical, Current Force vehicles. As combat vehicle systems become smaller and lighter and tactical vehicles are more often exposed to combat conditions, one of the greatest technological and operational challenges is providing adequate crew protection without reliance on heavy passive armor. These challenges are being addressed by major efforts in integrated survivability suites comprised of APS coupled with advanced ballistic protection including smart and ceramic armors integrated with advanced composite and laminate structures, and advanced transparent armor formulations. The APS against Kinetic Energy (KE) threats effort conducts essential trade studies, technical evaluations, and demonstrations of APS components/sub-systems including countermeasure warheads and interceptors, detectors, and trackers, and fire control hardware and software required to identify, classify, and defeat KE threats as defined for the 2017 threats to Future Force combat vehicles. Technologies and performance data are transitioned for use in Future Force manned ground vehicles and potential spin-offs to Current Force combat vehicles. This effort is integrated and coordinated with efforts from program elements (PEs) 0602624A (Weapons and Munitions Technology), 0603004A (Weapons and Munitions Advanced Technology), and 060313A (Missile and Rocket Advanced Technology). TWV Survivability focuses on maturing and demonstrating viable integrated survivability suites that can be tailored to meet current and future threats when applied to light, medium, or heavy tactical wheeled vehicles. This effort provides essential underpinning data to support the joint effort between the Army and Marines for the Joint Light Tactical Vehicles (JLTV). Lightweight, integrated armor technologies, using components from PEs 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology), and 0602105A (Materials Technology), are integrated and demonstrated through ballistic testing to validate performance versus weight against various armor protection requirements. APS and signature management treatments are also integrated and evaluated to determine effectiveness and ability to counter threats in conjunction with armor treatments. Modeling tools that characterize hardware performance of the survivability enhancements are matured and validated and linked to combat and tactical vehicle virtual prototyping tools, enabling more rapid and cost effective adaptations and evaluations of effectiveness in the future. The Vision Protection effort ending in FY09 matures and demonstrates treatments to optical systems that provide protection from frequency-agile laser weapons and is coordinated and collaborative between work conducted at Army Research Laboratory's PE 0602120A (S3I Technology), PE 0602705A (Elec and Electronic Dev), Natick Soldier Center PE 0602786A (Clothing and Equipment Tech), and the Communications-Electronics Research, Development, and Engineering Center's PE 0602712A (Camouflage and Counter-Recon Tech). These technologies are appropriate for transition to Future Force vehicles for spiral integration or to Current Force vehicles such as the Abrams, Bradley, and Stryker. Work in this PE is related to and closely coordinated with work conducted in PE 0602601A (Combat Vehicle and Automotive Technology) and in collaboration with the Army Research Laboratory's PE 0602618A (Ballistics Technologies) as well as with the US Marine Corps and Office of Naval 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, as well as the Army's TWV Fleet Modernization Strategy. Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI; Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; US Army Armaments Research, Development, and Engineering Center (ARDEC), Picatinny, NJ; and the US Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
APS against KE: In FY07, collaborated and conducted integration of AMRDEC's preliminary design of KE APS interceptors and	8658	17240	9869

ARDEC's blast warhead and fuze package for defeat of KE threats; conducted KE APS systems engineering support with development of Systems Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), systems architecture, initial system and component specifications, and interfaces. In FY08, provide design support to integrate matured components into Future Force combat vehicle architecture and hardware for the KE AP system; collaborate and integrate ARDEC's warhead and fuse package with interceptor being developed at AMRDEC; update the SEP, TEMP, systems architecture, system and component specifications and interfaces; coordinate, manage, and conduct KE APS component testing of warhead, fuze, and interceptor. In FY09, will complete component and system design specifications and finalize all system interfaces; will complete coordinatation and integration support of ARDEC's warhead and fuse package and AMRDEC's interceptor; will build and test warheads in support of KE APS final demonstration; will coordinate transition of components for integration into current and future force combat vehicles; will collaborate and coordinate with ARDEC and AMRDEC to conduct FY10 KE APS interceptor/system testing, demonstration, and analysis.			
TWV Survivability: In FY07, used modeling and simulation tools to conduct trade studies and analyses to identify viable candidate integrated survivability suites for one or more TWVs; matured selected safety equipment and short range threat APS components (non-KE threats) and validated ballistic performance, structural capability, and durability of components; assessed manufacturability and affordability of candidate solutions; selected "best mix" survivability suite for initial demonstration; provided results of assessments and data from performance tests to PM Future Tactical Systems. In FY08, finalize component maturation and fabricate demonstration vehicle(s) while continuing integrated suite design activities and conducting studies to determine the impact of various survivability suites on vehicle weight, volume, and power system. In FY09, will conduct extensive experiments and tests on an expanded set of integrated survivability suites on demonstration vehicle(s) to verify and validate the level of protection achieved, the durability of the systems and the impact of the added weight, volume, and power on vehicle performance; and will complete analysis tool to simulate the effects of mine blast impacts on vehicle and crew. The level of testing for this program will be increased to address emerging threats.	5405	11928	10976
Vision Protection: In FY07, integrated and evaluated nonlinear optical materials that protect the sensors from laser-induced damage; began construction of a breadboard targeting system using these concepts; and began design of laser-protected navigation camera system and optical fire control for future force combat vehicles. In FY08, complete construction of breadboard targeting system and conduct tests of the fire control camera breadboard for optical and laser protection performance and fabricate protection system for navigation camera. In FY09, will complete and validate performance of agile laser protection in future force combat vehicle-type navigation camera and optical fire control breadboards.	1971	5556	3817
Armor/Mine Protection: In FY07, investigated lighter weight/more efficient/novel protection technologies in the areas of opaque armor, transparent armor, and close-in Rocket Propelled Grenade (RPG) protection, and mine protection for Tactical Wheeled and Combat Vehicles; pursued near-term armor design options to provide increased protection against small arms, surface laid and buried mines, and Explosively Formed Penetrator (EFP) threats, close-in RPGs; provided design guidance for increasing Light Tactical Vehicle (LTV) mine protection; and developed initial vehicle-level mine response modeling and simulation (M&S) capability to support vehicle trade studies. In FY08, mature near-term opaque/transparent/RPG armor designs and develop design guidance for future Medium Tactical and Combat Vehicles mine protection; demonstrate initial mine kit designs; develop and demonstrate candidate spin-out armor/transparent armor/RPG protection; and further develop vehicle-level mine response M&S to include vehicle kinematics response. In FY09, will accelerate maturation and demonstration of combat and tactical wheeled vehicle armor recipes and improved mine kit designs against objective threats while reducing armor weights; will further develop vehicle-level mine response M&S tools to include crew/occupant response to support system level analysis.	1628	9469	12863
Small Business Innovative Research/Small Business Technology Transfer Programs.		933	

Total	17662	45126	37525

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**441**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
441 COMBAT VEHICLE MOBILTY	33194	43599	44659	50019	46789	41345	41738

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced mobility and electric component and subsystem technologies for next generation ground combat and tactical vehicles and provides demonstrations of increased vehicle performance and capability. It enables lightweight, agile, deployable, fuel efficient, and survivable ground vehicles needed for the Future Force and enhancements to the Current Force. It demonstrates critical propulsion, power, and electrical components and subsystems (advanced engines, lightweight track, energy storage devices, power distribution systems, and Pulse Forming Networks (PFNs)) needed to employ both conventional and alternative propulsions systems for combat and tactical vehicles. Power/energy component and Hybrid Electric Vehicle (HEV) technologies, which can provide power for propulsion, control systems, communications, life support systems, electric weapons, and protection systems, are key enablers for enhancing capabilities. In the near term a major focus is on evaluating and demonstrating the maturity of HEVs for military applications and on demonstrating the HEV performance benefits and burdens against relevant duty cycles and environments in a Power and Energy Systems Integration Laboratory (P&E SIL) and at instrumented test tracks. Over the longer term, the efforts focus on advancing component energy density and system efficiency while increasing platform capability. The P&E SIL is a reconfigurable hardware-in-the-loop experimentation facility that replicates vehicle power and performance characteristics in a simulated system representing military HEVs (including power distribution and storage systems, traction motors, active suspension, high-density capacitors and pulse power components, and high-temperature silicon (Si)/silicon carbide (SiC) electronics). The HEV Propulsion effort matures components and sub-systems and demonstrates them in the P&E SIL, which is reconfigurable but currently configured for Future Force combat class vehicles. The effort also supports development of mission duty cycle profiles critical to evaluations of ground vehicle HEV technologies. The HEV Experimentation and Assessment effort analyzes differences between the demands of commercial, civilian operating environments, and the military operating environments, determines the impact of these differences on the performance of various HEV designs and architectures, evaluates and demonstrates the maturity of HEVs for military applications, and develops modeling and simulation tools that may be used to predict drive cycle fuel economy and performance characteristics (primarily fuel economy but also acceleration, speed, reliability, maintainability, tractive power, and ability to maintain speed on grade) for tactical platforms. The Advanced HEV Components effort seeks significant increases in next generation combat and tactical vehicle mobility, efficiency, and mission capability without increasing vehicle weight or volume through the maturation and demonstration of advanced traction wheel motors, active suspension, high temperature electronic components, regenerative brakes, thermal management, lightweight track, and segmented band track. New designs and packaging concepts are matured and validated in component testing to verify improved performance, reliability, durability. The Pulse Power effort matures component technologies and demonstrates compact components and subsystems that enable revolutionary survivability and lethality applications. The goal is to make significant advances in the maturity of high power density, capacitor-based PFNs that enable advanced weapons including High Energy Laser and Electro-Magnetic gun systems. The Advanced Lightweight Track effort matures and demonstrates new segmented band track and hybrid steel track technologies that are robust, lightweight, exhibit low vibration and acoustic emissions, reduce crew maintenance, and are field supportable. The JP-8 Reformation for Fuel Cells effort matures reformer and desulphurization technologies, which converts battlefield fuels to the hydrogen required for fuel cell operation, where more efficient reformation is needed for practical use on future military vehicle power applications. The Fuel Efficiency ground vehicle Demonstrator (FED) focuses on demonstrating the viability of achieving significant decreases in fuel consumption without sacrificing the performance or capability in a tactical vehicle by integrating potentially high-payoff fuel efficient technologies and advanced lightweight materials in new and innovative designs. The Propulsion-Prime Power effort focuses on providing propulsion and power technologies for current and future tactical wheeled 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Hybrid Electric Vehicle Propulsion and P&E SIL: In FY07, purchased/built, integrated, and evaluated enhanced hybrid electric propulsion components (batteries, switches, controllers, compact engine/generator, thermal management, and power distribution systems) in SIL; began validation of vehicle emulation model; added instrumentation to enable evaluation of Electromagnetic Interference (EMI) on the FY06/FY07 built future force prototype combat vehicle chassis; and continued to develop and incorporate future force combat vehicle duty cycles for use in SIL. In FY08, complete integration of advanced traction drive into the prototype combat vehicle chassis; optimize architecture for best thermal management; continue reducing EMI through filtering, shielding, and grounding; and continue to update power and energy mission profiles. In FY09, will upgrade electronic architecture and thermal management system on the prototype combat vehicle chassis to continue evaluation the hybrid electric system in a space constrained vehicle environment; and will utilize user-developed scenarios to establish baseline performance of prototype combat vehicle chassis and integrated hybrid electric propulsion system.	8607	7892	7760
Hybrid Electric Vehicle Demonstration and Assessment: In FY07, developed a set of representative duty cycles for light tactical vehicles for a variety of missions and determined an appropriate test operating procedure to enable direct comparison of HEV performance in tactical missions; provided input to vehicle performance assessments in cooperation with the Future Tactical Truck System military utility assessment; used Modeling and Simulation (M&S) to explore the variation in performance across various TWV missions/scenarios and various vehicle weights. In FY08, continue analysis and testing of HEVs, with focus on M&S excursions to expand lessons learned from military utility assessment and conduct additional experiments and performance tests. The demos also help refine HEV designs and/or applications to TWVs. In FY09, will continue analysis and testing of HEVs and 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 experiments on HEVs designed with various architectures.	2485	4832	4790
Advanced Hybrid Electric Vehicle Components: In FY07, matured and demonstrated inverter, battery, traction motor, and DC-DC converter component technologies; conducted product evaluations/tests; continued evaluations and laboratory tests of Li-ion and other types of high performance batteries; evaluated advanced thermal management technologies for maintaining coolant temperatures of 110 C° during system demonstrations using innovative cooling techniques (i.e. spray cooling and hybrid cooling loop); and demonstrated component performance in high power density DC-DC converters and in-vehicle applications. In FY08, demonstrate 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 mature and demonstrate system architecture designs for improving reliability, safety, and power consumption strategies. In FY09, will conduct laboratory assessment of several advanced high energy/power density battery systems to gauge their suitability for final Non-primary Power System (NPS) hardware; and will demonstrate advanced power generation technologies to meet NPS requirements (Silent Watch increase duration from 5 to 12 hours and power from 2 to 8 kW).	8794	6232	4896
Pulse Power: In FY07, demonstrated reduced size for critical pulse power components while maintaining the critical electrical performance needed for the dual mode PFN, the Solid State Laser (SSL) PFN and Electro-magnetic (EM) Gun switch; evaluated performance of improved High Energy Density (HED) capacitors in Advanced EM Armor application/vehicle demonstration; integrated and demonstrated transitional switch with improved pulse width for EM Gun at scaled power levels, and completed the design/development of the laboratory version of the a PFN/Battery Box for SSL. In FY08, complete development of vehicle-ready version of the 100kW power supply for the SSL to include development, integration, and test of high power-density batteries with the	4912	6613	5478

PFN/Battery Box, continue to improve EM Gun Switch with SiC based devices; increase HED capacitor's life by 25 percent; and increase energy density of HED capacitors to 2.0 J/cc. In FY09, will develop active cooling for the HEL pulse power supply, allowing greater operational time and increased power/weight efficiency by 40 percent; and will develop high voltage-reversal capacitors with extended durability and increased capacity.			
HIPER: In FY07, redesigned turbo-machinery system, including controls, on a high power density 440 kW capable test engine and conducted engineering tests to obtain performance and durability data.	2013		
Advanced Lightweight Track: In FY07, fabricated prototypes of new segmented band track and a lightweight hybrid steel track incorporating new bushing elastomers; and evaluated and analyzed effectiveness of reinforcement and joint structural performance for anti-personnel mine blast survivability, heat transfer, and sprocket/track interfaces. In FY08, integrate and evaluate 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, a set of Hybrid Lightweight Track will be fabricated and vehicle tested for durability, mobility, and survivability capabilities to demonstrate a sufficient technology maturity for transition to Future Force manned ground vehicles.	3911	3849	2000
JP-8 Reformation for Alternative Power Sources: In FY07, assessed selected reformation and desulphurization technology approaches and began initial system integration efforts for future laboratory hardware performance demonstration. In FY08, integrate JP-8 reformer to transportable system and interface with fuel cell; and optimize key components to make the system transportable.	2472	3739	
Fuel Efficiency ground vehicle Demonstrator (FED): In FY08, use 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; identify potentially 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); select best design and begin physical fabrication/integration effort. In FY09, will complete demonstrator fabrication/integration and conduct comparative performance evaluations, using M1114 Up-armored HMMWV as baseline; will analyze test results and identify opportunities to implement technologies developed, integrated, and evaluated in current and future force vehicles.		9282	9976
Propulsion-Prime Power: In FY09, will test and evaluate for Tactical Wheeled Vehicles compact advanced high power density components developed by the Advanced Hybrid Electric Vehicle (HEV) Components effort; will modify, optimize, and evaluate performance of commercially available tactical vehicle engines to enable them to operate using standard JP-8 fuel without damaging components that would lead to engine failure; will mature, demonstrate, and refine Magneto-Rheological Suspension on Stryker MGS to improve vehicle stability; will complete and verify system level models of the suspension and propulsion systems; will develop and refine intelligent power management components and control strategies on system/test platform; and will evaluate intelligent power and thermal management concepts.			9759
Small Business Innovative Research/Small Business Technology Transfer Programs.		1160	
Total	33194	43599	44659

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**497**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
497 COMBAT VEHICLE ELECTRO	9288	13027	7459	7598	7718	7890	8067

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 for Future Force vehicles and, where practical, for insertion into Current Force vehicles. The project advances open system architectures for ground combat vehicles that allow more efficient crew stations to be adapted for a variety of Future Force 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. The Robotics Collaboration effort matures and demonstrates common scaleable user interface software that can reside on multi-screen mounted crewstations, single screen operator control units, or small Soldier portable devices. A major objective is to construct a common scaleable interface that has potential to reduce platform-unique training requirements by providing intuitive interfaces with a common look, feel, and function across a range of devices for the control of unmanned ground and air systems. The interface is designed to allow graceful degradation of the display system, reconfiguring controls and displays in the event of hardware failure and to provide associated functionality to the Soldier upon the discovery of available services. Robotics Collaboration also matures and refines mounted crew and dismounted Soldier task models, combines these in an Intelligent Systems Behavior Simulator (ISBS), and conducts focused experiments that will define key metrics and drive development of embedded intelligent agents that have potential to lessen Soldier workload and reduce and/or automate mounted and dismounted system control tasks. This work is performed in conjunction with Robotics Collaboration effort described in project 515. Force protection measures of the future require the mounted Soldier to operate for extended periods of time under armor with hatches closed. When operating in this mode, the Soldier's local situational awareness and ability to maneuver the vehicle currently are degraded. A portion of this project focuses on Intelligent Secure Mobility (ISM), work that seeks to improve mobility and survivability by collecting and analyzing data from vehicle sensors to provide mounted Soldiers and crew with enhanced local area awareness inside the vehicle. Unmanned assets organic to the platoon expand the local sensing sphere to increase standoff distances and response times. Real-time embedded models predict vehicle system behavior to support safe mobility and weapon operations. The effort supports definition and refinement of requirements based on employment of human factor methodologies and through human-in-the-loop static and ride-motion simulation. The Robotics Collaboration and 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Robotics Collaboration: In FY07, refined and modeled additional crew control tasks, display information, and intelligent agents; integrated display designs and intelligent agents into target hardware; conducted experiments in which Soldiers evaluated the mounted and dismounted scaleable interface; and measured the impact of controlling unmanned (and manned) systems on Soldier task work load during performance of militarily significant combat scenarios. In FY08, refine task timelines and models in the Intelligent Systems Behavior Simulator (ISBS) environment based on Soldier evaluations and experimental data; conduct final design and integration of scaleable interface software and intelligent agents into mounted and dismounted system hardware and perform final capstone Soldier operational	9288	12682	7459

field experiments in militarily significant combat scenarios in urban environments, capturing all relevant performance data. In FY09, will perform ISM human-in-the-loop simulation experiments to identify best design approaches for augmented reality interface and automation capabilities required for vehicle navigation and local awareness; begin development of augmented reality and automation technology; begin development of predictive models for safe mobility and weapon operations.			
Small Business Innovative Research/Small Business Technology Transfer Programs.		345	
Total	9288	13027	7459

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**515**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
515 ROBOTIC GROUND SYSTEMS	16855	9424	10182	10316	10942	11102	11269

A. Mission Description and Budget Item Justification: This project matures and demonstrates unmanned ground vehicle technologies for the Future Force and explores feasibility for enhancements to the Current Force. 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. The Near Autonomous Unmanned Systems effort matures a set of automated tactical behaviors and self-security systems that allow unmanned vehicles to perform intelligent tactical maneuvers in a semi-autonomous mode and enable self-protection through the identification and deterrence of human threats. This effort also develops UGV control architecture and demonstrates the viability of autonomous vehicle operations in a relevant environment. These technologies are integrated with sensor hardware onto a demonstration platform. Potential missions/functions include perimeter security, medical re-supply, and evacuation; scout/reconnaissance; and remote weapons delivery. This effort integrates a brass-board Autonomous Mobility Perception Suite onto a large scale UGV platform to provide autonomous maneuver capabilities. The work also develops and integrates the mission execution, computer operating environment, and vehicle management system hardware and software necessary for unmanned vehicle control. The Robotics Collaboration effort develops, matures, and demonstrates models that optimize the way Soldier-robot teams perform operations. Models are validated through both man-in-the-loop simulation and field experiments in which Soldier-robot teams perform military relevant scenarios. It develops 3D models and algorithms using colorized ranging with Laser Radar (LADAR) and visual sensors for safe operations of unmanned systems around humans. In addition, this effort focuses on developing and demonstrating UGV behaviors, including force protection and tactical/reactive/self-security, which provides the ability to consistently operate safely in a semi-autonomous mode in urban environments in the presence of Soldiers, pedestrians, and other vehicles. It also matures technologies that contribute to improved/enhanced navigation. Work done in this project is complementary to the Robotics Collaboration effort described in project 497. The Robotic Vehicle Control Architecture Technologies (RVCAT) effort develops a UGV end-to-end control architecture to reduce future UGV technology integration risk and demonstrate the viability of autonomous UGV operations in a relevant environment. The effort integrates a prototype Autonomous Navigation System (ANS) onto a large scale UGV platform to provide autonomous maneuver capabilities as well as develops and integrates the mission execution, computer operating environment, and vehicle management system hardware and software necessary for unmanned vehicle control. RVCAT performs a series of engineering evaluations and Soldier operational exercises to measure system performance and effectiveness from both the technical and operational point of view. 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 (Tank and Automotive Technology) and by the Army Research Laboratory (ARL) PE 0602618A (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. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Near Autonomous Unmanned Systems: In FY07, integrated a brass-board Autonomous Mobility Perception Suite and control architecture	12946	4714	2492

components onto a large scale UGV platform, designed control architecture for command and control of UGVs by Soldier operators, designed and developed the mission execution and vehicle management hardware and software for UGV control, integrated and assessed tactical behavior algorithms designed to enable maneuver- and formation-based missions; integrated human detection and tracking components associated with self-security suite into testbed and evaluated performance through engineering testing; conducted engineering field evaluations and experiments to assess maturity and assist in development of tactics, techniques, and procedures; and continued to mature tactical behavior algorithms and self protection technologies using data collected from field experiments. In FY08, develop and begin integration and evaluation of tactical behavior algorithms required for scout missions and mature entire suite of tactical behaviors and vehicle self-security system. In FY09, will conduct capstone Soldier-in-the-loop field experiments in a militarily relevant environment using a militarily significant scenario.			
Robotics Collaboration: In FY07, conducted experiments to evaluate Soldier-robot teaming models in the performance of militarily significant combat scenarios employing unmanned systems; conducted engineering evaluations to collect data and refine initial safe operation models, and supported the control architecture design development for the Robotic Vehicle Control Architecture program. In FY08, integrate Soldier-robot teaming and safe-operations algorithms into hardware and perform capstone Soldier-field demonstration in urban environments to obtain performance data and support the Robotic Vehicle Control Architecture technologies program technical efforts. In FY09, will develop and evaluate baseline behaviors that enable UGVs to navigate around people and other vehicles in a realistic military testing environment.	3909	4447	3327
Robotic Vehicle Control Architecture Technology: In FY09, will integrate a prototype Autonomous Navigation System (ANS) onto the UGV platform; will conduct a series of engineering evaluations on the UGV platform to test and measure system capabilities given the prototype ANS and upgraded control architecture hardware and software; and will finalize platform system development and update with latest Software and interfaces.			4363
Small Business Innovative Research/Small Business Technology Transfer Programs.		263	
Total	16855	9424	10182

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603005A - Combat Vehicle and Automotive Advanced Technology**	**53G**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
53G FUTURE COMBAT SYSTEMS (FCS)	20951	14101	11992				

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. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, Affordable Adaptive Conformal Electronically Scanned Array Radar (AACER) fabricated optimized integrated airborne system antenna array and perform ground performance demonstrations; the Air Assault Expeditionary Force experiment performed operational assessment of warfighting utility of FCS enabling technologies and concepts, in an operational environment, via experimentation with surrogates and mature demonstrator hardware/software. Mobile Network MMO (Multi-Input/Multi-Outut) validated MNM concept with perform 10-node demonstration tests on improved MIMO hardware/software demonstrator; UPI conducted full-up demonstration of enhanced capability sensors on two UGCV platforms; initiated a redesign and build of the Crusher vehicles to address UGV requirements.	20951		
In FY08, complete design for Crusher/UGV vehicles subsystems including software and mission payloads and conduct subsystem design performance tests followed by integrated testing; Integrate and test armor and active protection components; mature and integrate combat vehicle power and energy components.		13707	
In FY09, will finalize control architecture designs for the control of UGVs by Soldier operators; will 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.			11992
Small Business Innovative Research/Small Business Technology Transfer Programs.		394	
Total	20951	14101	11992

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	11626	14082	9183	8787	8321	8506	8698
257	DIGITAL BATTLEFLD COMM	1405	1987					
588	HIGH ALTITUDE AIRSHIP ACTD							
592	SPACE APPLICATION TECH	10221	9038	4819	3624	4548	6161	6300
DF7	DF7		3057	4364	5163	3773	2345	2398

A. Mission Description and Budget Item Justification: 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. The Army has identified the need to develop tactically relevant space-based capabilities that are responsive, assured, accurate, timely and interoperable as one of the essential capabilities required in support of Army and joint ground maneuver force operations. 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 funds the Space Applications Technology efforts that provide technology options for networked and integrated surveillance and command and control capabilities to achieve 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 & Technology (ASAALT) Special Programs Office. Work in this PE is coordinated with PE 0602120A (Sensors and Electronic Survivability). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	11997	12255	9235
Current BES/President's Budget (FY 2009)	11626	14082	9183
Total Adjustments	-371	1827	-52
Congressional Program Reductions		-173	
Congressional Rescissions			
Congressional Increases		2000	
Reprogrammings	-54		
SBIR/STTR Transfer	-317		
Adjustments to Budget Years			-52

One FY08 congressional adds totaling $2000 were added to this PE.

($2000) No-Idle Climate Control for Military Vehicles

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603006A - Command, Control, Communications Advanced Technology**	**592**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
592 SPACE APPLICATION TECH	10221	9038	4819	3624	4548	6161	6300

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. The Army has identified the need to develop and exploit tactically relevant space based capabilities that are responsive, assured, accurate, timely and interoperable as one of the essential capabilities required in support of Army and joint ground maneuver force operations. This project provides technology options for networked and integrated surveillance and command and control capabilities to achieve information superiority, enhanced situational awareness, and support for distributed operations. 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 Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Distributed Imaging Radar Technology: In FY07, field demonstrated and evaluated the distributed aperture radar brassboard with wide area imagery and Moving Target Indicators (MTI); modified software and refined algorithms based on analysis of demonstration results. In FY08, demonstrate and validate modified software and refined distributed imaging radar algorithms on tactical air and/or high altitude platforms within the Distributed Common Ground Station-Army (DCGS-A); transition validated software to DCGS-A.	5600	3175	
All Weather Radio Frequency (RF) Launch Detection: In FY07, developed an RF test receiver to implement the baseline algorithm; matured algorithms and expanded threat set to include tanks and artillery; and assessed system receiver hardware requirements to extend field of view for increased detection range. In FY08, mature, evaluate, and validate algorithms for an expanded threat set, to include rockets and missiles, and assess space and battlefield RF receiver requirements for tactical applications.	2290	2125	
Ground Based Space Surveillance: In FY07, completed expanded threat set signature and processing efforts, integrated netted sensor hardware/software, and demonstrated mobile data processor with ground sensor. In FY08, complete and validate algorithm and netted sensor hardware/software development; demonstrate mobile data processor with ground sensor in netted ground architecture; and transition ground based space surveillance technology to the US Army 1st Space Brigade.	2331	2349	
Vertical Integration of Space Technology and Applications (VISTA): In FY08, design and demonstrate Intelligent Agent components that process missile warning messages; develop agent reference models and VISTA architecture; and complete software builds of components. In FY09, will mature and demonstrate vertical and horizontal integration of missile threat warning, collaborative planning, and tailored		1156	3443

data, and information distribution to verify compatibility of intelligent agent and knowledge management technologies with Army networks within battle command applications.			
Payload Technology Development: In FY09, will mature selected technology efforts in areas of light weight materials and microelectronic components in order to reduce size, weight and power for brassboard communications relay payloads operating in high altitude environments; will mature responsive nano-satellite, tactical space communications, and space sensor technology to support in-theater operational control and direct down link to the tactical commanders.			1376
Small Business Innovative Research/Small Business Technology Transfer Programs		233	
Total	10221	9038	4819

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technology**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	9022	6740	6853	6883	6967	7111	7260
792	Personnel Performance & Training	6456	6740	6853	6883	6967	7111	7260
79A	Personnel & Training Adv Tech Initiatives (CA)	2566						

A. Mission Description and Budget Item Justification: This program element (PE) funds the Army's behavioral and social science advanced technology development program that provides non-materiel solutions to transform the human warfighter in concert with the technological transformations in systems, weapons, equipment, and the changes in mission requirements to meet the goals of the Future Force. The program focuses on development, maturation, and demonstration within the following three areas: (1) technologies to assess how Soldiers and units are impacted by mission, policy, or program changes; (2) training techniques that enable Soldiers to take full advantage of advances in technology and systems as they evolve and help the Army attain its goals of embedded training in future combat systems; and (3) strategies and tools to enhance leader development so less experienced leaders have tactical and strategic capabilities and can easily adapt to changing mission demands. In addition, this program exploits opportunities to enhance Current Force capabilities. This program leverages and coordinates with work in outside organizations such as the Institute for Creative Technologies (ICT), Simulation and Training Technology Center (STTC), and US Air Force Research Laboratory (USAFRL). This PE is managed by the US Army Research Institute for the Behavioral and Social Sciences (ARI). 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	9200	6783	6871
Current BES/President's Budget (FY 2009)	9022	6740	6853
Total Adjustments	-178	-43	-18
Congressional Program Reductions		-43	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	7		
SBIR/STTR Transfer	-185		
Adjustments to Budget Years			-18

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603007A - Manpower, Personnel and Training Advanced Technology**	**792**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
792 Personnel Performance & Training	6456	6740	6853	6883	6967	7111	7260

A. Mission Description and Budget Item Justification: The objective of this project is to refine, mature, and demonstrate advanced behavioral and social science technologies that enhance performance to ensure that the human warfighter keeps pace with the transformations in systems, weapons, equipment, and mission requirements to meet the goals of the Future Modular Force. The project, where feasible, exploits opportunities to enhance Current Force capabilities. Advanced technology development efforts include: maturing and demonstrating training methods and techniques that prepare battle commanders to effectively operate in digitized, networked environments, and that enable the use of embedded training technologies envisioned for future command and control (C2) systems, such as the Future Combat Systems (FCS); devising strategies to use distributed and game-based technologies for effective multi-site training, assessment, and feedback; and developing tools that capitalize on the various synthetic environments that facilitate the advancement of leader knowledge, skills, and abilities (KSAs), and that can provide virtual mission experiences to leaders early in their career development cycle to foster cognitive flexibility, adaptability, and mission readiness. In addition, this project matures techniques to determine the effects of policy changes (such as implementation of the Army Force Generation Model [ARFORGEN]) and operational changes (such as increased number and length of deployments) on unit cohesion and Soldier readiness. This program leverages and coordinates research efforts with the Institute for Creative Technologies (ICT), Simulation and Training Technology Center (STTC), and Communication-Electronics Research Development and Engineering Center (CERDEC). This program element (PE) is managed by the US Army Research Institute for the Behavioral and Social Sciences (ARI) and work in this PE is related to and fully coordinated with efforts funded in PE 0601102A, project 74F, and PE 0602785A, project 790. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Personnel Technology: In FY07, conducted trend analysis of longitudinal research findings of the effects on unit cohesion of stabilizing unit personnel from the first brigade from stand-up through post-deployment to inform early stages of implementing ARFORGEN. Validated new Selection Test Battery to determine the extent to which it predicts aviator performance in Initial Rotary Wing Training. In FY08, provide lessons learned to Army G-1 and Commanding General, Human Resources Command on unit stabilization; increase complexity of aviation Selection Test Battery and investigate its validity as a tool to assign aviators to specific aircraft. In FY09, will continue attitude and opinion research on factors that influence cohesion, Soldier and family satisfaction, retention, and readiness.	1488	1951	1489
Training Technology: In FY07, refined products and techniques that provide train-up tools for experiments on the spin out of Future Force technological capabilities to the Current Force; refined learning models for single-user immersive training technologies and the potential assessment methods to determine effectiveness of these technologies. In FY08, refine and demonstrate methods for more rapid development of training support packages that meet future technology and system spin out requirements; validate assessment methods of single-user immersive training technologies; and will develop preliminary guidelines for designing effective single user, interactive, distributed training using game-engine-based immersion. In FY09, will mature prototype training and training support packages that enable improved commander and staff performance in network-enabled environments; will validate and refine assessment measures and metrics used in single-user immersive training technologies; and develop training tools and techniques to improve drill sergeant skills as trainers and improve initial entry training so first-term Soldiers are better prepared for operational deployments.	3622	4279	4914

Leader Development Technology: In FY07, implemented critical thinking training modules and leader development case-study vignette approaches in select brigade combat teams and assessed the impact on development of basic leadership skills (critical thinking, interpersonal, self-assessment) using protocols developed in applied research. In FY08, develop techniques to train leaders to be adaptable negotiators and to provide a wider range of strategies to persuade others with differing goals. In FY09, will evaluate the use of techniques that leaders need as the basic elements necessary for leadership in complex environments.	1346	400	450
Small Business Innovation Research/Small Business Technology Transfer Programs		110	
Total	6456	6740	6853

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	49542	56591	50961	51967	55023	56251	57514
TR1	TAC C4 TECHNOLOGY INT	16176	35623	37502	38971	40928	41841	42781
TR2	DIGITAL BATTLEFLD COMM	23973	13118	13459	12996	14095	14410	14733
TR8	C3 DEMONSTRATIONS (CA)	9393	7850					

A. Mission Description and Budget Item Justification: The goal of this program element (PE) is to mature and demonstrate technologies for a secure, mobile, wireless network that will operate reliably in diverse and complex terrain, in all environments for the Army's Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. 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/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) experiments to measure the battlefield effectiveness for the Future Force. This PE also provides: protection technologies for tactical wireless networks against modern network attacks; smart communication technologies to network and control unmanned systems anywhere on the battlefield enabling timely sensor-decider-engagement linkage to defeat critical targets; advanced antenna technologies for greater communications mobility, range, and throughput; and automated network management aids. Several tasks are conducted in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the other Services. Project TR8 funds congressional special interest efforts.

Since the current program element 0603008A, project TR2 efforts are complementary to those funded from 0603008A, project TR1, all efforts funded and executed from project TR2 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden. In FY08 and beyond, TR2 will contain only those efforts transferred from 0603238A (Global Surveillance/Air/Precision Strike), project 177 (JT ALS PS DEMO) to support the advanced technology demonstration for the Program Executive Office Intelligence, Electronic Warfare, and Sensors (PEO IEW&S) that is executed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ. In FY08, the Joint Programs Sustainment and Development (JPSD) Project Office, an element of the PEO IEW&S, will be disbanded.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is fully coordinated with PE 0602782A (Command, Control, Communications Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology). Work is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	53129	49199	51213
Current BES/President's Budget (FY 2009)	49542	56591	50961
Total Adjustments	-3587	7392	-252
Congressional Program Reductions		-508	
Congressional Rescissions			
Congressional Increases		7900	
Reprogrammings	-2294		
SBIR/STTR Transfer	-1293		
Adjustments to Budget Years			-252

Three FY08 congressional adds totaling $7900 were added to this PE.

($500) Advanced Wireless Technologies
($3400) Portable Mobile Emergency Broadband Systems (PMEBS)
($4000) Applied Communications and Information Networking (ACIN)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR1**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
TR1	TAC C4 TECHNOLOGY INT	16176	35623	37502	38971	40928	41841	42781

A. Mission Description and Budget Item Justification: This project matures and demonstrates key communications, mobile networking, and information assurance technologies for the dismounted Soldier, embedded network communications, and the Future Force. These technologies enable commanders and individual Soldiers to survive and fight by providing secure, reliable, mobile communications network solutions that function in complex and diverse terrain. It seeks to provide the ability to move large amounts of data over extended ranges with minimal infrastructure, tying in networks of unattended sensor fields. The efforts here concentrate on three major goals: provide a series of technology demonstrations of C4ISR capabilities to significantly reduce the risk associated with the networks of networks approach to the Future Combat System (FCS) brigade combat team (BCT) integrated on-the-move lethal force structure; 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 of emerging network technologies in an operationally relevant environment. Antenna Technologies mature a family of mission tailored antennas to provide higher gains to sustain Wideband Network Waveform (WNW) link connectivities, reduce visual signature on ground platforms, increase resistance to damage from ballistic debris strikes, reduce the number of platform antennas while increasing their ability to support multiple waveforms, and integrate conformal, lightweight antennas within the Soldiers' protective combat wear for suppressed equipment visual signatures, improved mobility, survivability, and fightability. Wireless information assurance efforts provide network protection for mobile wireless ad hoc networks and provides safeguards against modern network attacks. The Proactive Integrated Link Selection for Network Robustness effort matures and integrates technologies to provide automatic network communications link selections that address the challenge of limited network connectivity. The Communications Planner for Operational and Simulation Effects with Realism (COMPOSER) effort matures software tools that enable the Warfighter to dynamically plan, predict, and visualize network communications performance due to maneuver and environmental effects faster than real time (virtual). COMPOSER is the Army component to the Coalition Joint Spectrum Management and Planning Tool (CJSMPT) Joint Capability Technology Demonstration (JCTD).

Since the current program element 0603008A, project TR2 efforts are complementary to those funded from 0603008A, project TR1, all efforts funded and executed from project TR2 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Joint Tactical Radio System (JTRS) Squad-Level Communications: In FY07, completed Soldier Radio Waveform (SRW) voice and data communications services for dismounted Soldier applications; extended application for unmanned aerial vehicle and unmanned ground vehicle to support teleoperations/navigation, intelligence, surveillance and reconnaissance (ISR) data transport, and communications range extension services; completed validation of SRW network performance in technical test in laboratory and field environments; conducted follow-on operational experiments with Future Force Warrior ATD and FCS Brigade Combat Team Spin Out #1; and delivered final	7009		

release of SLICE SRW 2.1 software application to JTRS Joint Program Office for porting to JTRS Ground Mobile Radio and Handheld, Manpack, and Small Form Fit (HMS) for JTRS Software Communications Architecture and NSA security certifications.			
Antenna Technologies: In FY07 improved gain performance of a triband antenna that provides 4 port capability; demonstrated prototype triband antennas; improved gain performance of survivable 2 port low profile antennas with a ballistic radome; demonstrated dual band (Ku/Ka band) antenna system in an on-the-move (OTM) environment; developed high efficiency Ku power amplifier module; matured Ka power amplifier module; and completed development of X-band OTM antenna system. In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; develop and demonstrate affordable terrestrial directional antenna; complete development and ruggedization of survivable 2 port low profile and triband antenna prototypes; develop and demonstrate broadband low cost low profile directional antenna prototypes for application to PM Signal Warfare requirements for reduced cosite interference; integrate and demonstrate a dual band SATCOM antenna on a Warfighter Information Network-Tactical (WIN-T) vehicle; complete development of power amplifiers and integrate into antenna assemblies; develop a low profile single beam SATCOM antenna; demonstrate vehicle X-band OTM antenna system. In FY09, will mature and demonstrate a low profile Ku/Ka SATCOM antenna; will begin to mature an ultra low profile Ka/Q SATCOM antenna with simultaneous beams.	3077	7583	4058
Tactical Wireless Network Assurance (TWNA): In FY07, matured intrusion detection system framework and integrated with the FCS Automated Intrusion Detection and Response (AIDR) component of System of Systems Common Operating Environment (SoSCOE) by developing and providing an application programming interface to accept Intrusion Detection alerts; matured certificate revocation capability within Tactical Public Key (TPK) framework to reduce impact of security overhead on Mobile Ad Hoc Networks (MANETs), provided demonstration encapsulating matured wireless security capabilities; provided TPK enabling technologies to FCS/WIN-T.	2107		
Wireless Information Assurance (IA): In FY09, will mature and demonstrate IA technologies enabling information exchange across activity domains ensuring survivability of tactical networks and critical information against information warfare attacks; will mature and demonstrate network management/information assurance fault correlation engine that will reduce the software footprint by creating an integrated suite of network operations tools.			3904
Proactive Integrated Link Selection for Network Robustness: In FY07, matured design of planning mode components based on modeling and simulation (M&S) results; matured system architecture to include design of deployed mode link selection technologies that enhance connectivity and useable capacity of wireless networks to improve end user traffic performance; began M&S of deployed mode link selection algorithms. In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; continue M&S and design of enhanced implementation of deployed mode link selection algorithms; implement first level integration among link selection algorithms; conduct functional, performance characterization and scalability testing of mature link selection algorithms within laboratory and relevant field environment. In FY09, will complete implementation of deployed mode link selection algorithms; will conduct final architecture, design maturation, and integration of planning and deployed mode link selection algorithms; will conduct performance testing in a relevant field environment of all planning and deployed mode link selection technologies with representative WIN-T hardware.	3183	7752	9070
Communications Planner for Operational and Simulation Effects with Realism (COMPOSER): In FY07, 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 (CJSMPT) applications. In FY08, integrate and test enhanced COMPOSER technologies in support of the CJSMPT effort.	800	2696	
Dismounted Communications in Urban Terrain: In FY09, will mature communications capabilities for dismounted Soldier operating in highly complex terrain (e.g., urban environments) through the use of space-time adaptive processing, cross layer networking algorithms,			2460

and network security features such as employing random noise waveforms and other low probability of intercept, low probability of detection technologies to reduce communications systems vulnerability.			
Applied Communications and Information Networking (ACIN): In FY09, ACIN will mature and demonstrate commercial networking and communications technology in intelligent agents and mobile networking; will provide rapid adaptation of commercial communications equipment for military use through the development of new architectures combining commercial and military unique technologies; and will provide modeling and simulation and planning tools for communications/network planning.			1385
C4ISR On-The-Move (OTM) Experiment: In FY08, this work is being consolidated in this project from PE/project 0603008A/TR2; assess the capability, functionality, and performance of current and emerging radio waveforms from the JTRS Joint Program Office on JTRS HMS and Ground Mobile Radio representative hardware; conduct 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; assess the technology readiness level of Army science and technology efforts maturing in the FY08 timeframe in an operationally relevant field environment; assess the performance of the baseline and alternative C4ISR on-the-move architectures and various network configurations to inform the current and future forces; utilize 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 M&S via distributed connectivity; and employ data collection, reduction and analysis techniques facilitating early assessment of emerging C4ISR technologies in a system of systems construct. In FY09, will 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; will 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; will assess the technology readiness level of Army science and technology efforts maturing in the FY09 timeframe in an operationally relevant field environment; will continue to support FCS technical evaluations to explore FY09 programmed increments of Army Battle Comma		12513	11166
C4ISR Network Mining: 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, this work is being consolidated in this project from PE/project 0603008A/TR2; mature network data mining software analysis to understand the relationships and patterns in stored transaction data based on open-ended user queries; mature analytical software for use in battle command systems including statistical and machine learning. In FY09, will mature network data mining analytical software particularly neural networks for applicability to next generation battle command systems; will conduct demonstrations focused on four types of relationships. 1) Classes: stored data is used to locate data in predetermined groups. 2) Clusters: data items are grouped according to logical relationships or consumer preferences. 3) Associations: data can be mined to identify associations. 4) Sequential patterns: data is mined to anticipate behavior patterns and trends.		4175	5459
Small Business Innovative Research/Small Business Technology Transfer Programs		904	
Total	16176	35623	37502

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603008A - Electronic Warfare Advanced Technology**	**TR2**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
TR2 DIGITAL BATTLEFLD COMM	23973	13118	13459	12996	14095	14410	14733

A. Mission Description and Budget Item Justification: In FY07 this project matures and demonstrates an integrated Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-The-Move (OTM) (sensor to shooter) capability for the Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. C4ISR OTM provides an operationally relevant field experimentation venue complemented by constructive and virtual M&S for the assessment of emerging individual C4ISR technologies, system of systems, and architectures that increase the survivability and lethality of Future Force platforms.

In FY08 and beyond, Theater Effects Based Operations (TEBO) Advanced Capabilities Technology Demonstration (ACTD) provides the United States Forces Korea (USFK) with enhanced capabilities to analyze, plan, execute, and assess operations, at strategic and operational levels, using an effects based approach. TEBO integrates computer-aided decision support tools, concepts, and procedures to provide a more comprehensive understanding of a given adversary and the environment. TEBO helps to identify those actions that can be taken to influence behavior and facilitate the harmonization of all elements of national power to support national objectives. It provides greater responsiveness and adaptability to better manage the rapidly changing situations of today's environment. TEBO conducts a limited military utility assessment to determine the extent to which the TEBO concept has been adopted and incorporated into the staff organization processes. TEBO assessment tools will be incorporated into USFK Theater Architecture.

Since the current program element (PE) 0603008A, project TR2 efforts are complementary to those funded from PE 0603008A, project TR1, all efforts funded and executed from project TR2 in FY07 are being transferred to project TR1 in FY08 and beyond, to reduce administrative burden. In FY08 and beyond, project TR2 will contain only those efforts transferred from PE 0603238 (Global Surveillance/Air/Precision Strike), project 177 (JT ALS PS DEMO) to support the advanced technology demonstration for Program Executive Office, Intelligence, Electronic Warfare, and Sensors (PEO IEW&S) and will be executed by the Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ. In FY08, the Joint Programs Sustainment and Development (JPSD) Project Office, an element of the PEO IEW&S will be disbanded.

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

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
C4ISR On-The-Move (OTM) Experiment: In FY07, assessed the capability, functionality, and performance of the programmed increments of: Joint Tactical Radio System (JTRS) Soldier Radio Waveform (SRW) 2.1 running on JTRS Handheld, Manpack, and Small Form Fit (HMS) hardware; WIN-T Network Centric Waveform development; and Joint Network Node (WIN-T increment 1) technology insertion; demonstrated commercial SATCOM, commercial wireless technologies, and protocols, Information Assurance and ISR sensor and sensor fusion in an operationally relevant field environment complimented with virtual and constructive modeling and simulation; conducted the initial experimentation under of the FCS Experiment Phase 2 Campaign to assess the capability, functionality, and performance of FCS Battle Command (1.0), System of Systems Common Operating Environment (SoSCOE) (1.8) and Spin Out 1 and 2	16710		

hardware and software; functioned as lead system integrator for Advanced Air Expeditionary Force (AAEF) experiment at Fort Benning Ga. to include supporting data collection and reduction, M&S integration, training , and buildup to support engineering, and integration efforts; supported test design, engineering integration, regression testing, instrumentation and data collection/reduction for the WIN-T Increment 2 technology readiness level 6 demonstration of three technologies: highband networking radios; network operations; and high mobility networking; demonstrated the dual-network utilizing a total of 16 network nodes, 15 running the line of sight Highband Networking Waveform (HNW) and 8 running the SATCOM Network Centric Waveform (NCW) in a WIN-T Increment 2 representative configuration, operating under scripted traffic and mobility conditions. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.			
Adaptive Joint C4ISR Node (AJCN) ACTD: In FY07, completed Extended User Evaluation and sustainment for leave behind equipment.	1060		
Proactive Integrated Link Selection for Network Robustness: In FY07, matured planning mode link selection algorithms that enhance connectivity and useable capacity of wireless networks to improve end user traffic performance; implemented deployed mode link selection algorithms; matured software operations to manage interactions and interfaces among link selection algorithms; matured system architecture to include design of deployed mode link selection technologies that will enhance connectivity and useable capacity of Future Force networks to improve end user traffic performance. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	1968		
C4ISR Network Mining: Data mining consists of five major elements: extracting, 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 FY07, assessed the three Services network centric warfare program architectures and identified interoperability issues; provided the Training and Doctrine Command (TRADOC) the results of the analysis to influence requirements updates and support TRADOC campaign of experimentation effort; demonstrated, and transitioned updated data collection tools to the 25th Infantry Division. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	1934		
Radio Enabling Technologies and Nextgen Applications (RETNA): In FY07, demonstrated functional thermal management approaches compatible with the Joint Tactical Radio Systems HMS; validated performance of thermal management for operational suitability; demonstrated compact wideband power amplifiers for use in JTRS HMS.	1336		
Antenna Technologies: In FY07, completed antenna development and conducted test/demonstration of body wearable antenna prototypes for HMS. In FY08 and beyond, funding for this effort was transferred to PE/project 0603008A/TR1.	965		
Theater Effects Based Operations (TEBO) ACTD: The TEBO ACTD will demonstrate an Effects-based Operations (EBO) process and will provide United Stated 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, this work is being consolidated in this project from PE/project 0603238A/177; mature TEBO software to Spiral V configuration; mature and solidify 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; mature human interfaces and scalability of the TEBO toolset, demonstrate TEBO capabilities in Joint Forces Command (JFCOM) exercises in coordination with United Stated Forces Korea. In FY09, will initiate the sixth and final developmental spiral; will participate in the two annual Korean exercises - Key Resolve (2QFY09) and Ulchi Forward Guardian (4QFY09) as well as participate in PACOM's Terminal Fury exercise; will transition activities from the TEBO toolset to Defense Information Systems Agency and Net-Centric Enterprise Services.		12891	13459
Small Business Innovative Research/Small Business Technology Transfer Programs		227	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	21561	22365	18881	20231	20477	20247	20724
HB5	IMMERSIVE ENVIRONMENTS DEMONSTRATIONS (CA)	1743	1987					
S28	INSTITUTE FOR CREATIVE TECH (ICT)-Adv Tech Dev	5089	4802	4880	5066	5148	5271	5397
S29	MODELING & SIMULATION - Adv Tech Dev	1649	3750	3891	3979	4062	3457	3550
S31	MATREX	10672	10037	10110	11186	11267	11519	11777
S33	TRAINING AND SIMULATION SYSTEMS INITIATIVES (CA)	2408	1789					

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates advanced technology for the next generation training and simulation systems of the Future Force (FF), and where feasible, the Current Force. Work is focused in three projects. The Institute for Creative Technology project S28 incorporates advanced modeling and simulation (M&S) and training and leader development technology into immersive training demonstrations that have an emphasis on urban operations. The Modeling & Simulation project S29 demonstrates a framework for future embedded training and simulation systems for the FF to include the Future Combat System (FCS) and dismounted warrior systems. The MATREX project S31 develops, integrates, and demonstrates an overarching M&S architecture that incorporates multi-resolution entity-based models, simulations, and tools which facilitate systems of systems-scale integration to support Network-Centric Warfare (NCW) M&S capability. The MATREX project also uses a building block approach to integrate interoperable components for engineering-level simulations and models over a distributed network to support decision points across the entire acquisition life cycle. Projects HB5 and 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 Adv 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 (RDE Command), System of Systems Integration (SOSI), Fort Belvoir, VA and the Simulation and Training Technology Center, Orlando, FL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	20863	18723	19002
Current BES/President's Budget (FY 2009)	21561	22365	18881
Total Adjustments	698	3642	-121
Congressional Program Reductions		-158	
Congressional Rescissions			
Congressional Increases		3800	
Reprogrammings	1282		
SBIR/STTR Transfer	-584		
Adjustments to Budget Years			-121

Three FY08 congressional adds totaling $3800 were added to this PE.

($800) Experiential Technologies for Urban Warfare and Disaster Response
($1000) Vigilant Auto-ID and Access Control System
($2000) Joint Fires and Effects Training System (JFETS)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S28**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S28	INSTITUTE FOR CREATIVE TECH (ICT)-Adv Tech Dev	5089	4802	4880	5066	5148	5271	5397

A. Mission Description and Budget Item Justification: This project matures and demonstrates affordable immersive technologies that include the application of photo-realistic synthetic environments, multi-sensory interfaces, virtual humans, and training applications on low-cost game platforms. Immersive technologies enrich the Army's capabilities and readiness by expanding the types of experiences that can be trained or rehearsed, and by improving the effectiveness of the experience and the quality of the result. The synergy between these immersive technologies and the embedded training advanced technology maturation within project S29 (Modeling and Simulation) of this program element provide units with a set of complementary embedded and deploy-on-demand systems that provide just-in-time, dynamic, realistic training, and mission rehearsal capabilities. 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 R&D 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, Orlando, FL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Immersive Techniques: In FY07, assessed and refined the integration of pedagogical and situational aspects of rapid scenario development techniques into immersive environments; assessed and refined the integration of intelligent mentoring capabilities into a single user immersive simulation learning environment; demonstrated methods to integrate political, religious, and cultural traits into immersive environments; demonstrated the integration of specific immersive environments that each enables critical urban characteristics. In FY08, develop, assess, and refine immersive training methods such that they are more representative and supportive of military action within complex political, religious, and cultural environments; demonstrate methods to integrate cultural traits into avatars operating in interactive environments; create visualizations of the complex urban environment to support both immersive training and command and control concepts. In FY09, will integrate photorealistic representations of complex terrain and rendering of specific individual facial features onto interactive avatar models operating in an asymmetric environment to support more realistic training; will demonstrate methods to extend the immersive environment to large format applications that support multi-player and team training; will demonstrate methods to support computer generated after action reviews, computer avatar-based mentoring, and computer directed scenario adaptation based on multi-player distributed training challenges.	5089	4668	4880
Small Business Innovative Research/Small Business Technology Transfer Programs		134	

Total	5089	4802	4880

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S29**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S29	MODELING & SIMULATION - Adv Tech Dev	1649	3750	3891	3979	4062	3457	3550

A. Mission Description and Budget Item Justification: This project matures and demonstrates affordable 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 (FF) systems to include dismounted warrior systems. This project uses simulation techniques and tools that include computer generated forces, virtual terrain databases, and small image generators to create virtual training environments that include virtual opposing forces that can be detected and engaged by operators of go-to-war systems. Embedding simulation-based training technologies into combat vehicles and dismounted Soldier systems enrich the Army's training capabilities and readiness. It provides Soldiers, crews, and small unit leaders whose operational systems are located at home-station or deployed to remote locations worldwide with the ability to use those systems as training and mission rehearsal tools. 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. These next generation training systems contains embedded wireless technologies that connect mounted and dismounted Soldiers and other weapon systems to support distributed combined arms team training. 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. This program provides enhanced capabilities in intelligent tutoring and advanced immersive dismounted training technologies. Demonstrations include technologies that form a framework for future training applications for the range of FF 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.

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, Orlando, FL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Embedded Techniques: In FY07, conducted analysis of current force vehicles to determine display and control requirements to support embedded training; analyzed training software components-suitability to provide individual crew and collective embedded training; demonstrated human-terrain annotation for representation of cultural characteristics in military constructive simulation. In FY08, conduct experiments with embedded training common components and develop user interfaces to support deployable mission planning and rehearsal; mature and demonstrate the use of instructional development tools for adaptive learning environments. In FY09, will demonstrate an embedded training mission rehearsal capability on current force vehicles and dismounted Soldiers to mitigate embedded training technology risks for these systems as well as for Future Forces; will mature common embedded training technologies supporting all target vehicles and Soldiers.	1649	3645	3891
Small Business Innovative Research/Small Business Technology Transfer Programs		105	
Total	1649	3750	3891

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603015A - Next Generation Training & Simulation Systems**	**S31**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
S31 MATREX	10672	10037	10110	11186	11267	11519	11777

A. Mission Description and Budget Item Justification: The project Modeling Architecture for Technology, Research, and Experimentation (MATREX) provides the foundation for the distributed modeling and simulation (M&S) environment employed to reduce program cost, schedule, and technical risk across the Army's acquisition programs. MATREX provides a unifying M&S architecture, supporting tools, and infrastructure that ease the integration and use of multi-resolution live, virtual, and constructive (LVC) applications. MATREX provides capabilities to support the examination of Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) concepts and system-of-systems (SoS) solutions at the entity level to facilitate studies and technology demonstrations that assess the operational impact of Network-Centric Warfare (NCW) concepts and technologies. MATREX creates a simulation environment that models the Current and Future Force tactical network systems, the information that flows through that network (communications representation), and the impact of this information on force effectiveness. Efforts include the creation of a continuously available secure Distributed Virtual Laboratory (DVL) that is used for collaborative design, development, integration, test, and execution of simulation experiments, studies, and analyses with geographically dispersed command elements and Cross Command Collaboration Effort (3CE) network partners. These partners include the Research, Development, and Engineering Command (RDECOM), Army Test and Evaluation Command (ATEC), and the Army Training and Doctrine Command (TRADOC). MATREX supports the development and selection of "best of breed" high-resolution engineering-level models to support the evaluation of Future Force (FF) concepts to include dismounted warrior systems. Integration of high-resolution engineering-models within the MATREX architecture provide the framework to operate a true multi-resolution environment that can scale to the FF brigade combat team operations, enhancing the user's ability to study the measures of effectiveness. This project supports the partnership with the other 3CE members in the development and use of MATREX to establish a common environment that supports development, training, and testing within the community for the development and evaluation.

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), Systems of Systems Integration (SOSI), Fort Belvoir, VA, and executed across the Command.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
MATREX: In FY07, delivered MATREX interoperable environment and integrated tool suite to TRADOC and ATEC; integrated Maneuver Command and Control, Logistics, and environment capabilities into the MATREX architecture; enhanced the ability for end-to-end analysis in an environment that integrates Network Centric Warfare capabilities to support decision making; implemented more robust system-level verification and validation of MATREX; transitioned existing MATREX One Semi-Automated Forces (OneSAF) Testbed Baseline based capabilities to an OneSAF Objective System capability. In FY08, extend MATREX capabilities to fully implement the TRADOC Integrated Process 3 (Networked Fires; Intelligence, Surveillance, and Reconnaissance; Battle Command; etc.) operational thread, and fully integrate weather, chemical-biological effects with complimentary human-behavior enabled Battle Command. In FY09, will increase MATREX scalability across all capabilities to model a FF brigade combat team; will address event management by updating Simulation Initialization capability to shorten event setup time and execution; will implement a cross command data collection and analysis tools capability to provide an integrated acquisition support capability for Army decision making.	10672	9756	10110

Small Business Innovative Research/Small Business Technology Transfer Programs		281	
Total	10672	10037	10110

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603103A - Explosives Demilitarization Technology**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	25004	21511	10564	10971	11190	11440	11697
D51	Explosives Demil Tech	9945	10283	10564	10971	11190	11440	11697
D91	EXPLOSIVE DEMIL DEMONSTRATIONS	15059	11228					

A. Mission Description and Budget Item Justification: This program element supports the Explosive Demilitarization Technology Program. Project D51 provides a cooperative interservice, interagency effort dedicated to the maturation of 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). There are currently nearly 500,000 tons of conventional munitions requiring disposition with a forecast of 475,000 tons and over 275,000 missiles and missile components to flow through the stockpile between FY 2008-2013. The effort employs the highly matured technology base in the DoD Service Laboratories and Technical Centers, the Department of Energy (DOE) National Laboratories, industry, and academia. The program 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) DDemilitarization's technical and programmatic support staff in this effort. The program supports the Research and Development (R&D) Technology goals of the PM Demilitarization Strategic Plan which focuses on technology transfer opportunities. The program supports an annual Global Demilitarization Symposium for the technical review and data evaluation from ongoing projects and advanced demonstrations. The PM Demilitarization R&D Integrated Planning Team utilizes a systematic approach for project prioritization. Project D91 funds congressional 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.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603103A - Explosives Demilitarization Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	25640	10349	10632
Current BES/President's Budget (FY 2009)	25004	21511	10564
Total Adjustments	-636	11162	-68
Congressional Program Reductions		-138	
Congressional Recissions			
Congressional Increases		11300	
Reprogrammings	85		
SBIR/STTR Transfer	-721		
Adjustments to Budget Years			-68

Three FY08 Congressional Adds totaling $11.3M were added to this PE.

($2.4M) Cryofracture/Plasma Arc Demilitarization Program
($2.4M) Sierra Army Depot Cryofracture/Plasma Arc Transportable System
($6.5M) Missile Recycling Capability--Letterkenny Munitions Center

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603103A - Explosives Demilitarization Technology**	**D51**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
D51 Explosives Demil Tech	9945	10283	10564	10971	11190	11440	11697

A. Mission Description and Budget Item Justification: The Explosive Demilitarization Technology Program is a cooperative interservice, interagency effort dedicated to the maturation of 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). There are currently nearly 500,000 tons of conventional munitions requiring disposition with a forecast of 475,000 tons and over 275,000 missiles and missile components to flow through the stockpile between FY 2008-2013. The effort employs the highly matured technology base in the DoD Service Laboratories and Technical Centers, the Department of Energy (DOE) national laboratories, industry, and academia. The program 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 PM Demilitarization's technical and programmatic support staff in this effort. The program supports the Research and Development (R&D) Technology goals of the Program Manager Demilitarization Strategic Plan which focuses on technology transfer opportunities. The program supports an annual global demilitarization symposium for the technical review and data evaluation from ongoing projects and advanced demonstrations. The PM Demilitarization R&D Integrated Planning Team utilizes a systematic approach for project prioritization. The program element contains no duplication with any effort within the Military Departments. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Resource Recovery and Reuse (R3): In FY07, began transitioning of near infrared (NIR) explosive detection unit and completed testing for detection of residual explosives in autoclaved 105MM projectiles; continued testing of the propellant conversion technology; and continued Joint Program integration. In FY08, research additional modeling using cluster model technology for the NIR scanners and complete machine vision integration for 155MM projectiles; demonstrate optimized propellant conversion to fertilizer technology; initiate accelerated design and fabrication of the Demilitarization by Inductive Heating Meltout (DIHME) project for 60MM mortars and improve the design in an effort to accommodate an additional demil requirement for 81mm and 120mm mortars; continue Joint Program integration. In FY09, will mature and demonstrate DIHME project for 60MM, 81mm, and 120mm mortars; will initiate development of machine vision for other projectiles; will initiate transition of propellant conversion to fertilizer technology; will continue research and development alternatives for ammonium perchlorate; will demonstrate HMX Requalification technology; and will continue Joint Program integration.	5063	7129	6720
Advanced Destruction: In FY07, transitioned transportable Contained Detonation Technology (CDT); completed demonstration of stationary CDT and initiated transition; performed hydrolysis test for aluminum Cartridge Actuated Device/Propellant Actuated Device (CAD/PAD). In FY08, complete transition of stationary CDT; initiate development of characterization data for Acid Hydrolysis steel CAD/PADs; demonstrate Mobile Plasma Treatment System (MPTS). In FY09, will initiate testing and development of Acid Hydrolysis	570	1208	1703

technology; will initiate design to demil M433- HEDP Cartridges.			
Molten Salt Oxidation (MSO) Waste Stream Treatment: In FY07, matured and successfully demonstrated the MSO technology application to different demilitarization process waterstreams.	402		
Supercritical Water Oxidation (SCWO): In FY09, will mature and demonstrate SCWO technology to treat liquid effluent from a supercritical water oxidation reactor.			589
Advanced Munitions Disassembly: In FY07, completed operational demonstration of robotic disassembly of Area Denial Anti-personnel Mine (ADAM) projectile; explored recycling/disposal methods for spent abrasive in the abrasive waterjet technology and optimized nozzle performance; explored development of a disassembly system for the Stinger Missile; initiated development of segmenting rocket motors. In FY08, initiate transition of robotic disassembly of ADAM projectile; transition waterjet technology to the Demil by Induction Heating Meltout (DIHME) project for 60MM mortars; design and fabricate a disassembly system for the Stinger Missile; demonstrate rocket motor segmenting technique. In FY09, will complete operational demonstration and will initiate transition of rocket motor segmenting technique.	2886	1658	785
Advanced Removal: In FY07, initiated development of propellant removal system using Augering techniques; initiated development of a flexible multi-missile milling system. In FY09, will initiate design and fabrication of a propellant removal system using Augering techniques; will initiate design and fabricate a flexible multi-missile milling system.	1024		767
Small Business Innovative Research / Small Business Technology Transfer Programs		288	
Total	9945	10283	10564

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	12559	14903	7116	6766	6895	7049	7207
H29	MED PROTECT AGNST HIV	6749	6954	7116	6766	6895	7049	7207
T16	MILITARY HIV INITIATIVES CA	5810	7949					

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced technology of candidate human immunodeficiency virus (HIV) vaccines, prepares and conducts human clinical studies to assess safety and efficacy (effectiveness) of candidate HIV vaccines, conducts research to control HIV infection in military environments, protect the military blood supply, and protect military personnel from risks associated with HIV infection. All HIV technology development activities are conducted in compliance with U.S. Food and Drug Administration (FDA) regulations and conducted under an Investigational New Drug application with FDA. 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 (Phase 1, 2, and 3) to prove safety and effectiveness of the drug/vaccine/device for the targeted disease/condition. An increasing number of people 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 U.S. Army Medical Research and Materiel Command and the National Institute of Allergy and Infectious Diseases. 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Walter Reed Army Institute of Research, Rockville, Maryland, and its overseas laboratories; and the Naval Medical Research Center, Silver Spring, Maryland, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation, Rockville, Maryland.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	12897	6998	7162
Current BES/President's Budget (FY 2009)	12559	14903	7116
Total Adjustments	-338	7905	-46
Congressional Program Reductions		-95	
Congressional Recissions			
Congressional Increases		8000	
Reprogrammings	25		
SBIR/STTR Transfer	-363		
Adjustments to Budget Years			-46

One FY08 congressional adds totaling $8000 were added to this PE.

($8000) HIV Research

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603105A - MILITARY HIV RESEARCH**	**H29**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
H29 MED PROTECT AGNST HIV	6749	6954	7116	6766	6895	7049	7207

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced technology of candidate human immunodeficiency virus (HIV) vaccines, prepares and conducts human clinical studies to assess safety and efficacy (effectiveness) of candidate HIV vaccines, matures and assesses methods to control HIV infection in military environments, protect the military blood supply, and protect military personnel from risks associated with HIV infection. All HIV technology development activities are conducted in compliance with U.S. Food and Drug Administration (FDA) regulations and conducted under an Investigational New Drug application with FDA. 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 (Phase 1, 2, and 3) to prove safety and effectiveness of the drug/vaccine/device for the targeted disease/condition. An increasing number of people 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 U.S. Army Medical Research and Materiel Command and the National Institute of Allergy and Infectious Diseases. 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Walter Reed Army Institute of Research, Rockville, Maryland, and its overseas laboratories; and the Naval Medical Research Center, Silver Spring, Maryland, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation, Rockville, Maryland.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
HIV Program: Complete preclinical testing (studies required by FDA prior to testing in humans) and conduct manufacturing and clinical studies of HIV vaccine candidates. In FY07, conducted vaccine test site development and conducted clinical studies, including transition to the next phase of clinical testing of two vaccines involving up to 300 human subjects and long-term (up to 3 years) follow-up of subjects from completed trials; continued activities required to support HIV vaccine development including regulatory reporting on conduct of clinical trials to the FDA; assessed clinical materials to understand responses to vaccines; and maintained clinical trial facilities in the U.S. and international field trial sites in Kenya, Uganda, and Tanzania. In FY08, continue 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; continue long-term clinical follow-up of vaccinated subjects; and continue to develop and maintain new clinical trial sites in Africa and Asia to maintain a sufficient base of potential subjects for testing of vaccines under development by the U.S. Government. In FY09, will continue to assess ongoing vaccine trials to down-select various candidates and continue activities in support of vaccines under development.	6749	6759	7116
Small Business Innovative Research/Small Business Technology Transfer Programs		195	
Total	6749	6954	7116

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603125A - Combating Terrorism - Technology Development**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	12953	12978	13064	13184	12671	12745	13123
DF3	CONSEQUENCE MANAGEMENT & RECOVERY	1066						
DF5	AGILE INTEGRATION & DEMONSTRATION	11887	12978	13064	13184	12671	12745	13123

A. Mission Description and Budget Item Justification: This program element (PE) funds efforts to accelerate technologies with high payoff to address current operational shortfalls and assist deliveries of Future Force oriented projects into current operations capabilities. Survivability and Denial, Project DF1 demonstrates a survivability planning capability and lightweight low-cost blast/ballistic protective measures. This increases base camp survivability of personnel and equipment against advanced conventional weapons and terrorist threats, reduces logistics requirements, and enhances the capability of the Future Force in low-intensity conflicts and peacekeeping operations. Agile Integration and Demonstration, Project DF5 funds critical technology acceleration efforts of selected high-payoff technologies emerging from work in other PEs that have potential to fill emerging capability gaps requiring immediate action. Project DF5 also includes the Rapid Equipping Force (REF) effort to develop a 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. Intent of these alternative power sources is to reduce the tether of fuel resupply. 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. W

ork in this PE is performed by the US Army Engineer, Research, and Development Center headquartered at Vicksburg, Mississippi and Research, Development, and Engineering Command (RDECOM), and the Rapid Equipping Force (REF), Ft. Belvoir, Virginia.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603125A - Combating Terrorism - Technology Development**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	8503	13061	13148
Current BES/President's Budget (FY 2009)	12953	12978	13064
Total Adjustments	4450	-83	-84
Congressional Program Reductions		-83	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	4686		
SBIR/STTR Transfer	-236		
Adjustments to Budget Years			-84

FY07 increases consist of an effort for HMMWV improvement program and an IFF effort. These IFF funds were made available to fund a near-term, prototype power solution that will result in a more capable on-board mobile power system consisting of a higher ampere alternator and a Commercial Off-The-Shelf (COTS) inverter. New capabilities to detect and counter enemy threats installed on Armored HMMWV (UAH) and the RG-31 Combat Utility Vehicles (CC-0120) in use in Iraq and Afghanistan demand greater voltage and amperage than legacy vehicle platforms can provide.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603125A - Combating Terrorism - Technology Development**	**DF5**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
DF5	AGILE INTEGRATION & DEMONSTRATION	11887	12978	13064	13184	12671	12745	13123

A. Mission Description and Budget Item Justification: This project allows the Army to exploit emerging technology from across the Army Research Community and focus those technologies on addressing current warfighter needs. Efforts derive from successes of the Research, Development, and Engineering Command (RDECOM), the Army Corps of Engineers Research and Development Center, the Medical Research Materiel Command, and the Space and Missile Defense Command. Successes emerging from Department of Energy (DOE) Laboratories are also potential AIDE projects. This effort allows research activities to team with Program Managers and the Rapid Equipping Force to accelerate technology maturation and ready technologies to transition to the operational environment. Short term maturation could include, but is not limited to, accelerating the technology development schedule and/or performing detailed safety and validation tests in field/operational environment testing to improve technology readiness. While not limited to these areas, major efforts under this project support the accelerated maturation of counter terrorism capabilities (detection, surveillance of deployment, and disruption/destruction of threat), and Soldier and Force Protection measures and well as emerging Energy Surety technologies for transition into an operational environment. Supported requirements are approved by TRADOC or the combatant commanders. 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 managed by the US Army Research, Development, and Engineering Command, Ft. Belvoir, Virginia.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
In FY07, completed maturation, demonstration, and evaluation of several FY06 efforts. Those efforts include the development of game based software programs, providing enhanced Soldier training systems, to include the Every Soldier a Sensor (ES3) training system and a Tactical Combat Casualty Care (TC3) training system to provide combat medics a virtual environment for realistic, tailorable training. TheTC3 training system is being used in basic training of all combat medics as well as distance learning by all medics worldwide. The ES3 system is now deployed to Fts. Jackson, Benning, Sill, Campbell, Lee, Leonardwood, and OIF and OEF and available on line through AKO to authenticated users. Completed significant operational enhancements to the Mobile RAID surveillance system (EMRAID) including integrated navigation, FBCB2, UTAMS, and voice communications followed by an in-theater evaluation, integrating the advance capability into the Cougar route clearing vehicle for extended use in OIF and/or OEF. Delivered a uniform solution using improved flame resistant materials. Matured and demonstrated force protection effort including add-on armor to provide additional protection to route reconnaissance vehicles and built prototypes and conducted operational testing of enhanced ballistic protection for Engineer bridge erection boats. Matured and demonstrated a small, easily portable oxygen concentrator for patient treatment and transport. Demonstrated Soldier and operational enhancements in a PC-based bilateral Negotiation Environment Simulation (BLNE) to provide realistic comprehensive language and cultural training for Soldiers and officers deployed to a foreign country.	7207		
In FY07, designed and developed a concept cab for the HMMWV to improve force protection. Exploited various integration and feasibility strategies associated with integrating the cab on the HMMWV chassis. Fabricated four concept cabs for demonstration. Three concept cabs have been used for live fire demonstrations, the fourth was used to support system integration and for the human factors and	4680	7554	8173

safety trials, load assessments, maintenance, to mature the design. In FY08, complete maturation, demonstration, and evaluation of FY07 efforts in preparation for transition to operational units. This effort continues to identify maturing technologies from within all Army R&D Activities and the DOE, to accelerate the development of suitable technologies to the warfighter for demonstration, and experimentation. Projects to be initiated include the maturation, demonstration, and evaluation of overhead protection on the Gunners Protection Kit, a Soldier power manager system to reduce 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 continues to be on those areas that provide the operational forces increased protection and survivability, and meet the Operational Need Statements of the deployed forces in OEF and OIF. In FY09, will complete maturation, demonstration, and evaluation of FY08 efforts in preparation for transition to operational units. Will identify and mature through prototype development and testing of 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.			
The Rapid Equipping Force (REF) is developing a 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, incorporate spiral development of more efficient photovoltaic technology, wind technology, and more advanced algorithms for intelligent power management to provided increased power (10kw and 15kw) for THEPS. Larger size THEPS, enabling a flexibility in support for remote operations, tactical command posts, and temporary Forward Operating Bases (FOB). In FY09, will develop and demonstrate 10-15kw THEPS and will network THEPS into an intelligent power grid to provide more efficiencies and redundancies. Will evaluate THEPS effectiveness in field tests conducted at remote sites and operating bases.		5061	4891
Small Business Innovative Research/Small Business Technology Transfer Programs		363	
Total	11887	12978	13064

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603270A - Electronic Warfare Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	24674	41951	23996	19317	18700	19118	19547
K12	EW Demonstrations (CA)	6730	24643					
K15	ADVANCED COMM ECM DEMO	9096	9335	14534	9415	9506	9718	9936
K16	NON-COMMO ECM TECH DEM	8848	7973	9462	9902	9194	9400	9611

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, for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. 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. Project 442 funds efforts related to the design, development, and application of electronic warfare technologies to enhance the survivability capabilities of ground combat vehicles, aircraft, and the dismounted Soldier. In addition, this project offers improvements to Current Force EW sensors and ECM systems to further protect high-value ground targets, aircraft, and the Soldier from threat surveillance and tracking systems; imaging systems; and advanced RF/EO/IR missiles, artillery, and smart munitions. Improvements to the next generation EW protection sensors augment the classic intelligence, surveillance, and reconnaissance (ISR) sensors by providing multi-functional capabilities for on-board and off-board situational awareness (SA), targeting, and combat identification. 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. Project 906 funds 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 in accordance with concepts for Future Force intelligence operations. Specifically, its technologies focus on detecting threat sensors and emitters associated with weapon systems, targeting systems and command, control, communications, computers, and intelligence (C4I) systems and networks.

Efforts in this PE are 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). Project 475 funds congressional special interest efforts. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603270A - Electronic Warfare Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	25280	17419	18864
Current BES/President's Budget (FY 2009)	24674	41951	23996
Total Adjustments	-606	24532	5132
Congressional Program Reductions		-268	
Congressional Rescissions			
Congressional Increases		24800	
Reprogrammings	-1		
SBIR/STTR Transfer	-605		
Adjustments to Budget Years			5132

FY09 was increased to support the advanced development research for combat identification.

Six FY08 congressional adds totaling $24800 were added to this PE.

($1600) WIZARD - Remotely Controlled Improvised Explosive Device Countermeasures
($2000) US Army Future Force ELINT
($2400) Advanced IED Jammer Research and Development Program
($2800) DAIRCM/CMWS for Army Helicopters
($6400) Non-communications ECM Technology Demonstration (Augments current program)
($9600) Advanced Communications ECM Demonstration (Augments current program)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - Electronic Warfare Technology**	**K15**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K15 ADVANCED COMM ECM DEMO	9096	9335	14534	9415	9506	9718	9936

A. Mission Description and Budget Item Justification: This project matures and demonstrates the ability to locate and identify modern tactical battlefield enemy and blue force radio frequency (RF) communications and radars for the Future Force to conduct uninterrupted air and ground based intelligence collection and long range targeting operations in a hostile electromagnetic environment. This project provides flexible, modern systems to achieve information dominance, protect the force, and shape the battlespace. Networked Electronic Warfare (NEW) provides lightweight, low cost Unmanned Aerial System (UAS), and Unattended Ground Sensors (UGS) Electronic Support Measures (ESM) to detect and locate modern signals of interest. This project designs, develops, and demonstrates communications countermeasures (CM) and counter-countermeasures (CCM) technologies to first intercept, identify, and locate tactical communications and then manipulate threat computer networks and their components.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Ft. Monmouth NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats. In FY07, demonstrated UAS and ground-based electronic support measures (ESM) systems in a high emitter density suburban and urban operational environment; transitioned ESM systems to Program Manager Signal Warfare; matured wideband antenna and power amplifiers that cover the entire frequency range of current and anticipated future threats; optimized adaptive array processor to counter problems associated with multipath (signal bouncing off structures and arriving at different times and from varying directions), co-channel (receiving two signals on the same frequency at the same time), and co-site interference (transmitting and receiving at the same time from the same location); matured software algorithms to map present communications architecture in areas of interest; performed analysis to determine the optimal network based attack schema. In FY08, conduct developmental tests of surgical EW techniques against 3 threats simultaneously; integrate complementary jamming and detection/location/neutralization capabilities such as time difference of arrival (TDOA) geolocation and electronic attack based on geolocation; integrate algorithms into government off the shelf hardware. In FY09, will integrate commercial off-the-shelf 3-D visualization and mapping tools with geo-location solution set for optimal urban situational awareness and emitter representation; will integrate capabilities into net-centric solution that combines jamming and detection/locations/ neutralization capabilities; will complete algorithm development and validation and fabrication of adaptive processing arrays. Work related to this effort is also being accomplished under PE 0602270A projects 442 and 906 and PE 0603270A project K16.	9096	9140	9310
Combat Identification (CID) Technology Demonstration: This effort matures and demonstrates real time CID technologies for light weight tactical vehicles and Soldiers. In FY09, will 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; will mature TI interrogation approaches utilizing either laser or radio frequency			5224

components; will 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; will 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/project: 0602120A/H15.			
Small Business Innovative Research/Small Business Technology Transfer Programs		195	
Total	9096	9335	14534

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603270A - Electronic Warfare Technology**	**K16**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K16	NON-COMMO ECM TECH DEM	8848	7973	9462	9902	9194	9400	9611

A. Mission Description and Budget Item Justification: This project matures and demonstrates the Future Force non-communication, multi-functional electronic warfare capability to enhance the survivability of aviation platforms, ground combat vehicles, and the dismounted forces. The survivability approach provides detection avoidance through situational awareness and identification technologies, signature management, hit avoidance using warning receivers, and electronic countermeasures. This project demonstrates recent advances in radio frequency (RF), infrared (IR) and electro-optical (EO) sensor and jamming sources to detect, locate, deceive, and 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 matures the ability to neutralize booby traps. Technology is demonstrated by embedding the maximum capability in projected brigade combat team (BCT)/Future Force systems with a focus on minimizing impacts to vehicle weight, cost, logistics, and fielding. Additionally, this project demonstrates EO technologies and countermeasure technologies against laser-aided and electro-optically directed gun or missile systems. This project also demonstrates Electronic Support (ES) technologies used against communications and non-communications signals for targeting, combat identification and tactical Situation Awareness (SA). Efforts are focused on detecting, identifying, and geolocating emitters of interest from an effective standoff distance and providing near real-time SA updates to the BCT commander.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command, Communications-Electronic Research, Development, and Engineering Center, Ft. Monmouth NJ, and the Army Research Lab, Adelphi MD.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Networked Electronic Warfare: This effort provides autonomous detection, classification, correlation, and geo-location capability against modern wireless emitters and other threats. In FY07, developed counter threat prototypes and algorithms, including unique waveforms, antennas, high sensitivity receivers, and high power transmitters for threat detection and neutralization technologies. In FY08, integrate algorithms into government off-the-shelf hardware; conduct performance testing of prototype system; refine the system design based on test results; integrate jamming and detection/location/neutralization capabilities. In FY09, will complete algorithm development and validation of adaptive processing arrays; will integrate visualization and mapping tools with geolocation solution sets; will demonstrate capability in the lab. Work related to this effort is also being accomplished under PE/project: 0602270A/442; 0602270A/906, and 0603270A/K15.	1989	1967	2232
Cueing Sensor: This effort matures and demonstrates low cost infrared sensors that detect rocket propelled grenades, anti-tank guided missiles, tank fired kinetic energy and high energy anti-tank rounds and then cue active protection systems for Army vehicles. In FY07, matured dual band focal plane arrays (FPA), detection algorithms, and signal processing; performed live-fire testing of prototype warning and cueing sensors and systems; selected one system based on test results. In FY08, optimize FPA design; enhance and evaluate sensor, electronics, and algorithms for testing on-the-move (OTM) environment. In FY09, will demonstrate the cueing sensor software and hardware against different types of live fire munitions (threats to ground vehicle); will demonstrate the capability to detect, declare, and classify the live fire threats; will transition the cueing sensor hardware and software to the active protection system (APS) effort for	1926	3483	7230

integration into the kinetic energy APS vehicle survivability system. Work related to this effort is also being accomplished under PE/projects: 0602270A/442; 0602120A/H15; and 0603772A/243.			
Combat Identification Technologies: In FY07, designed and fabricated geometric pairing (GP) and RF Tag hardware for the ground Soldier and demonstrated dismounted integration concepts and technical performance characteristics; conducted first technical testing of GP situation awareness and RF Tag concepts; completed inserting millimeter wave identification functionality into custom ASICs. Work related to this effort is also being accomplished under PE/project 0602120A/H15.	1078		
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 FY07, assessed RPG detection with Common Missile Warning System (CMWS); modified the APR-39A(V)1 Radar Warning System software to display HFI warnings; matured modeling and simulation of sensor and threats; leveraged UK/USAF optical CM for small arms and RPGs. In FY08, complete software modifications to cockpit display HFI display interface; define overall suite architecture for net-centric survivability in a Simulation environment; conduct live fire test to demonstrate CMWS processing upgrades for hostile fire indication and countermeasure; transition technology to Aviation and Missile Research, Development, and Engineering Center aircraft survivability program for flight testing.	3855	2346	
Small Business Innovative Research/Small Business Technology Transfer Programs		177	
Total	8848	7973	9462

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	69885	77259	63998	70767	70623	66613	65193
206	MISSILE SIMULATION	3282	3458	3534	3568	3594	3675	3757
263	FUTURE MSL TECH INTEGR(FMTI)	9116	30921	36927	48999	48585	45610	46634
550	COUNTER ACTIVE PROTECTION	14230	15297	15402	8227	5659	5785	5914
655	HYPERVELOCITY MISSILE TD							
704	Advanced Missile Demo	9024	8320	6149	7943	10723	8443	6699
G03	Army Hypersonics Advanced Technology		1973	1986	2030	2062	3100	2189
NA6	Missile and Rocket Initiatives (CA)	34233	17290					

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 for the Future Modular Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This PE includes high fidelity simulations, design, demonstration and testing for real-time Hardware-in-the-Loop (HWIL) of advanced tactical missiles and Active Protection System Interceptors for ground and air platforms The technologies focused on in this PE enhance the warfighting capabilities for locating targets in clutter, precision guidance, high speed missile flight, and missile communications, command, and control. The major efforts in this PE are the Non-Line-of-Sight Launch System (NLOS-LS), Advanced Multi-Mission Precision Guided Munition (AMMPGM), Active Defense for the Current and Future Force (concentrating on defense against rockets, artillery, and mortars (RAM)), and Active Protection System (APS) components for ground and air platforms. A key effort is the development of a guided interceptor to work with the APS being developed for Future Combat Systems (FCS) and the Future Force. This interceptor requires advanced technology in controls, inertial sensors, and guidance algorithms. Development and demonstration of the guided interceptor is in collaboration with the FCS APS developer, who will provide the tracking sensor and launch mechanism required for the development and demonstration of the guided interceptor. Survivability efforts are coordinated 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 Army Hypersonics Advanced Technology program matures and demonstrates critical technologies required for force protection against Unmanned Aerial Vehciles and rotary wing aircraft. Project NA6 supports Congressional special interest items. The emphasis in this PE is on smaller, lighter weight, more affordable missiles. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. This work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center and Space and Missile Defense Command located at Redstone Arsenal, AL.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	62940	60353	64398
Current BES/President's Budget (FY 2009)	69885	77259	63998
Total Adjustments	6945	16906	-400
Congressional Program Reductions		-494	
Congressional Rescissions			
Congressional Increases		17400	
Reprogrammings	8671		
SBIR/STTR Transfer	-1726		
Adjustments to Budget Years			-400

FY07 funds were increased to support the Interceptor for Kinetic Energy Active Protection System.

Seven FY08 congressional adds totaling $17400 were added to this PE.

($1000) High Fidelity Virtual Simulation and Analysis (HFVSA)
($1600) Smart Energetics Architecture for Missile Systems
($2400) Army Virtual Emergency Testbed (AVERT)
($2400) Perimeter & Maritime Sensor Network
($3000) Software Engineering Enhancements
($3000) Waterside Wide Area Tactical Coverage & Homing (WaterWATCH)
($4000) Rapid Response System for Protection of Air and Ground Vehicles

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**206**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
206 MISSILE SIMULATION	3282	3458	3534	3568	3594	3675	3757

A. Mission Description and Budget Item Justification: This project matures, develops, and demonstrates modeling and simulation tools for missile design and analysis. This project accomplishes the design, expansion, and improvement of Hardware-in-the-Loop (HWIL) simulation capabilities. HWIL simulation is used to evaluate tactical and theater missiles and precision-guided munitions (ground-to-air, ground-to-ground, air-to-ground) guided by radar frequency (RF), millimeter-wave RF (MMW), electro-optical (EO), and passive and active infrared (IR) spectral signals. Future missile systems use multi-mode combinations of these guidance technologies such as those envisioned for the Non-Line-of-Sight Launch System (NLOS-LS) and other systems within the Future Modular Force. Evaluation 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 the probability of successful flight tests. Recent developments in HWIL simulation technology have enabled these techniques to be applied to missile production lot acceptance testing and post-deployment stockpile reliability tests to reduce their costs. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Missile Simulation: In FY07, demonstrated scanning and multi-channel laser radar (LADAR) projector capability to provide input to a high-resolution LADAR sensor. Completed the advanced high dynamic range infrared (IR) projector and completed initial tests. Completed preliminary design modifications for the development of millimeter wave (MMW) synthetic aperture radar (SAR) processing for missile guidance. Demonstated general-purpose interfaces using Field-Programmable Gate Arrays (FPGA) for interfacing to PAM, Longbow and Common Missile seeker designs. Supported integration and development of a multi-mode HWIL capability. Extended scene generation techniques to a practical application. In FY08, define architecture and interface requirements for reusable and standardized HWIL modules to provide more cost effective HWIL simulation systems. Development of standardized interfaces, internal components and creation of a core data network will make these goals realizable. The efforts focus on the HWIL common module and interface definition and testing of high bandwidth communications between prototype modules. In FY09, will continue the common HWIL framework development by testing standard high bandwidth interfaces for an infrared (IR) seeker, 6-DOF and facility modules. Will investigate controls to project polarization capable signals. Will develop and test a passive IR projector with polarization capability. Will continue the development of MMW synthetic aperture radar (SAR) integration and signal processing techniques for high resolution characterization and validation database development.	3282	3365	3534
Small Business Innovative Research/Small Business Technology Transfer Programs		93	
Total	3282	3458	3534

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**263**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
263 FUTURE MSL TECH INTEGR(FMTI)	9116	30921	36927	48999	48585	45610	46634

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced tactical missile technologies such as seekers, propulsion, airframes, and guidance and controls for missiles supporting the Future Modular Force and where feasible transitions products into current force. This project focuses on: Multi-mode seekers, controllable thrust motors (gels, pintle-controlled solids, and air breathing), and aided target acquisition (ATA) for missile systems. Seeker development addresses imaging infrared, laser radar (LADAR), and millimeter wave seeker technologies, combined with semi-active laser technology, to provide precision strike and fire-and-forget guidance modes. In addition, this project matures affordable, controllable thrust rocket motors that provide longer ranges, and shorter flight times while increasing system safety and robustness in various mission roles while maturing missile guidance and electronics technologies to enable target position updates and re-tasking orders to the missile, and transmission of imagery to the ground for target verification and battle damage assessment. This project demonstrates an active defense against rockets, artillery, and mortars capability for the Future Force, concentrating on using component technologies funded under program element (PE) 0602303A. The continuing Smaller, Lighter, Cheaper (SLC) Tactical Missiles effort matures component technology developed in PE 602303 that focuses on reducing the cost and logistics burden of precision munitions. This effort's goal is to reduce the cost per kill of precision guided missiles, through the innovative application of technology, as well as initiate guided missile technology efforts for direct and indirect fire missions for individual Soldiers. Close Combat Networking of Weapons and Sensors (CCNW&S) demonstrates a prototype infantry networked lethality capability to dramatically improve weapon/target pairing at the squad and platoon level. This effort responds to a priority US Army Infantry Center need for direct-fire range overmatch against current and future threats. This effort strives to leverage and ensure compatibility with fielded tactical systems, including weapons, sensors, displays, radios, and networks. A key component of the Close Combat Networking of weapons effort is the addition of networked Far Target Locators (FTL) and image/data transmission capability to the Javelin Command Launch Unit (CLU) and Tube-launched, Optically-tracked, Wire-guided (TOW) Improved Target Acquisition System (ITAS). These FTLs organically calculate target coordinates and feed the infantry battle command system. Networked CLUs are to be employed in the same manner. Payoffs include increased Line-of-Sight/Beyond-Line-of-Sight lethality and overmatch made possible by synchronized sensors, fires, and maneuver in near-real time; increased warfighter survivability via early acquisition and targeting; and increased situational awareness. These features provide a common operating picture for the manned platform and dismounted Soldier through the rapid sharing of actionable information. The project also matures the technologies developed and funded under PE 062303A. These efforts directly support the NLOS-LS System Development and Demonstration (SDD) program and multiple other systems managed by the Program Executive Officer for Missiles and Space. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Enhanced Seeker Development: In FY07, continued fabrication and performed subsystem tests of the PAM (Precision Attack Missile) multi-mode seeker. Conducted aided target acquisition (ATA) performance evaluations utilizing seeker captive flight test data and developed concepts, detailed designs, and began prototype fabrication and component/subsystem testing. In FY08, integrate PAM seeker and electronics together and perform tower and captive flight testing of the PAM seeker. In FY09, will perform two captive flight tests and continue evaluation and maturing seeker technology for transition of the PAM seeker, ATA, and electronics as a spiral upgrade to NLOS-LS SDD.	6510	2323	992

Advanced Propulsion and Warheads: In FY07, updated propulsion trades and evaluations of critical enhanced Precision Attack Missile (PAM) propulsion subsystems for spiral insertion. In addition, conducted baseline evaluations and simulation of the high efficiency turbo-engine (HETE) critical technologies as a potential replacement for PAM propulsion. In FY08, investigate enhanced NLOS-LS technologies, including the HETE technology for potential NLOS-LS variants; perform prototype hardware evaluations through bench testing of components and wind tunnel testing of variant concept designs. In FY09, will perform integrated prototype system concept demonstrations and evaluations of an NLOS-LS cargo variant for rapid, precision deployment of submunitions.	861	4724	1984
Modeling/Simulation and System Performance Evaluation: In FY07, conducted preflight and post flight reconstruction of PAM captive flight tests performed and supported simulation formal accreditation process. Continued trade studies taking into account various regions, targets, environments, and countermeasures, identifying NLOS-LS variants, and critical subsystem requirements. Addressed manufacturing and affordability (M&A) issues and expanded the envelope of conditions evaluated by the simulation. Performed trade studies and generated detailed simulation models for evaluation of NLOS-LS variant designs. In FY08, support few-on-few simulations and experiments. Perform trade studies and generate detailed simulation models for evaluation of PAM propulsion and PAM multi mode seeker technology insertion. Model M&A issues in preliminary design phase of NLOS-LS variants. In FY09, will perform many-on-many system trade studies and generate detailed simulation models for evaluation of NLOS variants and PAM upgrades while continuing to address M&A issues; will conduct excursions to expand the envelope of simulation evaluated conditions.	1745	2528	992
Smaller, Lighter, Cheaper (SLC): In FY08, conduct multipurpose warhead design verification testing and warhead pre-qualification tests in conjunction with Armaments Research Development Engineering Center. In FY09, will conduct requirements analysis and trade studies for small, low cost seeker/sensor system and will design and initiate prototype development of electronics for small lightweight precision missiles. Will leverage latest in nanotechnology and electronics packaging to achieve small, light, missile form factors to meet urban and emerging threats. Will conduct trades, build prototype designs and test components in relevant environments. Mature technologies will transition to PM CCWS family of missile systems.		5183	7725
Close Combat Networking of Weapons and Sensors: In FY08, complete technical specifications definition for network-enabled Tube-launched, Optically-tracked, Wire-guided (TOW) Improved Target Acquisition System (ITAS), and Javelin Command Launch Unit (CLU), including providing a digital link to the current and future tactical network radios/waveforms. Conduct a networked lethality force effectiveness study to quantify force-multiplying battlefield effects of networked TOW and ITAS, including consideration of interface to infantry battle command (AFATDS, FBCB2). Conduct mission software design and development, and component-level assessment and design for CLU Far Target Locator (FTL) and network interface. In FY09, will continue mission software design and development. Will conduct prototype strap-on FTL and network interface development, and integration and test with the CLU. Will conduct planning for a networked lethality demo employing current and future tactical radios/waveforms.		3845	4960
Multi-Mission/Multi-Purpose Single Missile Propulsion: In FY08, perform system level trades and concept designs of gelled bi-propellants, pintle-controlled solids, and hybrids that provide longer ranges, close inner boundaries, 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. In FY09, will complete concept designs. Will conduct fabrication and prepare for demonstration of critical components (including propellants, engine, expulsion systems, and controls) for variable propulsion motors. Will conduct validation of designs.		1291	2391
Defense Against Rockets, Artillery, and Mortars (RAM): This project transitions from Defense Against RAM efforts in PE 0602303A, project 214. In FY08, conduct development of integrated, form factored interceptor prototypes, launcher prototypes, and fire control prototypes capable of intercepting and defeating rocket, artillery, and mortar threats. Conduct fabrication of interceptor, launcher, and fire control components. In FY09, will complete fabrication of prototype interceptor, launcher, and fire control components and conduct		10188	17883

bench and field testing. In addition, will integrate components and begin system level Hardware-in-the-Loop (HWIL) testing and evaluation. Will use the component and system level testing results to update and verify the system level simulations.			
Small Business Innovative Research/Small Business Technology Transfer Programs		839	
Total	9116	30921	36927

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**550**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
550 COUNTER ACTIVE PROTECTION	14230	15297	15402	8227	5659	5785	5914

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 within his project include the development of: Guided interceptors capable of defeating tank fired large caliber anti-armor threats, anti-tank guided missiles and long range rocket propelled grenades (RPGs) and collaborate with Weapons and Munitions Technologies (PE) 62624, project H28 Combat Vehicle and Automotive Advanced Technology (PE) 63005, project 221 on integration into the active protection system for ground vehicles. Explore an integrated aircraft survivability technology maturation program, with mature new survivability techniques and technologies optimized to work in concert with components already matured and being fielded. System modeling and simulation conducted with user participation maximizes the opportunities for operator input to survivability system configuration and guide all aspects of technology maturation. A systems approach ensures the avoidance of interference among survivability system components and techniques while taking every advantage of synergy and assistance from existing aircraft survivability components to improve the performance of the entire survivability suite. This project complements work done on adaptive infrared suppressor, Manned Unmanned Rotorcraft Enhanced Survivability (MURES), Survivability Planner Associate Re-router (SPAR), and acoustic signature technologies matured in the Aviation Advanced Technology Program Element (PE) 0603003A, 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 Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Kinetic Energy Active Protection System (KEAPS) Guided Interceptor: In FY07, continued development of guided interceptor component technologies to include guided interceptor guidance algorithms, inertial measurement unit, RF seeker, rocket motor, airframe, and control system; built components and began component and subsystem testing, including motor/airframe static tests. In FY08, complete development of components and begin integration into hardware-in-the-loop simulation facility for subsystem testing. Seeker, mission computer, inertial instruments, and control system emulator will be used for HIL testing to evaluate seeker dynamic performance, flight software, and guidance algorithm. Power system, mission computer, telemetry, and propulsion system will be integrated for ballistic flight testing to evaluate interceptor kinematic and aerodynamic performance. Control prototypes will be integrated into interceptors for flight testing to evaluate control authority and aerodynamic response to control. Conduct at least two ballistic flight tests, and conduct up to four pre-programmed control flight tests. In FY09, complete integration of interceptor components and demonstrate fully guided interceptor in up to six flight tests including flight tests from launch to threat defeat. Begin fabrication of guided interceptors for integrated system level demonstration. Begin integration of guided interceptor into the AP system on an FCS vehicle for demonstration. This effort is in collaboration with (PE) 62624, project H28 and (PE) 63005, project 221.	14230	14886	15402
Small Business Innovative Research/Small Business Technology Transfer Programs		411	
Total	14230	15297	15402

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**704**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
704 Advanced Missile Demo	9024	8320	6149	7943	10723	8443	6699

A. Mission Description and Budget Item Justification: This project demonstrates advanced state-of-the-art missile system concepts to enhance weapon system lethality, survivability, agility, versatility, deployability, and affordability for defense against the Future Force_s air and ground, armored and non-armored threats. Efforts within the Program Element (PE) include: Support the Extended Area Protection and Survivability (EAPS) program, the Counter Rockets, Artillery, and Mortars (CRAM) Tracking, and Fire Control effort transition short range surveillance sensor technology from Weapons and Munitions Advanced Technology (PE) 0603004A and fabricates prototype short range surveillance and fire control sensors capable of acquiring, tracking, intercepting, and defeating RAM threats. This project also supports advanced demonstration of the Advanced Multi-Role Miniature Precision Guided Missile (AMMPGM). The objective of the AMMPGM effort is to mature and demonstrate advanced, miniature, multi-role precision-guided missile technology that provides robust defeat of a variety of non-armored threats from multiple platforms including manned and unmanned air and ground platforms with a significantly reduced logistics footprint. This effort matures and demonstrates technology developed under 0602303A (Missile Technology). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Advanced Multi-Mission Precision Guided Munition (AMMPGM) for air platforms: In FY07, designed and fabricated a prototype smart launcher and IM capability for the Hydra-70 family of munitions, as well as other munitions such as Joint Common Missile. In FY08, complete fabrication and demonstration of alternate Hydra-70 aft configurations through HWIL testing, bench testing, and live fire testing.	2865	3297	
Counter Rockets, Artillery, Mortars (CRAM) Tracking and Fire Control: In FY08, transition short range surveillance sensors technology from PE 0603004A. Fabricate prototype short range surveillance sensors capable of acquiring and tracking rocket, artillery, and mortar threats under realistic operational conditions. Transition fire control sensor technologies from PE 0602303A (Missile Technology), project 214 and conduct development and initiate fabrication of prototype fire control sensors capable of providing end game accuracy for intercepting and defeating RAM threats In FY09, will complete the fabrication and integration of a prototype 360 degree, near hemispherical coverage surveillance sensor (specifically the Rotman lense antenna, exciter, receiver, signal processor and software will be fully integrated). Will test the integrated 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 section at range. Also, in FY09, will begin fabrication and integration of fire control sensor components (specifically fabrication of high packaging density, high power Ka-band transmitters will be initiated and integration with other components such as electronically scanned sensor arrays).		4790	6149
Advanced Air-breathing Propulsion Technology: In FY07, successfully completed prototype engine demonstration of a new generation of the most fuel efficient and technically advanced small military turbojets and turbofan engines in the world. The overall goal of the High Efficiency Turbine Engine (HETE) program is to develop new technologies and deliver engine demonstrators which have the same thrust, weight, and volume as the current best turbojets, but have 30% better fuel economy. The HETE program is focused upon scalable technology. The development of techniques, hardware and processes used in these engines broadly supports many thrust classes and size ranges of Army platforms. The core engine can be used as a high thrust per frontal area turbojet, the turbofan engine can be used to	6159		

maximize range and fuel efficiency, and a shaft engine version can be used as a very fuel efficient turboprop for UAVs (Unmanned Aerial Vehicles).			
Small Business Innovative Research/Small Business Technology Transfer Program		233	
Total	9024	8320	6149

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**G03**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
G03	Army Hypersonics Advanced Technology		1973	1986	2030	2062	3100	2189

A. Mission Description and Budget Item Justification: This project is reprioritizing Army Hypersonics funds to support other activities, including: Develop technology to support a force protection capability to protect a brigade against unmanned air vehicles and rotary wing aircraft. Extend the brigade force protection capability to a more inclusive threat set (e.g. all Unmanned Aerial Vehicles and Large Caliber Rockets) and to the protection envelope to a division/corps. Primary focus areas are those deemed critical for weapon maturation to enhance Army operational capability. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed at the US Army Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
NLOS-LS Air Defense (AD): In FY08, establish system constraints and performance goals for a missile capable of being launched from the NLOS-LS Launcher and capable of providing a force protection capability against slow flying airborne surveillance threats such as surveillance unmanned air vehicles and rotary wing aircraft. Additionally, develop multiple missile concepts to meet the requirements and identify critical technologies required to performance goals. In FY09, will select the most favorable concept for further development and begin maturation and demonstration of associated underlying critical component technologies.		1918	1986
Small Business Innovative Research/Small Business Technology Transfer Programs		55	
Total		1973	1986

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	29406	30700	30797	32541	32776	33512	34260
608	COUNTERMINE & BAR DEV	21213	22200	27455	27607	27744	28362	29000
64C	COUNTERMINE DEMONSTRATIONS (CA)	4842	5564					
683	Area Denial Sensors	3351	2936	3342	4934	5032	5150	5260

A. Mission Description and Budget Item Justification: 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 work enables assured mobility for the high operational tempo (OPTEMPO) of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. This PE also conducts modeling and simulation activities to assess the effectiveness of system concepts. Project 608 focuses on concepts and technologies that enable in-stride detection and breaching, close-in detection, area clearance, and neutralization of threats. This project demonstrates the ability to detect landmines and booby traps from handheld, ground, and aerial sensor systems; evaluates detection of both conventional and command detonated types of threats, metallic, and low/non-metallic threats; and emphasizes the use of wide-area multi-sensor fusion detection systems, coupled with small-area confirmation sensors. This multi-sensor approach has the potential to yield a high probability of threat detection with very low false alarm rates. Efforts within this project also assess available airborne sensors for use in landmine and booby trap detection missions for the current force. Project 608 also demonstrates novel explosive, electronic, and kinetic energy techniques to neutralize individual threats and to breach minefields. Project 683 explores alternative systems for anti-personnel landmines and innovative concepts for minefield clearance. Project 64C funds congressional special interest items.

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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	30218	25315	30935
Current BES/President's Budget (FY 2009)	29406	30700	30797
Total Adjustments	-812	5385	-138
Congressional Program Reductions		-215	
Congressional Rescissions			
Congressional Increases		5600	
Reprogrammings	-126		
SBIR/STTR Transfer	-686		
Adjustments to Budget Years			-138

Two FY08 congressional adds totaling $5600 were added to this PE.

($1600) Enhanced Landmine and IED Detection Technology
($4000) Advanced Demining Technology

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**608**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
608 COUNTERMINE & BAR DEV	21213	22200	27455	27607	27744	28362	29000

A. Mission Description and Budget Item Justification: This project matures and demonstrates countermine technologies for integration into future Army systems, and where feasible, exploit opportunities to enhance Current Force capabilities. The projects goal is to mature and demonstrate robust approaches to finding surface-laid and buried threats in temporally and spatially varying vegetation, soil, weather, and diurnal conditions. This effort focuses on enabling assured mobility for the Future Force. Specific activities include remote detection of minefields by aerial sensor systems, detection of individual threats by handheld and vehicle-based sensor systems, and neutralization of individual booby traps, landmines, and minefields. The threats being addressed include conventional, command detonated, and metallic and low/non-metallic anti-tank and anti-personnel threats. This project evaluates the effectiveness of wide-area multi-sensor fusion detection systems, coupled with slower small-area confirmation sensors, to yield a high probability of detection (Pd) at very low false alarm rates (FAR). This project evaluates airborne multispectral 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. Efforts in standoff mine detection provide mine detection capabilities for faster rate of advance (ROA) in high threat areas, using teamed sensors on both ground vehicles (at greater distances from the threat) and UASs. Autonomous mine detection sensor efforts provide the ability to detect anti-personnel mines at faster ROA by integrating mine detection sensors onto robotic platforms which preceed the Soldier thereby keeping the Soldier away from danger. Ground penetrating radar development efforts provide faster ROA for on-route and off-route mine detection capability with high Pd and low FAR. Airborne threat detection efforts demonstrate automated processes and algorithms that improve upon the current change detection process used to detects landmines and booby traps. The Threat Detection and Neutralization for Route Clearance effort demonstrates vehicle mounted technologies for in-stride detection and neutralization of roadside and in-road threats. The Mine Detection Payload for UASs effort demonstrates an airborne sensor payload and a threat detection algorithm suite.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Minefield neutralization efforts are closely coordinated with Navy/USMC. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Ft. Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Standoff Mine Detection System: In FY07, demonstrated forward looking sensor suite consisting of brassboard forward looking radar coupled with electro-optic/Infrared sensors integrated on a mine protected vehicle; developed and demonstrated two brassboards for standoff mine detection consisting of a magnetometer array and an early harmonic radar (detects electronic devices); evaluated variety of sensor technologies in desert conditions to determine their ability to detect deeply buried targets in road beds.	8275		
Autonomous Mine Detection Sensors (AMDS): In FY07, completed final prototype sensor build and automated target recognition /signal processing implementation on surrogate platform; conducted field tests in relevant environments. Transitioned AMDS to PM-Close Combat System (CCS).	2806		
Ground Penetrating Radar (GPR) Countermine On The Move: In FY07, completed automated target recognition development and GPR	4808		

integration onto a unmanned ground vehicle (UGV); conducted a series of on and off route demonstrations in a variety of operational scenarios and under representative environmental conditions; completed mobility evaluation. Transitioned GPR to PM-CCS.			
Threat Detection and Neutralization for Route Clearance: In FY08, mature vehicle mounted technologies and prototypes that provide standoff detection and neutralization of roadside and in-road threats to enable uninterrupted mobility and increase survivability for both convoy escort and route clearance mission. Detection sensors and sensor combinations may include conventional and non-linear radar, electromagnetic induction, and passive magnetometry, electro-optics, lasers, and chemical detection sensors. Neutralization techniques include directed energy and conventional ballistic approaches. In FY09, will continue development of detection and neutralization components; will conduct a series of component tests and select the most promising technologies/components for convoy escort and route clearance prototypes; will mature and demonstrate sensor fusion algorithms to reduce false alarm rates in high clutter/urban environments; will assess maturity of directed energy and conventional ballistic approaches for use against the full spectrum of the threats.		14971	19327
Airborne Mine Detection: In FY07, upgraded data collection assets to reduce the processing burden and automated, via software, the change detection activities between consecutive frames from the high altitude payload; completed cueing algorithm development and sensor integration; conducted system flight demonstrations in military like environment and assessed performance of the Change Detection Work Station.	5324		
Mine and Minefield Detection Payload for Tactical Unmanned Aerial Vehicle (TUAV): In FY08, conduct trade studies and modeling of sensor candidates to meet size, weight, and power constraints of a medium altitude TUAV airborne payload; mature sensors and algorithms tailored to sensor selection and mission; integrate sensor package for flight test. In FY09, will perform flight testing/data collections on manned aircraft, will mature algorithms based on sensor data collections and analysis.		6778	8128
Small Business Innovative Research/Small Business Technology Transfer Programs		451	
Total	21213	22200	27455

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**683**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
683 Area Denial Sensors	3351	2936	3342	4934	5032	5150	5260

A. Mission Description and Budget Item Justification: This project provides demonstrations of surveillance, command, and control technology components for alternative systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). The technology components include distributed personnel surveillance systems (autonomous seismic, acoustic, and day/night imaging sensor systems) and command and control systems (ad hoc networked, wireless, sensor communications, and information management tools) to be used with man-in-the-loop overwatch fires. This project uses 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Area Denial Sensors: In FY07, matured ground sensor discrimination algorithms; demonstrated an unattended ground sensor (UGS) working with an intelligent mine system concept of operations for discriminating combatant from noncombatant. In FY08, continue maturation of discrimination algorithms; incorporate advanced personnel detection sensors into testbed UGS; demonstrate modeling and simulation of sensor and operator interface. In FY09, will demonstrate detection and combatant/noncombatant discrimination with testbed UGS; will begin development of next generation sensor and discrimination system.	3351	2871	3342
Small Business Innovative Research/Small Business Technology Transfer Programs		65	
Total	3351	2936	3342

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	11788	10629	8809	9085	9341	8667	8592
627	JT SVC SA PROG (JSSAP)	10820	8045	8809	9085	9341	8667	8592
62D	SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)	968	2584					

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 to provide greater lethality, utility, and range at a significantly reduced weight for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The main efforts under this PE are the Lightweight Small Arms Technologies (LSAT) and the Lightweight Small Arms Systems (LSAS). The LSAT is a group of technologies that offer significantly reduced weight over the currently fielded weapons and ammunition. LSAS takes the technologies that were successfully demonstrated during LSAT and applies them to specific weapon systems and missions to determine their utility. All Joint Service Small Arms Program (JSSAP) efforts follow the Joint Service Small Arms Master Plan (JSSAMP), the Joint Capabilities Integration Development System (JCIDS) Small Arms Analysis, and the resulting Capabilities Development Documents. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by the US Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ. 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). Transition paths have been established in coordination with Program Executive Officer (PEO) Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, United States Marine Corps (USMC) PM Infantry Weapons; and PEO Special Programs, US Special Operations Command (SOCOM). Project 62D contains congressional adds only.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	8112	8097	8856
Current BES/President's Budget (FY 2009)	11788	10629	8809
Total Adjustments	3676	2532	-47
Congressional Program Reductions		-68	
Congressional Rescissions			
Congressional Increases		2600	
Reprogrammings	3876		
SBIR/STTR Transfer	-200		
Adjustments to Budget Years			-47

FY07 funds were increased to support HEAB.

Two FY08 congressional adds totaling $2600 were added to this PE.

($1000) Modular Individual Weapon Sight and Low Cost Remote Weapon Station
($1600) Polymer Small Arms Technologies, Transfer from PA,A line 2

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603607A - JOINT SERVICE SMALL ARMS PROGRAM**	**627**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
627 JT SVC SA PROG (JSSAP)	10820	8045	8809	9085	9341	8667	8592

A. Mission Description and Budget Item Justification: This project matures and demonstrates advanced technologies that integrate into individual and crew-served weapons and ammunition for all Services to provide greater lethality, utility, and range at a significantly reduced weight for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The main efforts are the Lightweight Small Arms Technologies (LSAT), the Lightweight Small Arms Systems (LSAS), and the High Explosive Air Burst (HEAB) ammunition and weapon system. The LSAT is a group of technologies that offer significantly reduced weight over the currently fielded weapons and ammunition. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden to maximize operational utility and survivability, while maintaining or improving current levels of performance. LSAS takes the technologies that were successfully demonstrated during LSAT and applies them to specific weapon systems and missions to determine their utility. The HEAB increases Soldier survivability, standoff and versatility by providing an increased probability to defeat point, area, and defilade targets out to 700 meters. All Joint Service Small Arms Program (JSSAP) efforts follow the Joint Service Small Arms Master Plan (JSSAMP), the Joint Capabilities Integration Development System (JCIDS) Small Arms Analysis, and the resulting Capabilities Development Documents. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work is performed by the US Army Armament Research, Development, and Engineering Center and PM Soldier Weapons, Picatinny Arsenal, NJ. 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). Transition paths are established in coordination with Program Executive Officer (PEO) Soldier, Project Manager Soldier Weapons, Product Manager (PM) Crew Served Weapons, PM Individual Weapons, United States Marine Corps (USMC) PM Infantry Weapons; and PEO Special Programs, US Special Operations Command (SOCOM).

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Lightweight Small Arms Technologies (LSAT): In FY07 integrated and demonstrated lethality and reliability of the lightweight weapons and ammunition in a light machine gun configuration with caseless and case telescoped ammunition; identified and matured prototype alternate weapon configurations and performed trade studies to determine best application(s) for lightweight technologies; continued refinement and maturation of both cased telescoped and caseless ammunition and weapon designs to achieve maximum weight reduction with maximum lethality and reliability.	6951		
Lightweight Small Arms Systems (LSAS): In FY08, mature and demonstrate high payoff technologies from LSAT that are technically successful, affordable, and manufacturable. Identify and complete design and development of selected ammunition and weapon configurations including cased telescoped and caseless ammunition, light machine guns and rifles/carbines. In FY09, will further develop and fabricate small quantities of ammunition and weapons prototypes in order to conduct and additional testing of hardware and to validate design and analyses.		7137	7432
Small Arms Technology Assessment and Effectiveness Modeling: In FY08, begin system integration planning and develop additional scenarios to assess utility of existing and potential future weapon concepts utilizing current simulation systems. In FY09, will further mature higher order simulations to assess the utility of complimentary programs in PE/project 622623A/H21.		713	1377
High Explosive Air Burst (HEAB) Ammuntion and Weapon Ssytem: In FY07, completed design of next generation of HEAB	3869		

ammunition and weapons systems; built and tested prototypes.			
Small Business Innovative Research/Small Business Technology Transfer Programs		195	
Total	10820	8045	8809

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	73826	53910	39916	40595	43985	45653	46756
590	OVERWATCH ACTD	287						
C65	DC65	4415	394					
K70	NIGHT VISION ADV TECH	17161	22857	23556	26863	28344	28648	29368
K73	NIGHT VISION SENSOR DEMONSTRATIONS (CA)	31134	18283					
K86	NIGHT VISION, ABN SYS	20829	12376	16360	13732	15641	17005	17388

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates sensor technology that will provide the Army with the capability for reconnaissance, surveillance, and target acquisition beyond today's tactical lines-of-sight and enhance the Army's ability to operate in all battlefield conditions. Major efforts within this PE are designed to increase 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) in support of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Project 590 focuses on assessing the military utility and maturing concepts of operation to address counter ambush operations. Project C65 supports classified activities. Properly accessed individuals can obtain further information from the ASA(ALT) Special Programs Office. Project K70 funds efforts related to night vision advanced technologies. This project will: develop technologies for networked, low-cost, distributed unmanned sensors for battlefield situational awareness, cost effective targeting (CET), and for autonomous target acquisition; demonstrate situational awareness for infantry carriers operating in close-in complex terrain; provide the vehicle commander, crew members, and dismounting infantry with an independent, simultaneous, multi-user close-hatched 360 degree by 90 degree hemispherical view of the area surrounding a stationary or moving vehicle during day and night operations; demonstrate the combat overmatch benefits of third Generation Infrared (IR) technology, including benefits such as rapid wide area search, multispectral aided target detection (AiTD), difficult target detection, and passive long range target identification (ID beyond threat detection) in both an air prototype and ground test-bed while on-the-move (OTM), and will support efforts to use standard components across multiple applications for cost savings; demonstrate the technical maturity of single-color, long wave infrared (LWIR), ground based Aided Target Recognition (AiTR) algorithms and Long Range Laser Target Identification (LRTID) utilizing gated Short Wave Infrared (SWIR) components; and insert third Generation IR assembly into a ground based long range sensor suite; demonstrate components to improve Soldier situational awareness. Project K86 funds efforts related to airborne night vision systems. This project demonstrates sensors and algorithms designed to detect targets (vehicles, personnel, mines) in camouflage, concealment, and deception; demonstrate sensors for Unmanned Aerial Systems (UAS) for beyond-line-of-sight targeting in areas shadowed by terrain features; demonstrate imaging, non-imaging, and active imaging sensors for UAS platforms; evaluate and demonstrate improved survivability and lethality by providing ID at enemy's detection ranges; and provide pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions. Project K73 funds congressional special interest items.

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

Statement. This PE adheres to Tri-Service Reliance agreements on sensors and electronic devices, with oversight, and coordination provided by the Joint Directors of Laboratories. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	75615	35892	40114
Current BES/President's Budget (FY 2009)	73826	53910	39916
Total Adjustments	-1789	18018	-198
Congressional Program Reductions		-382	
Congressional Rescissions			
Congressional Increases		18400	
Reprogrammings	142		
SBIR/STTR Transfer	-1931		
Adjustments to Budget Years			-198

Eight FY08 congressional adds totaling $18400 were added to this PE.

($1200) Cable Warning and Obstacle Avoidance System
($1600) Hyperspectral Sensors for Improved Force Protection (Hyper-IFP)
($1600) Next Generation FPA Development (Transfer from Line 19)
($2000) Advanced Night Vision Sensors
($2400) Hand Launched Unmanned Aerial System High Performance Payload (SUAS HPP)
($3200) Enhanced Digital Electronic Night-Vision (EDEN)
($3200) FCS Short Range Electro Optic Sensor Technology
($3200) UCXR System

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K70**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K70 NIGHT VISION ADV TECH	17161	22857	23556	26863	28344	28648	29368

A. Mission Description and Budget Item Justification: This project matures and demonstrates 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 ranges or are partially obscured by terrain features. This capability, linked to the limited situational awareness from the overhead/strategic available assets, is critical to the survivability, utility, and maneuver planning of the Army's Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. The maturation of distributed aperture sensors provides situational awareness imagery and target identification independently to the commander or multiple crew members for enhanced operations in day/night/adverse weather conditions. Third generation infrared (third Generation IR) technology efforts provide a combat overmatch capability for ground scouts and line of sight (LOS) shooters, ensuring passive, long range target detection, and identification (ID beyond threat detection) on ground platforms, through: collection of multispectral IR data sets for future Aided Target Detection (AiTD)/Aided Target Recognition (AiTR) algorithm development and third Generation IR performance model development and the development of a single 640x480 third Generation integrated Dewar/Cooler specification for air and ground platforms. The third Generation IR technology effort also includes the maturation of multispectral AiTR algorithms, and advanced Digital Signal Processing (DSP) algorithms to take advantage of third Generation IR imagers for insertion into medium range electro-optical systems. The Soldier mobility vision system matures a 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. It includes the ability to import alternate imagery/data (e.g. from a weapon sight) to the high resolution Helmet Mounted Display (HMD) in direct support of the PEO Soldier Digital Enhanced Night Vision Goggle (DENVG) program. The Miniature Target Acquisition, Far Target Locator System effort provides the dismounted Soldier with a miniature light weight, low power hand held, far-target locator system. The far target locator includes real-time adaptive Visible Near Infrared/Short Wave Infrared/Long Wave Infrared (VNIR/SWIR/LWIR) sensor fusion, a laser rangefinder/marker/illuminator, embedded global positioning system (GPS), target position determination, image and video transmission/reception/display, and electronic zoom with super-resolution (e.g., a method of increasing resolution by exploiting scanning anomalies like jitter/motion) capabilities.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Third Generation IR Technology: In FY07, completed dual band, phenomenology study data collections with the third Generation prototype Long Range Advanced Scout Sensor System (LRAS3); completed design and fabrication of mini-LRAS3 brass-board optics; began integration and demonstration of slim-line (dual band focal plane array (FPA) dual F# dewar) and miniaturized electronics (i.e. Slim-line, prototype, third Generation sensor) into common electro optic system (CEOS) turret sensor and mini-LRAS3 brass-board demonstrator. In FY08, finalize common air and ground integrated detector/cooler assembly specifications and complete the integration of the dual band FPA, dual F# dewar and miniaturized electronics into the CEOS; conduct multi-spectral aided target recognition evaluation with dual band FPA, dual F# dewar.	12479	9154	

Soldier Mobility Vision System: In FY07, finalized system design; conducted critical design review of the system and Application Specific Integrated Circuit (ASIC) for a low power, full field-of-view, digitally fused prototype helmet mounted vision system. In FY08, complete ASIC fabrication and deliver working ASIC to the PEO Soldier digital enhanced night vision goggle (DENVG) program; begin system hardware maturation and integration. In FY09, will complete the integration of prototypes; will conduct technical testing and user evaluation and transition products to the DENVG program.	1787	4446	3429
Distributed Aperture System (DAS): In FY07, completed DAS-2 design consisting of integrated color TV, infrared, and image intensification sensors; integrated DAS-2 onto troop carrying demonstrator vehicle; conducted DAS-2 user experimentation in complex and urban terrain; transitioned to PM-NV/RSTA.	2895		
Dismounted Troop Carrier Closed Hatch Local Situational Awareness: This effort will leverage existing DAS architecture and demonstration hardware to develop and integrate the automated pop up target detection algorithms and a 360° x 90° digital video recording capability with gunfire detection and audible sensing onto a vehicle platform. Target information will be transmitted onto the tactical network for force situational awareness and possible multiple target engagements. In FY08, develop user approved vignettes to define requirements, define sensor capabilities and product transitions. In FY09, will conduct trade off analyses of sensor and system design approaches; will define system architecture and planned interfaces; will complete modeling and simulation of human factors and operator cognitive loading of information; will begin hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable targeting information for the vehicle commander and crew in the urban fight.		474	1493
Miniature Target Acquisition, Far Target Locator System: In FY08, leverage the DARPA Multispectral Adaptive Networked Tactical Imaging System (MANTIS) Phase III program technologies of short wave infrared (SWIR), sensor fusion, and power management, and begin to integrate those technologies into the next generation of the PEO Soldier MRK VIIE program (formerly Theater-Application Launch-On Notice II program), a handheld multispectral (TV, NIR, LWIR) target locator that uses a digital magnetic compass and GPS to pinpoint and relay target coordinates; demonstrate day/night SWIR and improve laser capabilities with the MRK VIIE. In FY09, will conduct a 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; will develop an interface with existing/developmental dismounted Soldier communication systems for real time video/image transmission.		3000	3481
Dismounted Soldier Networked Situational Awareness with Sensor Imagery: Based on previous development of Soldier vision sensors, this effort will demonstrate the ability to display networked Situational Awareness (SA) information simultaneously with sensor imagery, through a Soldier display for weapon or head mounted sensors. In FY09, will define system architecture and planned interfaces; will complete modeling and simulation of system base performance along with human factors and operator cognitive loading of SA information; will begin hardware development efforts to provide improved SA, reconnaissance, and surveillance information which leverage recent component technology developments, in traditional and unused portions of the EO spectrum, to provide actionable targeting information for the dismounted Soldier in the urban fight.			4200
Advanced Lightweight Reconnaissance and Designation Sensor (ALWRDS): This effort leverages the significant investment by the industrial base in small pixel, mid-wave infrared (MWIR) focal plane arrays (FPAs), and the US Army applied research investment in extremely lightweight, low power laser designation technology from the Ultra-Lightweight Laser Designation effort to provide the individual dismounted Soldier and vehicle crews with an advanced lightweight target detection and call for fire capability. In FY08, complete 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, MWIR thermal sensor technology, far target location capability, and clip-on laser designator; begin the fabrication of the small pixel, MWIR thermal imaging sensor. In FY09, will mature the		5273	8323

ALWRDS sensor suite; will continue the fabrication of the small pixel, MWIR thermal sensor; will begin the fabrication of the lightweight, clip-on laser designator and far target location capability; and will conduct initial field performance evaluation of the small pixel, MWIR thermal sensor.			
Unmanned Sensors for Urban Missions (USUM): This effort will leverage manportable robotic platform sensor development and urban unattended ground sensors efforts to mature and integrate multiple sensor modalities, i.e. imaging, acoustic, explosive detection, to provide a flexible multi-mission robotic capability and to provide enhanced low cost imager for urban Unattended Ground Sensor application. In FY09, will complete trade off analyses of sensor and system design approaches; will define system architecture and planned interfaces; will complete modeling and simulation of human factors and operator cognitive loading of information; will begin hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable detection/situational awareness information for the Soldier.			2630
Small Business Innovative Research/Small Business Technology Transfer Programs		510	
Total	17161	22857	23556

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K86**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K86 NIGHT VISION, ABN SYS	20829	12376	16360	13732	15641	17005	17388

A. Mission Description and Budget Item Justification: This project matures and demonstrates intelligence, surveillance, reconnaissance, targeting, and pilotage technologies in support of the Army's aviation and networked systems. The goal is to provide the capability to detect and identify partially obscured targets from manned and unmanned air platforms and to perform reconnaissance, surveillance, and target acquisition (RSTA) and target designation beyond today's tactical line-of-sight. This capability is critical to the survivability of the brigade combat team (BCT) and future light maneuver forces. The technology efforts focus on improved RSTA and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for current and future helicopters (attack, scout, cargo, and utility) 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 BCT. The third Generation Infrared Technology effort for aviation improves survivability and lethality by providing identification at enemy's detection ranges and standardized components across different applications for cost savings. Next generation pilotage efforts demonstrate an advanced, cost effective, light weight sensor system which provides simultaneous multi-pilot/user, view of immediate surroundings available to the entire crew for enhanced pilotage in degraded and brown out conditions, and constant wide field of regard coverage for visual alert to potential attack while on-the-move or in hover for Utility and Heavy Lift rotorcraft. Advanced Lasers and UAS Payloads demonstrate improved target ID and laser designation capabilities from small platforms such as Class I UASs; investigates and matures other promising active payload concepts based on lightweight multi-purpose laser components to provide obstacle avoidance, local area terrain/feature mapping and/or through foliage/camouflage sensing.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Unmanned Aerial System (UAS) Electro-Optic (EO) Payloads: In FY07, completed maturation and integration of reconnaissance, surveillance, and target acquisition (RSTA)/ laser designation (LD) payload and conducted flight experiments from manned platform; began integration of RSTA/LD payload onto the organic air vehicle UAS platform; conducted a series of field experiments and data collections of multiple foliage penetration (FOPEN) technologies; and demonstrated active imaging FOPEN technologies system concepts and non-imaging FOPEN system concepts for small UASs.	11303		
Third Generation Infrared (IR) Technology: In FY07, conducted flight test of third generation infrared technology integrated into the surrogate AN/ZSQ-2 aviation turret and onto the Blackhawk testbed; analyzed results of flight test to demonstrate the enhanced target detection, and identification offered with a two-color target acquisition system; modified sensor software algorithms to improve range and automatic tracking performance based on the analysis. In FY08, complete demonstration of wide area search algorithms and integrate into the airborne control station; perform flight tests of the surrogate AN/ZSQ-2 aviation turrets wide area search capability; record third generation imagery to support dual color Aided Target Recognition (AiTR) maturation; and complete the fabrication and testing of the dual color, dual f# slim-line imagers optics.	7536	4387	

Objective Pilotage for Utility and Lift: In FY07, conducted sensor trade studies to determine the best low cost combination of distributed aperture pilotage sensors for lift and utility helicopters; selected an affordable combination of Long Wave Infrared (LWIR), Medium Wave Infrared (MWIR), Near Infrared (NIR), Image Intensified (I2), Low Light Level TV, Short Wave Infrared (SWIR) sensors; conducted assessment of processor requirements to provide sensor suite interface and image stitching, image fusion and threat warning techniques. In FY08, down-select sensor configurations, refine requirements and design specifications, assess and select available displays (helmet mounted display, panel mounted display); mature design and build sensor suite (including sensor pods, processors, displays, and required interface equipment). In FY09, will integrate sensor suite onto a helicopter testbed; conduct flight evaluation to perform engineering checkout, assess integration and sensor suite performance, and study human factors aspect of multi-sensor, multi-spectral, eye points, and their impact on mission performance; conduct limited user flight assessment.	1990	4790	7226
Advanced Lasers for Unmanned Aerial System (UAS) Payloads: In FY08, conduct design studies to investigate promising compact payload concepts, finalize payload performance goals, and establish laser component requirements; initiate development of 7 lb payload compatible with the Class 1 UASs with reconnaissance, surveillance, target acquisition (RSTA), and laser designation (LD) capabilities. In FY09, will validate performance of the laser designator/laser range finder components in a relevant environment and demonstrate proof-of-principle RSTA and LD payload breadboard; will finalize RSTA and LD payload system design; will conduct initial demonstrations of the laser, detector, and pointing/stabilization subsystems.		2893	9134
Small Business Innovative Research/Small Business Technology Transfer Programs		306	
Total	20829	12376	16360

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	16651	14887	15519	15760	15995	16385	16789
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1926	2013	2063	2088	2103	2150	2199
025	POLLUTION PREVENTION TECHNOLOGY	3312	3509	3622	3699	3772	3857	3943
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	8315	9365	9834	9973	10120	10378	10647
03F	Environmental Quality Tech Demonstrations (CA)	3098						

A. Mission Description and Budget Item Justification: The objective of this advanced technology development program element is to mature and demonstrate technologies that assist Army installations in becoming environmentally compatible without compromising the readiness or training critical to the success of the Future Force. Technologies demonstrated within this program element are transitioned from PE 0602720A (Environmental Quality Technology). 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 materiel. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, and supports the Army Strategy for the Environment. The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, and the US Army Research, Development, and Engineering Command, headquartered at Aberdeen Proving Ground, MD, execute the project work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	17098	14982	16449
Current BES/President's Budget (FY 2009)	16651	14887	15519
Total Adjustments	-447	-95	-930
Congressional Program Reductions		-95	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	-31		
SBIR/STTR Transfer	-416		
Adjustments to Budget Years			-930

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**002**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
002	ENVIRONMENTAL COMPLIANCE TECHNOLOGY	1926	2013	2063	2088	2103	2150	2199

A. Mission Description and Budget Item Justification: The objective of this advanced technology development project is to 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 now 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, and supports the Army Strategy for the Environment. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Installation Operations: Demonstrate environmentally safe and cost-effective technologies to manage and reduce the increase in noise concerns associated with training ranges. In FY07, integrated noise prediction and management tools into Army range design protocols. In FY08, complete initial blast noise complaint risk study criteria and develop impulse noise prediction models. In FY09, will complete complaint risk guidelines and a new noise modeling calculation engine for peak noise events based on statistical data and numerical analysis propagation algorithms.	1926	2013	2063
Small Business Innovative Research/Small Business Technology Transfer Programs			
Total	1926	2013	2063

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**025**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
025 POLLUTION PREVENTION TECHNOLOGY	3312	3509	3622	3699	3772	3857	3943

A. Mission Description and Budget Item Justification: The objective of this project is to mature and demonstrate pollution prevention advanced technologies required to comply 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 comply with existing and new national laws and local regulations; (2) demonstration of advanced nanocomposite packaging systems and advanced technologies for the reuse/recycling of waste during deployed operations in order to reduce logistics, health and force protection impacts; (3) demonstration of advanced technologies to enable sustainment of rocket and missile propellant production and maintenance facilities and training ranges through elimination or significant reduction of environmental impacts. These technologies are transitioned from PE 0602720A, project 895, and will ensure that advanced energetic materials required for the Future Force's high performance munitions are developed that are compliant with environmental and health laws and meet weapons lethality and survivability goals. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, 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) located at Aberdeen, MD, Natick Soldier Research, Development and Engineering Center (NSRDEC) located at Natick, MA, Armaments Research, Development, and Engineering Center (ARDEC) located at Picatinny Arsenal, NJ, Aviation and Missile Research, Development, and Engineering Center (AMRDEC) located at Huntsville, AL, and Tank-Automotive Research, Development, and Engineering Center (TARDEC) located at Warren, MI.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Sustainable Painting Operations: In FY07, reformulated hazardous air pollutant (HAP)-free sealants and adhesives used in weapon system maintenance, production, and industrial processes. In FY08, design and evaluate touch-up kits containing HAP-free paints for on-system field maintenance. In FY09, will investigate HAP-free coatings for production of medium and large caliber ammunition. Zero Footprint Camp: In FY07, matured and evaluated advanced nanocomposite packaging technologies to reduce the amount of packaging debris generated during deployed operations. In FY08, optimize nanocomposite packaging structures and evaluate prototype packages in an operational environment. Compliant Ordnance Lifecycle: In FY07, demonstrated alternatives to perchlorate and hydrazine propellants and non-toxic pyrotechnic compositions. In FY08, evaluate environmental health of new propellants, pyrotechnics and explosives, refine alternative rocket propellants/motor combinations, and demonstrate solventless processing of smoke compositions. In FY09, will scale-up synthesis of environmentally benign RDX replacement candidates for demonstration in munitions, will demonstrate hydrazine monopropellant replacement, and will refine solventless processing techniques.	3312	3410	3622
Small Business Innovative Research/Small Business Technology Transfer Programs		99	
Total	3312	3509	3622

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603728A - Environmental Quality Technology Demonstrations**	**03E**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
03E	ENVIRONMENTAL RESTORATION TECHNOLOGY	8315	9365	9834	9973	10120	10378	10647

A. Mission Description and Budget Item Justification: The objective of this advanced technology development project is to mature and demonstrate technologies transitioned from program element (PE) 0602720A (Environmental Quality Technology), project 835 that improve 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, and includes technology transition from the laboratory to demonstration/validation funded under PE 0603779A (Environmental Quality Technology - Dem/Val), project 04E. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement, and supports the Army Strategy for the Environment. The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Unexploded Ordnance (UXO). In FY07, developed and evaluated a model for active range real-time UXO discrimination and the Management Aid for UXO Detection Efforts (MAUDE) software application which assesses key geophysical and environmental site parameters and assists the site remediation manager with sensor/method/system site-specific selection guidelines for active range remediation. In FY08, complete development of rapid computational modeling for active range scenarios. Conduct 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, will conduct field evaluations of specialized instrumentation for targets, berms, and bunkers for monitoring impacts and condition assessment. Will investigate innovative technologies for range UXO maintenance and for mitigation of unique and emerging UXO.	2162	2260	1761
Hazard/Risk Assessment Tools for Toxicity of Munitions Constituents (MCs) and Munitions and Explosives of Concern (MECs). In FY07, matured migration of Adaptive Risk Assessment Modeling System(ARAMS) to the higher order modeling technique, adapted ARAMS to live fire range assessment, and continued preparation of geospatial environmental risk visualization techniques for incorporation into the Intelligent Preparation of the Battlefield (IPB) process. In FY08, initiate advanced toxicogenomic molecular tools to quantitatively assess MEC exposure, mathematical models of toxicity and effects due to existing, well characterized MEC, predicting multiple stressor impacts on toxicity, MEC toxicity mechanisms in ecological species, and species developmental pathways affected by MECs. In FY09, will conduct cross-species validation of MEC effects. Will initiate advanced protocols for rapid screening and monitoring of ecological impact of MECs. Will develop advanced computational chemistry predictions of chemical structures and	1540	2405	4436

physical properties of adsorbed explosives and organophosphorus compounds in soils. Will conduct technology demonstration of exposure quantification metrics for select representative nanomaterials.			
In Situ Remediation Technologies for Contaminated Groundwater and Soils. In FY07, completed in situ physical and biological cleanup processes for explosives in groundwater with process guidance, specifications, and protocols and continue to mature in situ chemical and plant uptake treatment methods to immobilize inorganics on berms at small arms training ranges. In FY08, mature near-surface biostabilization and phytostabilization technologies for inorganics on small arms firing ranges (SAFRs). Construct integrated assessment models for inorganics on SAFRs. In FY09, will finalize and validate remediation/management of inorganic residues on SAFRs with process guidance, specifications, and protocols.	1530	855	150
Characterization, Evaluation and Remediation of Distributed Source Contamination on Army Ranges. In FY07, completed a real-time detection capability for high concentration source zones for explosives and propellants and evolved geo-statistical methods to predict contaminant distribution patterns; matured in situ explosive treatment processes for distributed contamination on active ranges. In FY08, complete field evaluation of statistically valid range characterization/sampling protocols for MC sources on active range soils and surface waters. Continue maturing on-site, topical alkaline hydrolysis of impact area explosives and quantifying the effects of wildfire control practices on active ranges. In FY09, will conduct field evaluations of advanced spatial components for range risk assessment in Adaptive Risk Assessment Modeling System (ARAMS). Will quantify the effects of wildfire control practices on active ranges. Will perform field evaluation of on-site, topical alkaline hydrolysis of impact area explosives.	1939	2308	2319
Long Term Monitoring Applications. In FY07, integrated direct-push wells coupled to in situ real time sensing and analysis technologies, and evaluated integrated long term monitoring system designs for near real-time sampling, measurement, analysis, and information transmission. In FY08, complete advance development of prototype gene signature array microchip sensor for MCs. Evaluate field detection of MCs and emerging contaminants with negative ion miniature mass spectrometry. Conduct field evaluation of catalytic DNA and Surface Plasmon Resonance (SPR) affinity array sensors. In FY09, will complete advanced development of in situ biosensor technologies implemented in direct push wells. Will 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.	1144	1385	1168
Small Business Innovative Research/Small Business Technology Transfer Programs		152	
Total	8315	9365	9834

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**

COST (In Thousands)		FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	27100	28355	7654	5772	6798	6949	7106
T08	COMBAT ENG SYSTEMS	7587	6793	7654	5772	6798	6949	7106
T13	Stationary Power & Energy Tech Demonstrations (CA)	13703	15004					
T15	MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)	5810	6558					

A. Mission Description and Budget Item Justification: The objective of this advanced technology development program element (PE) is to 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 PE are transitioned from PE 0602784A (Military Engineering Technology). Military engineering technologies demonstrated include Joint Rapid Airfield Construction (JRAC) technologies that support the expedient upgrading of existing airfields and rapid construction of new contingency airfields. 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The U.S. Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	27688	6837	7676
Current BES/President's Budget (FY 2009)	27100	28355	7654
Total Adjustments	-588	21518	-22
Congressional Program Reductions		-182	
Congressional Rescissions			
Congressional Increases		21700	
Reprogrammings	125		
SBIR/STTR Transfer	-713		
Adjustments to Budget Years			-22

Twelve FY08 congressional adds totaling $21700 were added to this PE.

($500) Natural Gas Firetube Boiler Demonstration
($1000) Zero Energy Homes at Ft, Knox, Kentucky
($1000) Fireproofing/Corrosion Resistant Coating System for Military Infrastructure
($1200) Gas Engine Driven Air Conditioning Demonstration (GEDAC)
($1600) Synthetic Auto Virtual Environment (SAVE)
($1600) Army Applications of Direct Carbon Fuel Cells
($1600) Defense Applications of Carbonate Fuel Cells
($2000) Advanced Tactical Fuels for the Military
($2000) Direct Methanol Fuel Cell Development
($2200) Development and Research of Zero Energy Homes at Ft, Campbell
($3000) Regenerative Fuel Cell System for Silent Camp Operations
($4000) JGES for Improved Combat Situational Awareness

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603734A - Military Engineering Advanced Technology**	**T08**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
T08 COMBAT ENG SYSTEMS	7587	6793	7654	5772	6798	6949	7106

A. Mission Description and Budget Item Justification: The objective of this advanced technology development project is to 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. Joint Rapid Airfield Construction (JRAC) technologies support the expedient upgrading of existing airfields and rapid construction of new contingency airfields. 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) 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. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. The US Army Engineer Research and Development Center, headquartered at Vicksburg, Mississippi, executes the project work.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Joint Rapid Airfield Construction (JRAC): In FY07, successfully demonstrated JRAC technologies for site selection, enhanced construction, and rapid soil stabilization for C-17 contingency airfield operations during the Talisman Sabre Exercise at Bradshaw Field Training Area in Northern Territory, Australia.	2005		
Joint-Geospatial Enterprise Services (J-GES): In FY07, expanded J-GES capabilities including developing a technical architecture that supports evaluation of concept. Performed initial experiments based on this architecture that focused on determining where geospatial services should be employed and the value of these services to the military decision-making process. In FY08, continue evaluation focused on assessing geospatial data/information flow across multiple echelons to support battle command planning and mission rehearsal, as well as identifying transition opportunities for these geoservices to Battle Command and Intelligence, Surveillance, and Reconnaissance programs. In FY09, will transition urban-focused geospatial research and technologies developed under PE/project 0602784A/855 into the J-GES environment for demonstration and validation.	2715	1147	1286
Battlespace Terrain Reasoning and Awareness - Battle Command (BTRA-BC): In FY07, tested, evaluated and validated spatial and predictive analysis tools through experiments within simulated battle command and intelligence, surveillance and reconnaissance environments leveraging the J-GES as a specific beta evaluation testbed. The transitioned technologies were accredited and posted for community download and use in late FY07. In FY08, accredit sensor effects software developed using Capability Maturity Model Integration (CMMI) processes and transition to Commercialized Joint Mapping Tool Kit program of record. In FY09, will demonstrate and evaluate tools designed for urban data and urban routing structures within J-GES.	2867	5537	6368
Small Business Innovative Research/Small Business Technology Transfer Programs		109	
Total	7587	6793	7654

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Technology**

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	67308	74096	48236	41699	29033	32964	33809
101	TACTICAL AUTOMATION	13447	16033	16380	13511	14633	17002	17316
1AA	Tactical Computer Science Demonstrations (CA)	9200	9937					
1AB	SENSOR DEMONSTRATIONS (CA)	8667	9539					
243	SENSORS & SIGNALS PROC	35994	38587	31856	28188	14400	15962	16493

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates technologies to achieve information dominance in order to accomplish net-centric operations for the Army's Future Force and, where feasible, to enhance the Current Force capabilities. To gain and maintain battlefield dominance, the Warfighter needs to understand, decide, and act more rapidly than his adversaries. Project 101, Tactical Automation, matures and demonstrates technologies that will allow forces to effectively collect, analyze, transfer, and display information in a net-centric battlefield environment. It develops architectures and provides technologies to enable synchronized Command and Control (C2) during rapid, mobile, dispersed, and joint operations. It demonstrates technologies necessary for integrated battlefield situational awareness (SA), force synchronization (to include coordination between manned and unmanned assets), and distributed On-the-Move (OTM) C2 operations. Project 243, Sensors and Signal Processing, 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. Projects 1AA and 1AB fund congressional special interest efforts.

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

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Technology**

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	70248	67011	34448
Current BES/President's Budget (FY 2009)	67308	74096	48236
Total Adjustments	-2940	7085	13788
Congressional Program Reductions		-12515	
Congressional Rescissions			
Congressional Increases		19600	
Reprogrammings	-1293		
SBIR/STTR Transfer	-1647		
Adjustments to Budget Years			13788

FY09 funds increased for FOPEN for increased detection of targets of interest and analysis for testing on target UAS platform.

Nine FY08 congressional adds totaling $19600 were added to this PE.

($800) Advanced Radar Transceiver Integrated Circuits Development
($1200) Sensor Visualization and Data Fusion (SVDF)
($1600) Aviation Responsive Maintenance System
($2000) Software Lifecycle Affordability Management (SLAM)
($2000) X-band Interferometric Radar
($2400) Enhanced Multi-Mission Radar
($3200) 1 Megawatt Molten Carbonate Fuel Cell Demonstrator at 29 Palms
($3200) SharedVision
($3200) HYPERSAR Radar

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Technology**	**101**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
101 TACTICAL AUTOMATION	13447	16033	16380	13511	14633	17002	17316

A. Mission Description and Budget Item Justification: This project matures and demonstrates command and control architectures and technologies for Future Force and, where applicable, for Current Force information dominance. For the Army Future Force, a critical advancement in battle command is in the use of automated information technologies embedded throughout its warfighting units that enable them to use information as an element of combat power. This project supplies the tools to provide commanders at all echelons more timely and effective information and allows them to command from anywhere on the battlefield. This will allow Future Force commanders to understand, decide, and act faster than their adversaries, resulting in increased OPTEMPO, improved force synchronization, and reduced fratricide. This project matures advanced computer science and technology solutions addressing: information storage and retrieval; digital transfer and display of battlefield situational awareness (SA) and position/location information; synchronization of combined and joint force operations; and Command and Control (C2) On-the-Move (OTM). It matures key technologies in the following areas: automated decision support; advanced database design and distribution; dynamic digital display and manipulation; web-based architectures for intelligent software agents and mission execution monitoring; and mobile adaptive computing. Advanced C2 software services for the Current Force, the brigade combat team (BCT) and echelons above brigade are matured and demonstrated, including efforts involving Command and Control of robotic entities which mature and demonstrate software services optimized for unmanned air and ground robotic systems. Joint developer/warfighter experiments will be conducted in coordination with PM FCS BCT, Training and Doctrine Command (TRADOC) and Research, Development, and Engineering Command (RDECOM) partners.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army RDECOM, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Network Enabled Battle Command (NEBC): In FY07, demonstrated and transitioned information search and retrieval technology and execution decision support tools into PM Battle Command, Joint Tactical Common Operating Picture Workstation and Maneuver Control System architecture; matured information models to represent blue and red force resources, capabilities, and behaviors. In FY08, mature and demonstrate software to support the interfacing, and information management and exchange between BCT and echelons above brigade C2 software applications; mature and deliver final software products for running estimate, information search and retrieval, and decision support services to PM BC for inclusion in PM Tactical Battle Command Software services baseline.. In FY09, will mature network monitoring service for application in dynamic control of the Global Information Grid, from tactical through enterprise level network architectures; will 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; will demonstrate how quality of service metrics can be utilized to help intelligently manage the resources of distributed C2 service providers. Work related to this effort is also being accomplished under PE/project: 0602782A/779.	6135	7141	5119

Command and Control of Robotic Entities (C2ORE): In FY07, matured and demonstrated tactical battle command services for unmanned aerial systems (UASs); prepared for and executed a live experiment with one live and one simulated unattended ground sensor (UGS) cluster, three unmanned ground vehicles (UGVs), and two UASs; analyzed experimental data to assess and provide software improvements to the tactical battle command services. In FY08, mature and demonstrate tactical battle command services for unmanned ground vehicles; prepare for and participate in experimentations and a C2ORE lab demonstration at Fort Monmouth, NJ; mature air/ground collaboration software services. In FY09, will mature tactical battle command services and air/ground collaboration services to include UGSs, UASs, and UGVs and demonstrate all in a relevant environment; will execute a C2ORE capstone demonstration with up to five UGS clusters, five UGVs, and three UASs; will analyze experimental data and provide experimentation and analysis report detailing lessons learned and metrics evaluated; will transition software services to PM FCS.	7132	8704	9269
Battle Space Awareness and Positioning: In FY09, will 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; will 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. Work related to this effort is also being accomplished under PE/project: 0602782A/779.			1992
Joint Force Projection (JFP) Advanced Concept Technology Demonstration (ACTD): In FY07, matured the Force Projection mission capability package within the next generation Net-Enabled Command Capability (NECC) environment; supported JFP integration into USCENTCOM, USTRANSCOM, and JFCOM exercises; finalized transition of JFP technologies to NECC.	180		
Small Business Innovative Research/Small Business Technology Transfer Programs		188	
Total	13447	16033	16380

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603772A - Advanced Tactical Computer Science and Sensor Technology**	**243**

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
243 SENSORS & SIGNALS PROC	35994	38587	31856	28188	14400	15962	16493

A. Mission Description and Budget Item Justification: This project matures and demonstrates improved radar, sensor fusion, and correlation technologies for Future Force information dominance and where feasible exploits opportunities to enhance Current Force capabilities. The Suite of Sense Through the Wall Systems matures techniques for detection of personnel and objects through multiple wall types. Sensor fusion efforts demonstrate sensor management and data correlation, link analysis, and relationship discovery fusion 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), HUMINT, and biometrics technologies. This project matures and demonstrates technologies for wide area reconnaissance, surveillance, tracking, and targeting of individuals in complex and urban environments and asymmetric warfare. 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 Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. 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.

Accomplishments/Planned Program:	FY 2007	FY 2008	FY 2009
Multi-Mission Radar (MMR): MMR demonstrates the ability to deploy a single sensor that can perform multiple missions; air and missile defense (AMD) engagements of rockets, artillery, mortars, UASs, cruise missiles, and rotary-and fixed-wing aircraft; counter-fire target acquisition (CTA); air defense fire control (ADFC); Air Defense Surveillance (ADS); and air traffic control (ATC). In FY07, completed integration and testing of expanded 360 degree CTA capability, demonstrated integration with extended-light weight counter mortar radar, demonstrated cueing to external airborne sensor for mobile-shooter location; demonstrated a fully tested 360 degree MMR system and delivered prime item development specifications to Program Manager Radars suitable for moving into a system development and demonstration phase.	2881		
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. In FY07, matured and demonstrated integrated personnel detection/Concealed Weapon Detection (CWD)/Concealed Explosive Detection (CED) systems with greater standoff capability and increased probability of detection; conducted lab testing of individual STTW sensors against multiple wall types; developed techniques for detection of stationary personnel through multiple wall types; demonstrated handheld and small unmanned ground vehicle STTW during the Air Assault Expeditionary Force (AAEF) Experiment and Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) On-the-Move (OTM) experiment. In FY08, complete integration of personnel/CWD/CED prototypes; conduct final development testing of integrated STTW CWD/CED technology demonstrators against multiple wall types; conduct additional experiments in urban and complex environments to continue evaluation of new operational concepts/Tactics, Techniques, and Procedures; transition complete suite of STTW	7062	6265	

systems to PEO Solider (Soldier borne) and PM RUS (SUGV/UGV mounted). Work related to this effort is also being accomplished under PE/project: 0602270A/442.			
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 FY07, designed hardware for airborne radar system including transmitter, antenna, receiver, and processor to provide longer standoff range, wider area coverage, higher sensitivity, and higher probability of detection with lower false alarm rates; developed interface control documents for installation onto the Class IV UAS. In FY08, purchase radar components; begin fabrication of two system demonstrators and spares (specific steps include: lab test of transmitters, antennas, receivers, and processors); begin air worthiness release documentation. In FY09, will complete development of first system (specific steps include: integrate radar components for system level lab test, conduct lab tests for sensitivity/calibration, motion compensation, frequency notching, interface and control, modes, mission planning, built-in-test); will integrate datalink with radar for remote operation and data dissemination; will conduct environmental and ground end to end acceptance tests; will complete air worthiness release documentation and testing for manned platform and begin documentation for unmanned platform; will conduct and complete radar performance flight testing of the first radar on a manned surrogate UAS platform; will mature algorithms for increased detection of targets of interest, will develop specifications and perform required analysis for testing on target UAS platform; will begin radar integration on target UAS.	12736	20499	19920
Sensor Fusion: This effort develops 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 FY07, matured fusion service-oriented architecture (SOA)-compliant framework, which provides interoperability via the DCGS-A Integration Backbone (DIB); established a proxy for priority intelligence requirement (PIR) management service with limited functionality; began software development for: multi-INT correlation service, a contextual data mediator service, relationship discovery services, and sensor management service; designed platform installation; characterized baseline multi-INT data set; selected a low-cost, flexible, commercial processing architecture. In FY08, mature initial human intelligence (HUMINT) extraction, multi-INT Correlation (Level 1 Fusion), and contextual data mediator software services; mature and finalize the SOA fusion framework; demonstrate and evaluate initial integrated software services; mature relationship discovery service (Level 2a Fusion). In FY09, will finalize services development and integration and test in the integration lab; will demonstrate mature software services in Army or Joint experiments; will conduct final high fidelity lab experiments and demonstrations of fusion automation and demonstrations of fusion automation and answering capabilities. Work related to this effort is also being accomplished under PE/project: 0602270A/442.	3340	3725	3503
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 FY07, began radar development; identified and purchased all radar components and test equipment; integrated a suite of tools to include scenario generation, radar modeling, tracker modeling, tracker evaluation, and visualization to provide an integrated modeling environment. In FY08, mature radar model and existing trackers; continue hardware and software development; conduct component testing; assemble radar components; conduct tower testing of the prototype system to support risk reduction and acquire data needed for	8478	4377	4960

the development of signal processing algorithms; develop MTI exploitation approach; integrate software package into the development environment for evaluation under varying operating conditions. In FY09, will complete radar development and tower testing; will integrate system onto a manned surrogate platform and initiate flight testing; will collect tower and flight test data to support development of adaptive MTI processing algorithms, advanced motion compensation techniques and advanced exploitation and evaluation tools.			
Measurement and Signature Intelligence Technologies (MASINT) for clandestine tagging, tracking, and locating: 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. In FY08, evaluate candidate technologies for tagging, tracking and locating, and select the most viable technologies to pursue for near-term demonstration; demonstrate/test selected technologies for potential spiral transition to the user community. In FY09, will enhance demonstrators and/or evaluate new candidate technologies for near-term prototype development; will integrate selected technologies into a system demonstrator; will demonstrate/test selected technologies for potential spiral transition to the user community. Work related to this effort is coordinated with Army Research Lab efforts in PE/project 0602120A/H16.		2702	3473
Cueing Sensor: This effort matures and demonstrates 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 systems for Army vehicles. In FY07, matured and demonstrated dual band focal plane arrays, algorithms, and processing. Work related to this effort is also being accomplished under PE/projects: 0602120A/H15; 0602270A/A442; 0603270A/K16.	1497		
Small Business Innovative Research/Small Business Technology Transfer Programs		1019	
Total	35994	38587	31856